

ACCTactagtagcggcgcgtgcagttaatcactgattaactcggtagcaaatccagaaaagaggcctccgaaaggggggcctttttcgtttggtc  
cttttgttatcaataaaaaaggggagcggtttccgctcccctattgttcgtcTACAaccaataaaaaacgcccgcggaaccgagcgttctgaac  
aatccagatggagttctgaggtcattactggatctatcaacaggagtcgaagcgagctcgatatcatttaaattacgccccgcctgccactcatcgc  
agtactgttgtaattcattaagcattctgccgacatggaagccatcacaaacggcatgatgaacctgaatcgccagcgccatcagcaccttctgcgctt  
gcgtataatatattgccatggtgaaaacggggcggaagaagttgtccatatgtggccacatttaatacaaaactggtgaaactcaccagggattggct  
gaaacgaaaaacatatattctcaataaaccttttagggaaataggccaggttttcaccgtaaacgccacatcttgcaatatatgtgtagaaactgccg  
gaaatcgtcgtggtattcactccagagcgatgaaaacgtttcagtttgctcatggaaaacggtgtaacaagggtgaacactatccatatcaccagctc  
accgtctttcattgccatacgaaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccggataaaacttgtgcttattttctttacg  
gtctttaaaaaggccgtaatatccagctgaacggtctggttataggtagcattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattggg  
atatacaacggtggtatatccagtgattttttctcatttagcttcttagctcctgaaatctcgataactcaaaaaatacgcccggtagtgatctta  
tttcattatggtgaaagttggaacctctacgtgcccgatcaatttaaatGAGTttcagttccacaGTACCCagaaggtgcttCCAAccgtaga



aaagatcaaaggatcttcttgagatcctttttctgcgctaactctgctgcttgcacacaaaaaaccaccgctaccagcggtggttgttccggatc  
aagagctaccaactcttttccgaaggtaactggcttcagcagagcgagatacacaatactgttcttagttagccgtagttagccaccacttcaa  
gaactctgtagcaccgcctacatactcgctctgctaactctgttaccagtggctgctgccagtggcgataagtcgttaccgggttgactcaaga  
cgatagttaccggataaaggcgacggctcggttgtaacggggggttcgtgcacacagcccagcttggagcgaacgacctacccgaactgagatac  
ctacagcgtgagctatgagaaagcgccacgcttcccgaaggagaaaggcgacaggtatccggttaagcggcagggctggaacaggagagcgac  
gaggagccttccaggggaaacgcctggtatctttatagtcctgtcgggttccgccctctgacttgagcgtcgattttgtgatgctcgtcagggggg  
cggagcctatgaaaaacgccagcaacgcggccttttacggttctggccttttctggccttttctcacatACGAAAAAAAAacccgcccctg  
acaggcggggttttttccaattattgaaggccgctaacgcggcctttttgttctggtctgcctaatcaatgactaagaattcggcgccgttcta  
gagGGTCTCGAATGatgagtcgttagtcgtagtatggattgcaccaccagacgagcagccgccagtggcggtggccttgcgttggcactg  
ggggcactgaaagccgcaggcggtggttggctggagtggtaaacagggaatgaggatcagccgtaaaaaaggtaaaaaaggtaacat  
tacgtgggcctcttttaacctcagcgaacaggaccttgacgaataactacaaccaatttccaatgccgttcttggccgcttttcattatcggtcgtatc  
tggtgcaatttcagcgtcctgctgggacggctatctacgcgtaaatgcgttgctggcagataaattactgccgtgttgcaagacgatgacattatctg  
gatccacgattatcacctgttgccatttgcatgaattacgaaacggggagtgaataatgcattggttcttctgcatattcctttccgacaccgg  
aaatcttaacgcgtgccgacatatgacaccttcttgaacagcttctgattatgatttctgggttccagacagaaaacgatcgtctggcgttctg  
gattgtcttctaacctgaccgcgtcagcacagtagcgcaaaaagccatacagcctggggcaaaagcatttcgaacagaagtctacccgatcgccat  
tgaaccgaaagaaatagcgaacaggctgccgggactgccgcaaaaactggcgcaacttaagcgggaactgaaaaacgtacaaaatatctttc  
tgtcgaacggctggattattccaaaggttccagagcgctttctgcctatgaagcgttgctggaaaaatatccgcagcatcatggtaaaattcgttat  
accagattgcaccaacgtcgcgtggtgatgtgcaagcctatcaggatattcgtcatcagctcgaaaatgaagctggacgaattaatggtaaatacgg  
gcaattaggctggacgccgttattattgaatcagcattttgaccgtaaatctgatgaaaaattccgctactctgacgtgggcttagtgacccac  
tgctgacgggatgaacctggtagcaaaagagtatgttgcgtcaggaccagccaatccggcgcttctgttcttgcgaatttgcgggagcgga  
acgagttaacgtcggcgtaattgttaaccctacgatcgtgacgaagtgcagctgcgtggatcgtgcattgactatgtcgtggcgaacgtatttc  
ccgtatgcagaaatgctggacgttatcgtgaaaaacgatattaaccactggcaggagtgttcattagcgacctaagcagatagttccgcgaagcg  
cggaaagccagcagcgataaaagttgctacctttccaagcttgctagtaataaTGGCagag

#### **pIG003 iaaMH (4)**

ACGAAAAAAAAacccgcccctgacagggcggggttttttccaattattgaaggccgctaacgcggcctttttgttctggtctgcctaatcaa  
tgactaagaattcggcgccgttctagagGGTCTCGAatggttgaccggtttccggttgctattgatgattgagatgaacatcctaaggacttg  
ggtcaattccggcagaaaatcacggcgtgaggttgcaattatcggggccggcattgcaggcttagtagcagcatatgaattaagaatgggtctg  
aaacctgtagtctatgaggcctcaaaatgggaggtcgttacggtcacaggaattgaaggagcgaagggaattgttgcggaactgggcggtatgc  
gctttccagctcctccacagcgttctttcattacgttgataaactgggccttgaaagtcgtccgttccctaaccctttgacggcgccagtgccagcacg  
gtgattgacctggaaggtaccagctactatgcacagatgttatcagatctccagccctgttccaagaagtggcggtatgcatgggcagacgccttaga  
atcaggctctcaattggagatattcaacaggccattcgtgattctgacgtaccgcgtctTaaggaaactgtgaacaaactcgtgcctttgtgggacga  
tcgcactttctatgacttttagcgacctcaaaaggcctttgcgaattaagcttttaccatcgtgaggttttcggacaagtgtgtttgtacaggggggt  
gggattctgattttccaaatagtatgttagaaatcttctgtgttgatgacgaattgtgatgagcaccagcatctgattgttggtggcgtacagcaagt  
cctgtaggcctgtggtcgacgtgctgaacgtcgcacattggccaaagggtacgtcCcttctcacttcatcgggggtccccgcgccaggtgtc  
aaacgtattgcagtgctgaagatggttcattacggttacagataattggggcgatacacgtcaatacgtgccgttttgacaacctgtcaatcgtggc  
tgcttacaacgcagattgaatgtgaggaatcttgttttcacagaagatgtggatggcgctggatcgacgcgttacatgcagtcttctaaaactttgtg  
atggttgatcgccgttttgaaggacaaagatccggaaacgggtcgcgatcttatgtccatgaccctcaccgatcgcttaacgcgcggcacatactta  
tttgataatggcgacgacaagccaggcgttatttgcctgagttactcatggtatgagtgacgtttaaaaaatgttaccgcaaccgatcgagaaacgcgtc  
aaattagcttagatgcccttaaaaagattaccgaaaagtgatcgccgcagctattattggtgaccgattactgtgagttgggaagcggatccg  
catttctgggggcatttaaaggcggttaccgggccattaccgttacaaccagcgatgtacgcgattttatgcagcaggacatgccgtcagaacag  
cgtggcatgtttatgccggtgatgatcttggacaccggcatgggttgaggagcagtaaaacgtcattgaacgcggtgtggggcatcatgaac  
catttcggaggggaaaaccacgcagagaatccgggtcctggcgacgtttccatgagattggaccgatcgcgctgggggactaataatcgtgggac  
gccgcccctagaaaaggaggactaaaaatgcgcgaaatgattacgttgaatctctgtgcccgcattggcagacgaacagattgccgcagaaga  
attgcgcgagcgcgctggatacagaggctcgttaacactgttaaattgcttcattcgcgaaggcgacgccgtaagccaattcggtgaagcggatc



aggcgcgtaaaggaacttcactttggggggtgcctgtgagttttaaggataacatctgtgttcgcgggctgccactgacggcggggtaccgcggcatg  
agcggcctttattgccgatcaggatgcagcaatcgtgagccagttaaagcattgggagctgtgttcgcgggcaaaaataacatgcatgagctgtcatt  
tggcgctcagagcatcaatccacattggggcgcggttggaacccgggtggctccaggatattgcgccggaggttctagcggaggttccgctgcggcgg  
tcgcatctggaattgtcccgtcagcgtcgggacggacacaggcggctcaatccgtattccggcggcattttgcggcattacgggttttcgcctactac  
aggtcgcttgagtacggcggggatcattccggtcagccacgaaggattgtgtcggcctcctgacgcgcacagctggcgacgtgaatttgtgtatg  
ggctgctgtcaggaacacagcagagtttccctctaatacgcacgggaccttgccgcacggtgagcatgtgtctgacttagatggcgaag  
tagaacgtgcctgtatcaatgcgctgagcctcttacgaaaacgggcttgaatttgtgagatcgacgatgcggacattgtggaattgaaccagacat  
taaccttcacgggtccgctgtacgaatttttcgaggattttgtcctaactcttgttgccttaggttggaacatggcatccatcatattttgcacaagtgg  
atgatgcgaatgtgaaaggcattattaatcaccatctgggagagggcgcgattaagccggcacattatctgagtctctccagaatggagagctgtg  
aaacgcaagatggatgagcttttgcgcccacacattaaacttttagggatccgacggctccgtgtcgcgtgcctcatctggaccatgcagatcgtc  
cgggaatttttagccaggcatccgtaacacagacctcgaagcaacgcgatgttaccgaagcattacaattccggctgggtccggaaggccgctgccg  
gtcggccttagttttagtcgctcgtgctgtgatgcgttctctaagcaatgttagtttgatcgaaaaagtgttaaaaggctaataaTGGCagagA  
CCtactagtagcggccgtgcagttaatcactgattaactcggtagcaaaattccagaaaaggcctcccgaaggggggcctttttcgttttggctc  
ttttgtatcaataaaaaaggggagcgggttcccgctcccctattgttcgtcTACAaccaataaaaaacgcccggcggaaccgagcgttctgaaca  
aatccagatggagttctgaggtcattactggatctatcaacaggagtcgaagcgagctcgatatcattaaattacggcccgccctgacctcatcgca  
gtactgttgaattcattaagcattctgccgacatggaagccatcacaacggcatgatgaacctgaatcgccagcggcatcagcacctgtcgccttg  
cgtataatatttggccatgggtgaaaacggggcggaagaagttgtccatattggccacatttaaatcaaaactgggtgaaactcaccagggttggctg  
aaacgaaaaacatatttcaataaaccttttagggaaataggccagggtttcacgtaacacgccacatcttgcgaatatatgtgtgaaactgccgg  
aaatcgtcgtgtgattcactccagagcgatgaaaacgtttcagtttgcctatggaaaacgggtgaacaagggtgaacactatcccatatcaccagctca  
ccgtctttcattgccatacgaaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccggataaaacttgtgcttatttttttacgg  
tctttaaaggccgtaatatccagctgaacgggtcgtgtataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattggga  
tatatcaacgggtggtatatccagtgttttttctcatttttagcttccttagctcctgaaaatctcgataactcaaaaaatacggcgtagtgatcttatt  
tcattatgggtgaaagtgggaacctttacgtgcccgaatcaatttaaatGAGTttcagttccacaGTACcagaagggtgcttCCAaccgtagaa  
aagatcaaaggatcttcttgagatccttttttctgcgcgtaatctgtgcttgcgaacaaaaaaaccaccgctaccagcgggtgttgttgcgggatca  
agagctaccaactcttttccgaaggtaactggcttcagcagagcgcagatacacaatactgttctttagttagccgtagtttagggcaccactcaag  
aactctgtagcaccgcctacatacctcgtctgctaactcgtttaccagtgggtgctgccagtggcgataagtctgtcttaccgggttgactcaagac  
gatagttaccggataaggcgagcgggtgggtgaacggggggtcgtgcacacagcccagcttgagcggaacgacctacaccgaactgagatacc  
tacagcgtgagctatgagaaagccacgcttcccgaaggagaaaggcggacaggtatccggaagcggcagggtcggaaacaggagagcgcacg  
aggagcttccagggggaacgcctggtatctttatagtcctgtcgggttccacacctgacttgagcgtcgtattttgtgatgctcgtcaggggggc  
ggagcctatggaaaaacgccagcaacgcggcctttttacgggtcctggccttttctggccttttctgcacat

#### **PIG004 acdS (4)**

ACGAAAAAaaaccccgcccctgacagggcggggtttttttccaattattgaaggccgctaacgcggccttttttttctggtctgccttaataca  
tgactaagaattcgcgccgcttctagagGGTCTCgAATGaacttaaatcgttttgaacgctaccggttaacatttgaccagctccgattactcct  
cttaaagctttgtctgaacacctgggcggaaggtagagctgtatgccaaacgtgaagattgcaattcggggcttgcgttcgggggtaataagacgcg  
caaattagaataccttattcccaggcgattgagcaggatgcgacaccttggtttcaatcggcggcattcagagtaatcaaacccgtcaagtcgcg  
cagttgcagctcatttaggtatgaagtgtgttgggtccaagaaaactgggtcaattatagcgatgccgtgtatgaccgctgggaaatattgaatga  
gccgtattatgggggctgatgtacgcttagacgcagcaggattcgatattggcattcgtccttcatgggaaaaagctatgtcggatgtcgtggaacgtg  
ggggtaaaccgttcccgatcccgcgggtgctctgaacatccttatgggggtttaggggtcgttgatttgcggaagaggctccgtcaacaggaaaa  
gaattgggcttcaaattcgactatatctagtttgcctagtaacgggtccacgcaggcaggtatggctgtaggggttgcgcgatggcggttctaag  
aatgttatcgcgctgcagccagtgaagcctgaacagacaaaaagccagatcttacgtattgcagctacacggctgaattggctgaacttggccg  
tgaaatcactgaggagatgtcgtgctggacactcgtttgcataatccggagtagcggcttgccaaatgaaggaaactctttaggcaatccgtttatgtg  
ttctcttgaaggagtattgacggacccgtttacgaagggaagtcatgcacgggatgatcgagatggctcgcggcgaaatttccgatggctcaa  
aggattgtacgcgcatctgggcggggtccagcgttaaagcgttactcgttcttatttgcgaatgggtaataaTGGCagagACtactagtagcggc  
cgctgcagttaatcactgattaactcggtagcaaaattccagaaaaggcctcccgaaggggggcctttttcgttttggctctttgttatcaataaaa



aaggggagcggtttccgctcccctattgttcgtcTACAaccaataaaaaacgcccggcggaaccgagcggttctgaacaaatccagatggagttc  
tgaggtcattactggatctatcaacaggagtcgaagcgagctcgatatcatttaaattacgccccccctgccactcatcgagtagtctgttaattcatt  
aagcattctgccgacatggaagccatcacaacggcatgatgaacctgaatcgccagcgccatcagcaccttgctgccttgctgataatattgcccat  
ggtgaaaacggggcggaagaagttgtccatattggccacatttaaataaaaactgggaaactcaccagggattggctgaaacgaaaaacatattc  
tcaataaaccttttagggaaataggccaggttttcaccgtaacacgccacatcttgcaatatatgtgtagaaactgccgaaatcgctggtgattca  
ctccagagcgatgaaaacgtttcagtttgctcatgaaaaacggtgtaacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccata  
cgaaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccggataaaaacttgcttatttttcttacggtctttaaaaaggccgta  
atatccagctgaacggtctggttataggtacattgagcaactgactgaaatgctcaaaatgttctttacgatgccattgggataatcaacggtggtat  
atccagtattttttctcatttttagcttccttagctcctgaaaatctcgataactcaaaaaatacggccggtagtgatcttatttcattatggtgaaagtt  
ggaacctcttagctgcccgatcaatttaaGAGTttcagttccacaGTACCagaaggtgcttCAACccgtagaaaagatcaaaggatcttc  
ttgagatccttttttctgcgctaattctgctgcttgcacaaaaaaacaccgctaccagcggtggtttgtttgcccggatcaagagctaccaactctt  
ttccgaaggtaactggcttcagcagagcgcatgatacaaaatactgttctttagtgtagccgtagttaggccaccactcaagaactctgtagcaccgc  
ctacatacctcgctctgtaaatcctgttaccagtggtgctgcccagtggaagtcgtgtcttaccgggttgactcaagacgatgttaccggataa  
ggcgagcggtggtgctgaacggggggtcgtgcacacagcccagcttgagcgaaacgactacaccgaactgagatacctacagcgtagctatg  
agaaagcgccagcttcccgaaggagaaaggcgacaggtatccggtgaagcgcgagggtcggaacaggagagcgacagggagcttcagggg  
ggaaacgctggtatctttatagctcgtcgggttccgacactgacttgagcgctgattttgtgatgctcgtcagggggcgagcctatggaaaa  
acgccagcaacgcgcccttttacggttcctggccttttctggtccttttctcacat

#### plG005 Pcon-araC (8)

ACGGaaaaaaaaccccgcccctgacagggcggggttttttccaattattgaaggccgctaacgcgcccttttttctgtctgccttaataca  
tgactaagaattcgcgccgcttctagagGGTCTCGAGTAcagaaaagcccgcctttcgcgggccttctgctgagttatgacaactgacggcta  
catcattcatttttctcacaaccggcacggaactcgctcgggtggtccccggtgcatttttaataaccgcgagaaatagagttgatcgtaaaacc  
aacattgcgaccgaggtggcgataggcatccgggtggtgctcaaaagcagcttcgctggtgatacgttggtcctcgcgccagcttaagacgctaa  
tcctaactgctggcgaaaagatgtgacagacgacggcgacaagcaaacatgctgtgcgacgctggcgatatcaaaattgctgtctgccaggtg  
atcgctgatgtactgacaagcctcggtacccgattatccatcggtggatggagcgactcgtaatcgcttccatgcgcccagtaacaattgctcaag  
cagatttatcgccagcagctcgaatagcgccctccccctgcccggcgtaatgatttgcccaaacaggtcgctgaaatggggtggtgcgcttcatcc  
ggcgaaagaacccgtattggcaaatattgacggccagttgaaccattcatgccagtaggcgcgaggacgaaagtaaaccactggtgataccatt  
cgcgagcctccggatgacgaccgtatgatgaatctctcgtggcggaacagcaaaatatccccggtcggaacaaattctcgtccctgattttca  
ccccccctgaccgcaatggtgagattgagaataaacctttcattcccagcggtcggtcgataaaaaatcgagataaccgttggcctcaatcggc  
gttaaaccgcccaccagatgggcattaaacgagatcccggcgacaggggatcattttgcgcttcagccatactttcatactcccgcattcagagaa  
gaaaccaattgtccatattgCATggtatatctccttctaaagttaaacaaaattattgtagctgcaaccattatcaccgccagaggtaaaattgtca  
acacgcacggtgttagctcagcatGCCAAAGAGACtactagtagcgccgctgcagttaatcactgattaactcggtaccaaattccagaaaag  
aggcctcccgaagggggcttttttctgtttggtcctttgttatcaataaaaaaggggagcggtttccgctcccctattgttcgtcTACAaccaat  
aaaaaacgcccggcggaaccgagcggttctgaacaaatccagatggagttctgaggtcattactggatctatcaacaggagtcgaagcgagctcgat  
atcatttaaattacgccccccctgccactcatcgagtagtctgttaattcattaagcattctgccgacatggaagccatcacaacggcatgatgaac  
ctgaatcgccagcgcatcagcaccttgctgccttgctgataatattgcccatgggtgaaacggggcggaagaagttgcatattggccacatttaa  
atcaaaactggtgaaactcaccagggattggctgaaacgaaaaacatattctcaataaaccttttagggaaataggccaggttttcaccgtaacag  
cccatcttgcaatatatgtgtagaaactgccggaatcgctggtgattcactccagagcgatgaaaacgtttcagtttgctcatgaaaaacggtgt  
aacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaattccggatgagcattcatcaggcgggcaagaatgtgaata  
aaggccggataaaacttgcttatttttcttacggtctttaaaaaggccgtaatatccagctgaacggtctggttataggtacattgagcaactgact  
gaaatgcctcaaaatgttctttacgatgccattgggataatcaacggtggtatatccagtatttttctcatttttagcttccttagctcctgaaaatct  
cgataactcaaaaaatacggcggtagtgatcttatttcattatggtgaaagttggaacctcttagctgcccgatcaatttaaGAGTttcagttcca  
caGGTACCagaaggtgcttCAAgttacattgtcgatctgttcaggtgaacagcttgaatAcacaaaaactcgtaaaagctctgatgtatct  
atcttttttacaccgtttcatctgtgcatatggacagtttccctttgatatgtaacggtgaacagttgttctacttttgtttgtatgtctgctcactg  
atagatacaagagccataagaacctcagatccttccgtatttagccagtatgttcttagtggttcgttgttttgcgtgagccatgagaacgaacca



ttgagatcatacttactttgcatgtcactcaaaaattttgctcaaaaactggtagctgaattttgcagttaaagcatcgtgtagtgttttcttagtccgt  
tatgtaggttaggaatctgatgtaatgggtgttggtattttgtcaccattcattttatctggtgttctcaagttcgggtacgagatccatttgcctatctagt  
tcaacttgaaaaatcaacgtatcagtcgggcggcctcgcttatcaaccaccaatttcatattgctgtaagtgttaaatctttacttattggtttcaaaaac  
cattggttaagccttttaaaactcatggtagttattttcaagcattaacatgaactaaattcatcaaggctaattcttatatttgccttgtgagttttctttg  
tgtagttcttttaataaccactcataaatcctcatagagtattgtttcaaaagacttaacatgttcagattatatttatgaattttttaactggaaa  
agataaggcaatatctcttactaaaaactaattctaattttcgcttgagaactggcatagttgtccactggaaaaatctaaagcctttaaccaaag  
gattcctgatttcacagttctcgatcagctctctggttgccttagctaatacaccataagcattttccctactgatgttcatcatctgagcgtattggtt  
ataagtgaacgataaccgtccgttctttcctttaggggtttcaatcgtaggggttagtagtgccacacagcataaaattagcttggttcatgctccgtta  
agtcatagcgactaatcgtagttcatttgccttggaaaacaactaattcagacatacatctcaattggtctaggtgatttaatacactataccaattgaga  
tggttagtcaatgataattactagtccttttctttaggttgggtatctgtaaattctgtagaccttgcctggaaaactgtaaattctgtagacctt  
ctgtaaattccgtagaccttgtgtgttttttgtttatattcaagtgggtataatttagaataaagaaagaataaaaaaagataaaaagaatagat  
cccagccctgtgtataactcactacttttagtcagttccgcagattacaaaaggatgtcgaaacgctgtttgctcctctacaaaacagaccttaaaacc  
ctaaaggcttaagtagcacctcgcgaagctcgggcaaatcgctgaatattcctttgtctccgacctcaggcacctgagtcgctgtcttttctgtacat  
tcagttcgctcgctcacggctctggcagtgaaatgggggtgaaatggcactacaggcgctttatggattcatgcaaggaaactaccataatacaag  
aaaagcccgctcacgggcttctcaggcgctttatggcggtctgctatgtgtgctatctgacttttgcctgttcagcagttcctgccctgattttccagt  
ctggccacttcggattatcccgtgacaggtcattcagactggctaattgcaccagtaaggcagcggtatcatcaacaggcttaccgtcttactgtc

### PIG006 RNAT1 (3)

accttgcgccttgctgataatatttgccatggtgaaaacgggggcgaagaagttgtccatattggccacatttaaatcaaaaactggtgaaactcacc  
cagggttggtgaaacgaaaaacatatttcaataaaaccttttagggaaataggccagggtttcacctgaacacgccacatcttgcaatatatgtgt  
agaaactgcggaaatcgtcgtgttactccagagcgatgaaaacgtttcagtttgcctatggaaaacggtgtaacaagggtgaacactatccca  
tatcaccagctcacctgttttattgccatacgaaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccggataaaactgtgctt  
atttttctttacggtctttaaaaaggccgtaatatccagctgaacggtctggttataggtacattgagcaactgactgaaatgcctcaaaaatgttctttac  
gatgccattgggataatcaacggtggtatatccagtgttttttctcatttttagcttcttagctcctgaaaatctcgataactcaaaaaatagcccg  
gtagtgtatcttatttatttggtgaaagttggaacctttacgtgccgatcaatttaaaATGAGTttcagttccacaGTACCCagaagggtgcttC  
CAAccgtagaaaagatcaaaggatcttcttgagatccttttttctgcgctaattctgctgcttgcacaaaaaaaccaccgctaccagcggtggtt  
tgtttgccgatcaagagctaccaactcttttccgaaggttaactggctcagcagagcgagatacacaactgttctttagttagccgtagtttag  
gccaccacttcaagaactctgtagcaccgctacatacctcgctctgctaactcgttaccagtggtgctgctgagtgagcgataagtcgtgtcttaccgg  
gttgactcaagacgatgttaccggataaggcgagcggtcgggctgaacgggggggtcgtgcacacagcccagcttgagcgaaacgacctacac  
cgaactgagatacctacagcgtgagctatgagaaagcgccacgcttccgaaggagaaaggcgacaggtatccggtgaagcggcagggtcgga  
caggagagcgacaggggagcttcagggggaacgcctggtatctttatagtcctgtcgggtttgcgcacctctgacttgagcgtcgtattttgtgatg  
ctcgtcagggggcgagcctatggaaaaacgccagcaacgcggcctttttaggttctggtccttttgcctgcttgcacatACGGaaaaaaa  
aaccgcccctgacaggcggggttttttccaattattgaaggcgctaacgcggccttttttctgttctgcttctaatcaatgactaagaattc  
gcggccgctttagagGGTCTCGACtttgcctggtctgcgaagaggagaaataactaAATGagagACtactagtagcgccgctgcagtt  
aatcactgattaactcgttacaaattccagaaaaggcctcccgaaggggggcctttttcgttttggctcttttgttatcaataaaaaaggggag  
cggtttcccgtctcccttattgttcgtTACAaccaataaaaaacgccggcggaaccgagcgttctgaacaaatccagatggagttctgaggtcat  
tactggatctatcaacaggagtccaagcgagctcgatatcatttaaattacgccccgcctgccactcatcgagtagtgttaattcattaagcattct  
gccgacatggaagccatcacaacggcatgatgaacctgaatcgccagcggtatcagc

### PIG007 RNAT2C (3)

cggcatcagcaccttgcgccttgctgataatatttgccatggtgaaaacgggggcgaagaagttgtccatattggccacatttaaatcaaaaactggt  
gaaactcaccagggttggtgaaacgaaaaacatatttcaataaaaccttttagggaaataggccagggtttcacctgaacacgccacatcttgcg  
aatatatgtgtagaaactgcggaaatcgtcgtgttactccagagcgatgaaaacgtttcagtttgcctatggaaaacggtgtaacaagggtga  
acactatcccatcaccagctcaccgtctttcattgccatacgaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccggata  
aaacttgccttatttttctttaggtctttaaaaaggccgtaatatccagctgaacggtctggttataggtacattgagcaactgactgaaatgcctcaa



aatgttctttacgatgccattgggatatatcaacggtggtatatccagtgatttttttccatttttagcttccttagctcctgaaaatctcgataactcaaa  
aaatacgcccggtagtgatcttatttcattatggtgaaagtggaaacctttacgtgcccgatcaatttaaatGAGTtcagttccacaGTACCca  
gaaggtgcttCAAaccgtagaaaaagatcaaaggatcttcttgagatccttttttctgcgctaactgtgctgcaaaaaaaaccaccgctac  
cagcgggtggtttgttgcggatcaagagctaccaactcttttccgaaggtaactggcttcagcagagcgcagatacctaatactgttcttagtgta  
gccgtagttaggccaccactcaagaactctgtagcaccgcctacatacctcgtctgctaactcctgttaccagtggtgctgctccagtgccgataagtcg  
tgtcttaccgggttgactcaagacgatagttaccggataaggcgcagcggctcgggctgaacggggggttcgtgcacacagcccagcttgagcgaa  
cgacctacaccgaactgagatacctacagcgtgagctatgagaaagcgcacgctcccgaaggagaaaggcggacaggtatccgtaagcggc  
agggtcggaaacaggagagcgcacgagggagcttcagggggaaacgctggtatctttatagtcctgtcgggttcgccacctgtgactgagcgtcg  
attttctgatgctcgtcaggggggaggcctatggaaaaacgccagcaacgcggccttttaccggtcctggccttttctggccttttctcacatA  
CGGaaaaaaaaccccgccctgacagggcggggttttttccaattattgaaggccgctaacgcggccttttttctgtctgcctaatcaat  
gactaagaattcgcgccgcttctagagGGTCTCgCGACtttgctggccttaccggaaaggagaaatactaAATGagagACtactagt  
agcggcgtgcatgtaatactgtaatactcgttaccaaattccagaaaaaggcctcccgaaggggggttttttctgttttgctctttgttatca  
ataaaaaaggggagcggtttcccgctccccttattgttcgtcTACAaccaataaaaaacgccggcggaaccgagcgttctgaacaaatccagatg  
gagttctgaggtcattactggatctatcaacaggagtccaagcgagctcgatatcatttaattacgcccccgctgcccactcatcgagtagttgta  
attcattaagcattctgccgacatggaagccatcacaacggcatgatgaacctgaatcgccag

### **pIG008 RNAT3 (3)**

cggcatgatgaacctgaatgccagcggcatcagcaccttgcgccttgctataatatttgcccatggtgaaaacgggggcaagaagttgtccatat  
tgccacatttaatacaaaactggtgaaactcaccagggattggctgaaacgaaaaacatatttcaataaaccttttagggaaataggccaggtt  
tcaccgtaacacgccacatcttgcaatatatgtgtagaaactccggaatcgtcgtggtattcactccagagcgtgaaaacgtttagttgtcat  
ggaaaacggtgtaacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaattccggatgagcattcatcagcgggca  
agaatgtgaataaaggccggataaaacttgcttatttttcttacggtcttaaaaaggccgaatatccagctgaacggtctggttataggtacatt  
gagcaactgactgaatgcctcaaaatgttctttacgatgccattgggatatatcaacggtggtatatccagtgatttttttccatttttagcttccttag  
ctcctgaaaatctcgataactcaaaaaatacggcggtagtgatcttatttcattatggtgaaagtggaaacctttacgtgcccgatcaatttaaatGA  
GTtcagttccacaGTACCagaagggtgcttCAAaccgtagaaaagatcaaaggatcttcttgagatccttttttctgcgctaactgtgctgctt  
gcaacaaaaaaaccaccgctaccagcgggtggtttgttgcggatcaagagctaccaactcttttccgaaggtaactggcttcagcagagcgcaga  
taccataactgttcttagtgtagccgttagtgccaccacttcaagaactctgtagcaccgcctacatacctcgtctgctaactcgttaccagtg  
gctgctgccagtgccgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataaggcgcagcggctcgggtgaacggggggttcgtg  
cacacagcccagcttgagcgaacgacctacaccgaactgagatacctacagcgtgagctatgagaaagcggcagctcccgaaggagaaagg  
cggacaggtatccgtaacgggcagggctggaacaggagagcgcacgagggagcttccaggggaaacgctggtatctttatagtcctgtcgggtt  
tcgccacctgtgactgagcgtgatttttctgatgctcgtcaggggggaggcctatggaaaaacgccagcaacgcggccttttaccggtcctggcc  
ttttctggccttttctcacatACGGaaaaaaaaccccgccctgacagggcggggttttttccaattattgaaggccgctaacgcggccttttt  
tggttctggtctgcctaatcaatgactaagaattcgcgccgcttctagagGGTCTCgCGACatttgaaataaaggagaaatactaAATGag  
agACtactagtagcggcgtgcatgtaatactgtaatactcgttaccaaattccagaaaaaggcctcccgaaggggggttttttctgtttg  
gtcctttgttatcaataaaaaaggggagcggtttcccgctccccttattgttcgtcTACAaccaataaaaaacgccggcggaaccgagcgttctg  
aacaatccagatggagttctgaggtcattactggatctatcaacaggagtccaagcgagctcgatatcatttaattacgcccccgctgcccactcat  
cgagtagttgtaattcattaagcattctgccgacatggaagccatcaca

### **pIG009 RNAT4 (3)**

tgcgtataatatttgccatggtgaaaacgggggcaagaagttgtccatttgccacatttaatacaaaactggtgaaactcaccagggattggc  
tgaaacgaaaaacatatttcaataaaccttttagggaaataggccaggttttaccgtaacacgccacatcttgcaatatatgtgtagaaactgcc  
ggaaatcgtcgtggtattcactccagagcgtgaaaacgtttagttgtcatggaaaacggtgtaacaagggtgaacactatcccatatcaccagct  
caccgtctttcattgccatacgaattccggatgagcattcatcagcggggcaagaatgtgaataaaggccggataaaacttgcttatttttcttac  
ggctttaaaggccgaatatccagctgaacggtctggttataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattgg  
gatatatcaacggtggtatatccagtgatttttttctccatttttagcttccttagctcctgaaaatctcgataactcaaaaaatacggcggtagtgatctt



atttcattatggtgaaagttggaacctcttacgtgccgatcaatttaaatGAGTttcagttccacaGGTACCagaaggtgcttCCAACccgtag  
aaaagatcaaaggatcttcttgagatcctttttctgcgcgtaatctgctgcttcaaacaaaaaacaccgcgtaccagcggtggtttgttgcgga  
tcaagagctaccaactcttttccgaaggtaactggcttcagcagagcgcagataccaatactgttcttctagtgtagccgtagttaggccaccacttc  
aagaactctgtagcacccgctacatacctcgctctgctaactcgtgttaccagtggctgctgccagtggcgataagtctgtcttaccgggttgactcaa  
gacgatagttaccggataaggcgcagcggtcgggctgaacggggggttcgtgcacacagcccagcttgagcgaacgacctacaccgaactgagat  
acctacagcgtgagctatgagaaagcgccacgcttccgaagggagaaaggcggacaggtatccggtaacggcgagggtcggaacaggagagcgc  
acgagggagcttccagggggaaacgcctggtatctttatagtcctgtcgggtttcgccaccttgacttgagcgtcgatttttgtgatgctcgtcagggg  
ggcggagcctatggaaaaacgccagcaaccgggccttttacggttcctggccttttgctggccttttgctcacatACGAAAAAAAAAACCCGCCCC  
tgacagggcgggggttttttccaattattgaaggccgtaacgcggcctttttgttctggtctgccttaatcaatgactaagaattcgcggcgcttct  
agagGGTCTCGCAGCttatggttcggcgtggaaagaggagaaatactaAATGagagACtactagtagcggccgctgcagttaatcactgatt  
aactcggtagcaaattccagaaaagggcctcccgaaggggggcctttttcgttttggtcctttgttatcaataaaaaaggggagcggttcccgc  
cccctattgttctgTACAaccaataaaaaacgccggcggaaccgagcggttctgaacaaatccagatggagttctgaggtcattactggatctat  
caacaggagtccaagcgagctcgatatcatttaaattacgccccgcctgccactcatcgagtactgttgtaattcattaagcattctgccgacatgga  
agccatcacaacggcatgatgaacctgaatgccagcggcacgcaccttctgcct

**plG010 otsBA**

ACGGGAAAAAAACCACCCCGCCCTGACAGGGCGGGGGTTTTTTCCCAATTGAAGGCGCTAACGCGGCCTTTTTGTTTCTGGTCTGCCTTAATCAATGACTAAGAATTCGCGGCCGCTTCTAGAGGGTCTCGAATGACAGAACCGTTAACGGAACCCCTGAACATCCGCGAAATATGCTGGTTTTTGAATCTTGATGGAACGCTGGCGGAAATCAAACCGCATCCCGATCAGGTCGTCGTGCTGACAATATCTGCAAGGACTACAGCTACTGGCAACCGCAAGTGATGGTGCAATGGCATTGATATCAGGGCGCTCAATGGTGGAGCTTGACGCACTGGCAAAACCTTATCGCTCCCGTTAGCGGGCGTGCAATGGGGCGGAGCGCCGTGACATCAATGGTAAACACATATCGTTCATCTGCCGATGCGATTGCGCGTGATATTAGCGTGCAACTGCATACAGTCATCGCTCAGTATCCCGCGCGGAGCTGGAGGCGAAAGGGATGGCTTTTGCCTGCATTATCTGCAGGCTCCGCAGCATGAAGACGCATTAATGACATTAGCGCAACGTATTACTCAGATCTGGCCAAAATGGCGTTACAGCAGGGGAAAGTGTGTGTCGAGATCAAACCGAGAGGTACCAGTAAAGGTGAGGCAATTGCAGCTTTATGCAGGAAGCTCCCTTATCGGGCGAACGCCGTATTTCTGGGCGATGATTAAACCGATGAATCTGGCTTCGAGTCGTTAACCGACTGGGCGGAATGTCAGTAAAAATGGCACAGGTGCAACTCAGGCATCATGGCGACTGGCGGGTGTGCCGGATGTCTGGAGCTGGCTGAAATGATAACCCCGCATTACAACAAAAAGAGAAAAATAACAGGAGTGATGACTATGAGTCGTTAGTCGTAGTATGGATTGCACCACCAGACGAGCACGCCGCCAGTCGGGTGGCTTGCCTTGGCATACTGGGGGCACTGAAAGCCGCAGGCGGACTGTGGTTGGCTGGAGTGGTGAAACAGGGAATGAGGATCAGCCGCTAAAAAGGTGAAAAAGGTAACATTACGTGGGCCTCTTTAACCTCAGCGAACAGGACCTTGACGAATACTACAACCAATTTCCAATGCCGTTCTCTGGCCGCTTTTCATTATCGGCTCGATCTGGTGCAATTCAGCGTCTGCTGGGACGGCTATCTACCGGTAATGCCTTGCTGGCAGATAAATACTGCCGTGTGCAAGACGATGACATTATCTGGATCCAGATTACCTGTGGCATTGTGCGATGAATTACGAAACGGGGAGTGAATAATCGATTGGTTCTTTCTGCAATTTCTTTCCCGACACCGGAAATCTCAACGCGCTCGCGACATATGACACCTGCTTGAACAGCTTTGTGATTATGATTTGCTGGGTTCCAGACAGAAACGATCGTCTGGCGTTCTGGATTGTCTTTTAACCTGACCCGCTCACGACACGTAGCGAAAAAGCCATACAGCCTGGGGCAAAGCATTTCGAACGAAGTCTACCCGATCGGCATTGAACGAAAGAAATAGCCAACAGGCTCGCGGGCCACTCGCCGCAAACTGGCGCAACTAAAGCGGAAGTGAACGTAACAAATATCTTTCTGTGCAACGGCTGGATTATTTCAAAGGTTTGCAGAGCGTTTTCTCGCCTATGAAGCGTTGTGGAAAAATATCCGCAGCATCATGGTAAAAATCGTTATACCCAGATTGCACCAACGTCGCGTGGTGATGTGCAAGCCTATCAGGATATTCGTCATCAGCTCGAAAAATGAAGCTGGACGAATTAATGGTAAATACGGGCAATTAGGCTGGACGCCGCTTATTATTGAATCAGCATTTTGACCGTAAATACTGATGAAAATATTCGCTACTCTGACGTGGGCTTAGTGACGCCACTGCGTGACGGGATGAACCTGGTAGCAAAAGAGTATGTTGCTGCTCAGGACCCAGCCAATCCGGGCGTCTTGTCTTTCGCAATTTGCGGGAGCGGCAACGAGTTAACGTCGGCGTTAATTGTTAACCCCTACGATCGTGACGAAGTTGCAGTCGCTGGATCGTGCAATGACTATGTCGCTGGCGGAACGTATTTCCGTCATGCAGAAATGCTGGACGTTATCGTGAAAAACGATTAACCACTGGCAGGAGTGCTTCATTAGCGACCTAAAGCAGATAGTTCCGCGAAGCGCGGAAAGCCAGCAGCGCGATAAAGTTGCTACCTTTCAAAGCTTGCGTAGTAATAATGGCAGAGACCTACTAGTAGCGGCCGCTGCAGTTAATCACTGATTAACCGGTACCAATTCAGAAAAGAGGCTCCCGAAAGGGGGGCTTTTTGCTTTTGGTCTTTGTTATCAATAAAAAAGGGGAGCGGTTTCCGCTCCCTTATTGTTCTGTCTACAAACATAAAAAACGCCCGGCGCAACCGAGCGTTCTGAACAAATCCAGATGGAGTTCTGAGGTGCTACTGATCTATCAACAGGAGTCCAAGCGAGCTCGATATCATTAAATTACGCCCCGCTGCCACTCATCGAGTACTGTTGTAATTCATTAAGCATTCTGCCGACATGGAAGCCATCACAAACGGCATGATGAACCTGAATCGCCAGCGGCATCAGCACCTTGTGCTTGCGTATAATATTTGCCCATGGTGAACCGGGGCGAAGAAGTTGTCATATTGGCCACATTTAAATCAAACTGGTGAACCTACCCAGGGATTGGCTGAAACGAAAAAC



atattctcaataaaccccttagggaaataggccaggtttcacgtaacacgccacatcttgcaatatatgttagaaactgccgaaatcgctggtg  
tattactccagagcgatgaaaacgtttcagtttgcctcatggaaaacggtgtaacaagggtgaacactatcccatatcaccagctcaccgtctttcattg  
ccatacgaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccggataaaacttgcttattttcttacggtctttaaaaagg  
ccgtaatatccagctgaacggtctggttataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattgggatatatcaacggt  
ggtatatccagtgattttttctcatttttagcttccttagctcctgaaaatctcgataactcaaaaatacggcggtagtgatcttatttcattatggtga  
aagttggaacctcttactgccccgatcaatttaaatGAGTttcagttccacaGGTACCagaagggtgcttCAAAccgtagaaaagatcaaagg  
atcttcttgagatcctttttctgcgcgtaatctgctgcttgcacaaaaaaaccaccgctaccagcggtggtttgtttgccggatcaagagctaccaa  
ctctttttccgaaggtaactggcttcagcagagcgagataccaatactgttctttagttagcgttagttaggccaccactcaagaactctgtagc  
accgcctacatacctcgctctgtaactctgttaccagtggtgctgctgccagtggtgcgataagtcgtgcttaccgggttggtactcaagacgatgttaccg  
gataaggcgagcggtcgggctgaacggggggtcgtgcacagcccagcttgagcgaacgacctacaccgaactgagatacctacagcgtagg  
ctatgagaaagcgccacgcttccgaaggagaaaaggcgacaggtatccggtgaagcggcagggctggaacaggagagcgacgagggagcttc  
agggggaaacgctggtatctttatagtcctgtcggggttccacctctgacttgagcgtcgatttttgtgatgctcgtcaggggggaggcctatgg  
aaaaacgccagcaacgcggcctttttacggttcttgcccttttgctggccttttgctcacat

### **pIG012 Para (2)**

ACGGAaaaaaaaccccgccctgacagggcgggggttttttccaattattgaaggccgctaacgcggcctttttgtttctggtctgccttaatcaa  
tgactaagaattcgggcggttctagagGGTCTCGCTTtagcattttatccataagattagcggatcctacgtgacgtttttatcgcaactctct  
actgtttctcCATACCCGCGACagagACtactagtagcgccgctgcagttaatcactgattaactcggtaccaaattccagaaaaggcctc  
ccgaaagggggcctttttcgttttggctctttgttatcaataaaaaaggggagcggtttccgctccccttattgttcgtcTACAaccaataaaaaa  
cgcccgcggaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggatctatcaacaggagtcgaagcgagctcgatatcattt  
aaattacccccccctgccactcatcgagtactgttgaattcattaagcattctgccgacatggaagccatcacaaaaggcatgatgaacctgaat  
cgccagcgcatcagcacctgtgccttgctataatattgcccattgtaaaacggggcggaagaagttgtccatattggccacatttaaatcaaa  
actggtgaaactcaccagggttggtgaaacgaaaaacatatttcaataaaaccttttagggaaataggccaggtttcacgtaacacgccacat  
cttgcaatatatgtgtagaaactgccggaatcgtcgtggtattcactccagagcgatgaaaacgtttcagtttgcctatggaaaacggtgtaacaag  
ggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggcc  
ggataaaacttgcttatttttcttacggtctttaaaggccgtaatatccagctgaacggctggttataggtacattgagcaactgactgaaatgc  
ctcaaaatgttctttacgatgccattgggatatatcaacggtggtatatccagtgattttttctcatttttagcttccttagctcctgaaaatctcgataac  
tcaaaaaatacggcggtagtgatcttatttcattatggtgaaagttggaacctcttactgccccgatcaatttaaatGAGTttcagttccacaGGTA  
CCagaagggtgcttCAAAccgtagaaaagatcaaaggatcttcttgagatcctttttctgcgcgtaatctgctgcttgcaacaaaaaaaccacc  
gctaccagcggtggtttgtttgccggatcaagagctaccaactctttttccgaaggtaactggcttcagcagagcgagataccaataactgttctcta  
gtgtagccgtagttaggccaccactcaagaactctgtagcaccgcctacatacctcgctctgtaactctgttaccagtggtgctgctgccagtggtgcgata  
agtcgtgcttaccgggttggtactcaagacgatgttaccggataaggcgagcggtcgggctgaacgggggggtcgtgcacacagcccagcttgga  
gcgaacgacctacaccgaactgagatacctacagcgtgagctatgagaaagcgccacgcttccgaaggagaaaaggcgacaggtatccggtaa  
gcggcagggctggaacaggagagcgacgagggagcttccagggggaaacgctggtatctttatagtcctgtcggggttccacctctgacttgag  
cgtcgattttgtgatgctcgtcaggggggaggcctatggaaaaacgcagcaacgcggcctttttacggttcttgcccttttgctggccttttgctca  
cat

### **pIG017 RNAT101 (3)**

ACGGAaaaaaaaccccgccctgacagggcgggggttttttccaattattgaaggccgctaacgcggcctttttgtttctggtctgccttaatcaa  
tgactaagaattcgggcggttctagagGGTCTCGCGACattatagattactaccatcccacctcctagtgaagaggagaaataactaAATG  
aGAGACtactagtagcgccgctgcagttaatcactgattaactcggtaccaaattccagaaaaggcctccgaaaggggggctttttcgtt  
ttggtcctttgttatcaataaaaaaggggagcggtttccgctccccttattgttcgtcTACAaccaataaaaaacggcgggcgaaccgagcgttc  
tgacaaatccagatggagttctgaggtcattactggatctatcaacaggagtcgaagcgagctcgatatcatttaattacggcccgccctgccactc  
atcgagtagctgttgaattcattaagcattctgcgacatggaagccatcaaaacggcatgatgaacctgaatcgccagcggtcagcaccttgc  
gccttgctataatatttgccatggtgaaaacggggcggaagaagttgtccatattggccacatttaaatcaaaactggtgaaactcaccaggaggt



ggctgaaacgaaaaacatatttcaataaaccttttagggaaataggccagggttttcaccgtaacacgccacatcttgcaatatatgtgtagaaact  
gccggaaatcgtcgtgttattcactccagagcgatgaaaacgtttcagtttgctcatggaaaacgggtgaacaagggtgaacactatcccatatcacc  
agctcaccgtctttcattgccatagaaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccggataaaacttgcttatttttct  
ttacgggtcttaaaaggccgtaatatccagctgaacgggtcgtgttataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgcca  
ttgggatatatcaacgggtgtatatccagtgttttttctcatttttagcttccttagctcctgaaaatctcgataactcaaaaaatacggccggtagtga  
tcttatttcattatggtgaaaagttggaacctcttacgtgcccgatcaatttaaGAGTttcagttccacaGTACcagaagggtgcttCAAAccg  
tagaaaagatcaaaggatcttcttgagatcctttttctgctgtaatctgctgcttgcaacaaaaaaaccaccgctaccagcggtggtttgtttgcc  
ggatcaagagctaccaactcttttccgaaggtaactggcttcagcagagcgagatacacaataactgttctttagttagcgttagttaggccacca  
cttcaagaactctgtagcaccgcctacatacctcgctctgtaatctgttaccagtggctgctgaccagtggcgataagtcgtgtcttaccgggttgact  
caagacgatagttaccggataaggcgcagcggtcgggtgtaacggggggtcgtgcacacagccagcttgagcgaacgacctacaccgaactga  
gatacctacagcgtgagctatgagaaagcgccacgcttccgaaggagaaaggcgagcaggtatccgtaagcggcagggtcggaacaggagag  
cgacgagggagcttcagggggaaacgcctggtatctttatagtcctgtcggtttcgccacctgacttgagcgtgattttgtgatgctcgtcagg  
ggggcgagcctatgaaaaacgccagcaacgcggccttttacgggtcctggccttttgcctgttgcacat

#### **pIG018 RNAT102**

ccaaatactgttctttagttagcgttagttaggccaccacttcaagaactctgtagcaccgcctacatacctcgctctgtaatcctgttaccagtggc  
tgctgccagtggcgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataaggcgagcggtcgggtgaacgggggggtcgtgca  
cacagcccagcttgagcgaacgacctacaccgaactgagatacctacagcgtgagctatgagaaagcgccacgcttccgaaggagaaaggcg  
gacaggtatccgtaagcggcagggtcggaacaggagagcgacagggagcctccaggggaaacgcctggtatctttatagtcctgtcggtttc  
gccacctgacttgagcgtgattttgtgatgctcgtcagggggcgagcctatgaaaaacgccagcaacgggccttttacggttctggtcctt  
ttgctggcctttgtcacatACGGaaaaaaacccccgcccctgacagggggggttttttccaattattgaaggccgtaacgcggcctttttg  
tttctggtcgtccttaataatgactaagaattcgcgccgctttagagGTCTCGCGACCATTATATTAACCTACCATCCACCTCCT  
AGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcgccgctgcagttaatcactgattaactcggtaccaaattccagaaa  
agaggcctccgaaaggggggcctttttcgttttggtcctttgttatcaataaaaaaggggagcggtttccgctccccttattgtctcTACAacc  
aataaaaaacggcggggcaaccgagcgttctgaacaaatccagatggagtctgaggtcattactggatctatcaacaggagtccaagcgagctc  
gatatcatttaaattacgccccgcctgccactcatcgagctactgttgaattcattaagcattctgccgacatggaagccatcaaaacggcatgatg  
aacctgaatcgccagcggtcagcacctgtgccttgcgtataatattgccatggtgaaaacggggcggaagaagttgtccatattggccacatt  
taaataaaaactggtgaaactcaccagggttggtgaaacgaaaaacatatttcaataaaccttttagggaaataggccagggttttcaccgtaac  
acgccacatcttgcaatatatgtgtagaaactgccgaaatcgtcgtgttattcactccagagcgatgaaaacgtttcagtttgctcatgaaaacgg  
tgtaacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaattccggatgagcattcatcaggcgggcaagaatgtgaa  
taaaggccggataaaacttggttatttttcttacggtctttaaaaaggccgtaatatccagctgaacgggtcgtgttataggtacattgagcaactga  
ctgaaatgcctcaaaatgttctttacgatgccattgggatatacaacggtggtatccagtgattttttctcatttttagcttcttagctcctgaaaat  
ctcgataactcaaaaaatacggcggtagtgtatttatttatttggtgaaagttggaacctcttacgtgccgatcaatttaaGAGTttcagttcc  
acaGTACcagaagggtcctCAAaccgtagaaaagatcaaaggatcttcttgagatcctttttctgctgtaatctgctgcttgcaacaaaa  
aaaccaccgctaccagcggtggtttgtttgccggatcaagagctaccaactcttttccgaaggtaactggcttcagcagagcgagata

#### **pIG019 RNAT103**

ACtactagtagcgccgctgcagttaatcactgattaactcggtaccaaattccagaaaagaggcctccgaaaggggggcctttttcgttttggtc  
ctttgttatcaataaaaaaggggagcggtttccgctccccttattgtctcTACAaccaataaaaaacggcgggcaaccgagcgttctgaac  
aaatccagatggagtctgaggtcattactggatctatcaacaggagtccaagcgagctcgatatcatttaaattacggccgcctgccactcatcgc  
agtactgttgaattcattaagcattctgccgacatggaagccatcaaaacggcatgatgaacctgaatcgccagcggtcagcacctgtgcctt  
gcgtataatatttgccatggtgaaaacggggcggaagaagttgtccatattggccacatttaaataaaaactggtgaaactcaccagggttggt  
gaaacgaaaaacatatttcaataaaccttttagggaaataggccagggttttcaccgtaacacgccacatcttgcaatatatgtgtagaaactgccg  
gaaatcgtcgtgttattcactccagagcgatgaaaacgtttcagtttgctcatgaaaacgggtgaacaagggtgaacactatcccatatcaccagctc  
accgtctttcattgccatacgaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccggataaaacttggttatttttcttacg



gtctttaaaaaggccgtaatatccagctgaacggctctggttataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattggg  
atatatcaacgggtggtatatccagtgattttttctcatttttagcttccttagctcctgaaaatctcgataactcaaaaaatacggccggtagtgatctta  
tttcattatggtgaaagttggaacctttacgtgcccgatcaatttaaGAGTttcagttccacaGTACCagaaggtgcttCAAaccgtaga  
aaagatcaaaggatcttcttgagatcctttttctgcgcgtaactctgctgcttgaacaaaaaaaccaccgctaccagcggtggtttgtttgccggatc  
aagagctaccaactctttttcgaaggaactggcttcagcagagcgagataccaatactgttcttagtgtagccgtagttaggccaccactcaa  
gaactctgtagaccgcctacatactcgtctgctaactctgtttaccagtggtgctgccagtggtgataagtcgtgttaccgggttgactcaaga  
cgatagttaccggataaggcgagcggtcgggctgaacggggggttcgtgcacacagcccagcttgagcgaacgacctacaccgaactgagatac  
ctacagcgtgagctatgagaaagcgccacgttcccgaaggagaaaggcgagcaggtatccggtaagcggcagggtcggaacaggagagcgac  
gaggagcctccagggggaaacgcctggtatctttatagtcctgtcgggtttcgccacctgacttgagcgtcgattttgtgatgctcgtcagggggg  
cggagcctatgaaaaacggcagcaacgcggccttttacggttcctggcctttgtctggcctttgtctcacatACGAAAAaaaaaccccgccctg  
acaggcggggttttttccaattattgaaggccgtaacgcggcctttttgtttctgctgcctaatcaatgactaagaattcgggcggttcta  
gagGGTCTCGCGACATTATAGATTTGCTACCATCAACACTCCTAGTGAAAGAGGAGAAATACTAAATGagag

#### **pIG020 RNAT104**

gtggctgctgccagtggtgataagtcgtgttaccgggttgactcaagacgatagttaccggataaggcgagcggtcgggctgaacgggggggttc  
gtgcacacagcccagcttgagcgaacgacctacaccgaactgagatactacagcgtgagctatgagaaagcgccacgcttcccgaaggagaaa  
ggcggacaggtatccggtaagcggcagggtcggaacaggagagcgacagggagcttccagggggaaacgcctggtatctttatagtcctgtcgg  
gtttcgccacctgacttgagcgtcgattttgtgatgctcgtcagggggcgagcctatgaaaaacgcagcaacgcggccttttacggttcctg  
gcctttgtcggcctttgtctcacatACGAAAAaaaaaccccgccctgacaggcggggttttttccaattattgaaggccgtaacgcggcctt  
ttttgtttcgtcgtccttaataatgactaagaattcgggcggttctagagGGTCTCGCGACATTATATAACCCACACCTAGA  
CCTTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcgccgctgcagttaatcactgattaactcgggtaccaaattc  
cagaaaagaggcctcccgaaggggggcctttttctgtttggtcctttgttatcaataaaaaaggggagcggtttcccgtccccttattgttcgtTA  
CAaccaataaaaaacgcccggcggaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggatctatcaacaggagtccaagc  
gagctcgatatcatttaaattacggccgctgccactcatcgagtagtgttaattcattaagcattctgccgacatggaagccatcacaacggc  
atgatgaacctgaatgccagcgcatcagcacctgtcgccttgctataatattgccatggtgaaaacggggcggaagaagttgtccatattggc  
cacatttaaataaaaactggtgaaactcaccagggttggtgaaacgaaaaacataatttcaataaaacccttagggaaataggccagggtttcac  
cgtaacacgccacatcttgcaatatatgtgtagaaactccggaaatcgtcgtggtattcactccagagcgatgaaaacgtttcagtttgcctatgga  
aaacgggtgaacaagggtgaacactatccataaccagctcaccgtctttcattgccatacgaaattccggatgagcattcatcaggcgggcaaga  
atgtgaataaaggccggataaaactgtgcttattttctttacggtctttaaaaaggccgtaatatccagctgaacggctggttataggtacattgagc  
aactgactgaaatgcctcaaaatgttctttacgatgccattgggatatatcaacgggtggtatatccagtgattttttctcatttttagcttccttagctcct  
gaaaatctcgataactcaaaaaatacggccggtagtgatcttattcattatggtgaaagttggaacctttacgtgcccgatcaatttaaGAGTtt  
cagttccacaGTACCagaaggtgcttCAAaccgtagaaaagatcaaaggatcttcttgagatcctttttctgcgcgtaactctgctgcttga  
aacaacaaaaaccaccgctaccagcggtggtttgtttgccggatcaagagctaccaactcttttccgaaggtaactggttcagcagagcgagatac  
caaatactgttcttagtgtagccgtagtaggcccaccactcaagaactctgtagaccgcctacatacctcgtcgtctgctaactcgtttacca

#### **pIG021 RNAT105**

ACCtactagtagcgccgctgcagttaatcactgattaactcgggtaccaaattccagaaaaggcctcccgaaggggggcctttttctgtttggtc  
ctttgttatcaataaaaaaggggagcggtttcccgtccccttattgttcgtTACAaccaataaaaaacggcggaaccgagcgttctgaac  
aaatccagatggagttctgaggtcattactggatctatcaacaggagtccaagcgagctcgatatcatttaaattacggccgctgccactcatcgc  
agtactgttgaattcattaagcattctgccgacatggaagccatcacaacggcatgatgaacctgaatcgccagcgcatcagcacctgtcgcctt  
gctataatatttgccatggtgaaaacggggcggaagaagttgtccatattggccacatttaaataaaaactggtgaaactcaccagggttggt  
gaaacgaaaaacataatttcaataaaacccttagggaaataggccagggtttaccgtaacagccacatcttgcaatatatgtgtagaaactgccg  
gaaatcgtcgtggtattcactccagagcgatgaaaacgtttcagtttgcctatgaaacgggtgaacaagggtgaacactatccatataccagctc  
accgtctttcattgccatacgaaattccggatgagcattcatcaggcggggaagaatgtgaataaaggccggataaaactgtgcttattttctttacg  
gtctttaaaaaggccgtaatatccagctgaacggctctggttataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattggg



atatatcaacggttggtatatccagtgatttttttctcatttttagcttccttagctcctgaaaatctcgataactcaaaaaatacggcggtagtgatctta  
tttcattatggtgaaagttggaacctcttacgtgcccgatcaatttaaatGAGTtccagttccacaGTACCagaaggtgcttCAAaccgtaga  
aaagatcaaaagatcttcttgagatccttttttctgcgctaattctgctgcttgcacacaaaaaaccaccgctaccagcggtggtttgttgcggatc  
aagagctaccaactctttttccgaaggttaactggcttcagcagagcgcagataccaaatactgttcttagttagcgttaggttagccaccactcaa  
gaactctgtagcaccgctacatacctcgtctgctaactctgttaccagtggctgctgccaagtggcgataagtcgtgtcttaccgggttgactcaaga  
cgatagttaccggataaaggcgcagcggtcggtgtaacggggggttctgtcacacagcccagcttgagcgaacgacctacccgaactgagatac  
ctacagcgtgagctatgagaaagcgccacgcttcccgaaggagaaaggcgacaggtatccggtaagcggcagggctggaacaggagagcgcac  
gaggagccttccagggggaaacgcttggtatctttatagtcctgtcgggtttcgccacctgacttgagcgtcgattttgtgatgctcgtcagggggg  
cggagcctatggaaaaacgccaacgcggcctttttacggttctggccttttctggtcctttgtctacatACGAAAAaaaaaccccgccctg  
acaggcggggttttttccaattattgaaggccgtaacgcggcctttttgttctggtctgcctaatcaatgactaagaattcgcgccgcttcta  
gagGGTCTCGCGACATTATACTTACCCACACCTAGACTCCTAGTGAAAGAGGAGAAATACTAAATGagag

#### **pIG022 RNAT106**

tggctgctgccagtggtcgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataaggcgagcggtcggtgtaacggggggttcg  
tgcacacagcccagcttgagcgaacgacctacaccgaactgagatacctacagcgtgagctatgagaaagcgccacgcttcccgaaggagaaag  
gcggaacaggtatccggtaagcggcagggctcggaacaggagagcgacagggagccttccaggggaaacgcttggtatctttatagtcctgtcgggt  
ttcgccacctgacttgagcgtcgattttgtgatgctcgtcagggggcgagcctatggaaaaacgccagcaacgcggcctttttacggttctgtgc  
ctttgtggtcctttgtctcacatACGGaaaaaaaaccccgccctgacagggcggtttttttccaattattgaaggccgtaacgcggccttttt  
ttgttctggtctgccttaataatgactaagaattcgcgccgcttctagagGGTCTCGCGACATTCTAGATTGCTACCATCTATCCT  
CCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcgccgctgcagttaatcactgattaactcggtaaccaattccag  
aaaagaggcctcccgaagggggctttttcgttttggctctttgttatcaataaaaaaggggagcggtttcccgtccccttattgtctcTACA  
accaataaaaaacgcccggcgcaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggatctatcaacaggagtcgaagcgag  
ctcgatatcatttaaatcagccccgcttccactcatcgagtagtctgttaattcattaagcattctgccgacatggaagccatcacaacggcatg  
atgaacctgaatcgccagcgcatcagcacctgtgccttgcgtataatatttcccatggtgaaaacggggcggaagaagttgtccatattggcac  
atttaaatcaaaactggtgaaactcaccagggattggctgaaacgaaaaacataattctcaataaaccttttagggaaataggccaggttttaccgt  
aacacgccacatcttgcaatatatgtgtagaaactgccggaaatcgtcgtggtattcactccagagcgatgaaaacgtttcagtttgcctatggaaaa  
cggtgtaacaagggtgaacactatccatatacaccagctcaccgcttttattgccatacgaattccggatgagcattcatcaggcgggcaagaatgt  
gaataaaggccggataaaactgtgcttatttttcttacggtcttttaaaaggccgtaatatccagctgaacggtctggttataggtacattgagcaac  
tgactgaaatgcctcaaaatgttctttacgatgccattgggatatatcaacgggtgatatccagtgattttttctcatttttagcttccttagctcctgaa  
aatctcgataactcaaaaaatacggcggtagtgatcttattcattatggtgaaagttggaacctcttacgtgcccgatcaatttaaatGAGTtccag  
ttccacaGTACCagaaggtgcttCAAaccgtagaaagatcaaaggatcttcttgagatccttttttctgcgctaattctgctgcttgcacac  
aaaaaaccaccgctaccagcggtggtttgttgcggatcaagagctaccaactcttttccgaaggttaactggcttcagcagagcgcagataccaa  
atactgttcttctagtgtagccgtagttaggccaccactcaagaactctgtagcaccgctacatacctcgtctgctaactctgttaccag

#### **pIG023 RNAT107**

ttaccagtggtgctgccagtggtcgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataaggcgagcggtcggtgtaacggg  
gggttcgtgcacacagcccagcttgagcgaacgacctacaccgaactgagatacctacagcgtgagctatgagaaagcgccacgcttcccgaagg  
gagaaaggcggaacaggtatccggtaagcggcagggctcggaacaggagagcgacagggagccttccaggggaaacgcttggtatctttatagtc  
tgtcgggtttcgccacctgacttgagcgtcgattttgtgatgctcgtcagggggcgagcctatggaaaaacgccagcaacgcggcctttttacgg  
ttcctggtcctttgtggtcctttgtctcacatACGGaaaaaaaaccccgccctgacagggcggtttttttccaattattgaaggccgtaacgc  
ggccttttttctgtggtctgccttaataatgactaagaattcgcgccgcttctagagGGTCTCGCGACATTCTGGATTGCTACCATC  
TATCCTCCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcgccgctgcagttaatcactgattaactcggtaacca  
aattccagaaaagaggcctcccgaagggggctttttcgttttggctctttgttatcaataaaaaaggggagcggtttcccgtccccttattgttc  
gtcTACAaccaataaaaaacgcccggcgcaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggatctatcaacaggagtc  
caagcgagctcgatatcatttaaatcagccccgcttccactcatcgagtagtctgttaattcattaagcattctgccgacatggaagccatcaca



acggcatgatgaacctgaatcgccagcgcatcagcacctgtgccttgcgtataatattgccatggtgaaaacggggcgagaagtgtccat  
attggccacatttaaatcaaaactggtgaaactcaccagggattggctgaaacgaaaaacatattctcaataaacctttagggaataggccaggt  
tttcaccgtaacacgccacatcttgcgaatatatgttagaaactgccggaaatcgctggttattcactccagagcgatgaaaacgtttcagtttgctc  
atggaaaaacggtgtaacaagggtaacactatcccatatcaccagctcaccgtctttcattgccatacgaaattccggatgagcattcatcaggcggg  
caagaatgtgaataaaggccggataaaacttgtgcttattttctttacggctcttataaaaggccgtaatatccagctgaacggtctggttataggtaca  
ttgagcaactgactgaaatgcctcaaaatgttctttacgatccattgggatatacaacgggtgtatatccagtgttttttctccattttagttcctta  
gctcctgaaaaatctcgataactcaaaaaatacgcccggtagtgatcttatttcattatggtgaaagtggaaacctttacgtgccgatcaatttaaatG  
AGTttcagttccacaGGTACCagaagggtgcttCAAaccgtagaaaagatcaaaggatcttcttgagatcctttttctgcgctaactctgctgc  
ttgcaacaaaaaaaccaccgctaccagcggtggtttgtttgccgatcaagagctaccaactcttttccgaaggttaactggcttcagcagagcgca  
gataccaaatactgttcttctagtgtagccgttagtgccaccacttcaagaactctgtagcaccgcctacatacctcgctctgctaactctg

#### **pIG024 RNAT108**

gcaccgcctacatacctcgctctgctaactctgttaccagtggctgctgccagtggcgataagtcgtgtcttaccgggttgactcaagacgatagttac  
cggataaggcgagcggtcgggctgaacgggggggttcgtgcacacagcccagcttgagcgaaacgacctacaccgaactgagatacctacagcgtg  
agctatgagaaagcgccacgtctccgaaggagaaaggcggacaggtatccggttaagcggcagggctggaacaggagagcgacgagggagct  
tccagggggaaacgcctggtatctttatagtcctgtcgggtttcgccacctctgacttgagcgtcgatttttgtgatgctcgtcagggggcgaggcctat  
ggaaaaacgccagcaacgcggccttttacggttcttgcccttttctggtccttttctcacatACGAAAAaaaaaccccgccctgacaggggcg  
ggtttttttccaattattgaaggcgctaacgcggccttttttctgtctgcttaataatgactaagaattcgcgccgcttctagagGGTCT  
CGCGACATTATACTTAACCCACACCTAGACCTCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcgg  
ccgctgcagttaatcactgattaactcggtaccaaattccagaaaagaggcctcccgaaagggggcctttttctgttttggtcctttgttatcaataa  
aaaggggagcggtttccgctcccctattgttcgtcTACAaccaataaaaaacgccggcggaaccgagcgttctgaacaaatccagatggagtt  
ctgaggtcattactggatctatcaacaggagtccaagcgagctcgatatcattaaattacccccccctgccactcatcgagtactgttgtaattca  
ttaagcattctgccgacatggaagccatcacaaacggcatgatgaacctgaatcgccagggcatcagcacctgtgccttgcgtataatattgcc  
atggtgaaaacggggcgagaagtgtccatattggccacatttaaatcaaaactggtgaaactcaccagggattggctgaaacgaaaaacat  
tctcaataaacctttagggaataggccaggttttcaccgtaacacgccacatcttgcgaatatatgttagaaactgccggaaatcgctggttattc  
actccagagcgatgaaaacgtttcagttgtctatggaaaaacggtgtaacaagggtaacactatcccatatcaccagctcaccgtctttcattgccat  
acgaaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccgataaaacttgtgcttatttttcttacggcttataaaaggcgt  
aatatccagctgaacggtctggttataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatccattgggatatacaacgggtgta  
tatccagtgttttttctcatttttagcttcttagctcctgaaaaatctcgataactcaaaaaatacgcccggtagtgatcttatttcattatggtgaaagt  
tggaacctctacgtgccgatcaatttaaatGAGTttcagttccacaGGTACCagaagggtgcttCAAaccgtagaaaagatcaaaggatctt  
cttgagatcctttttctgcgctaactctgctgttgcaacaaaaaaaccaccgctaccagcggtggtttgtttgccgatcaagagctaccaactctt  
tttccgaaggttaactggcttcagcagagcgagataccaaatactgttcttctagttagccgttagtgccaccacttcaagaactctgta

#### **pIG025 RNAT109**

ctgttaccagtggctgctgccagtggcgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataaggcgagcggtcgggctgaac  
gggggggttcgtgcacacagcccagcttgagcgaaacgacctacaccgaactgagatacctacagcgtgagctatgagaaagcgccacgcttccga  
aggagaaaggcggacaggtatccggttaagcggcagggctggaacaggagagcgacgagggagcttccagggggaaacgcctggtatctttata  
gtcctgtcgggtttcgccacctgacttgagcgtcgatttttgtgatgctcgtcagggggcgaggcctatggaaaaacgccagcaacgcggcctttt  
acggttcttgcccttttctggtccttttctcacatACGAAAAaaaaaccccgccctgacaggcggggttttttccaattattgaaggcgcta  
acgcggccttttttctgtgctgcttaataatgactaagaattcgcgccgcttctagagGGTCTCGCGACATTATACTTAACCCAC  
ACATAGACCTCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcggcctgcagttatcactgattaactcgg  
accaaattccagaaaagaggcctccgaaaggggggcctttttctgttttggtcctttgttatcaataaaaaaggggagcggtttccgctcccctatt  
gttcgtcTACAaccaataaaaaacgccggcggaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggatctatcaacagga  
gtccaagcgagctcgatatcatttaattacggccgctgccactcatcgagtactgttgtaattcattaagcattctgccgacatggaagccatca  
caaacggcatgatgaacctgaatcgccagcgcatcagcacctgtgccttgcgtataatattgccatggtgaaaacggggcgagaagtgtgc



catattggccacatttaaatcaaaaactgggtgaaactcaccagggattggctgaaacgaaaaacatattctcaataaaccttttagggaaataggcca  
ggttttcaccgtaacacgccacatcttgcaatatatgtgtagaaactgccggaaatcgctgtggtattcactccagagcgatgaaaacgtttcagttg  
ctcatggaaaacgggtgaacaaggggaacactatcccatatcaccagctcaccgtctttcattgccatacgaaattccggatgagcattcatcaggcg  
ggcaagaatgtgaataaaggccggataaaacttgtgcttattttctttacgggtctttaaaaaggccgtaatatccagctgaacgggtctggttataggta  
cattgagcaactgactgaaatgcctcaaatgttctttacgatgccattgggatatacaacgggtgtatatccagtgattttttctcatttttagcttcct  
tagctcctgaaaaatctcgataactcaaaaaatacgcccggtagtgatcttatttcattatgggtgaaagttggaacctcttacgtgcccgatcaatttaa  
tGAGTttcagttccacaGTACcagaaggtgcttCCAAcccgtagaaaagatcaaaggatcttcttgagatcctttttctgcgctaattctgct  
gcttgcaaaaaaaaaccacgctaccagcggtggtttgtttgccgatcaagagctaccaactcttttccgaaggtaactggcttcagcagagcgc  
agataccaatactgttcttagtgtagccgtagttaggccaccacttcaagaactctgtagcaccgcctacataacctcgctctgctaatac

#### **pIG026 RNAT110**

tgtagcaccgcctacatacctcgctctgctaactcctgttaccagtggtgctgctccagtgggcgataagtcgtgtcttaccgggttgactcaagacgatag  
ttaccggataaggcgagcggtcgggctgaacggggggttcgtgcacacagcccagcttgaggcgaaacgacctacaccgaactgagatacctacag  
cgtgagctatgagaaagcgccacgcttcccgaaggagaaaggcggacaggtatccggtgaagcggcaggggtcggaacaggagagcgacagggg  
agcttcacgggggaaacgctgtatctttatagtcctgtcgggttcgccacctctgacttgagcgtcgattttgtgatgctcgtcagggggcgagg  
cctatggaaaaacgccagcaacgcggcctttttacgggtcctggccttttctgctgacctttgtctacatACGAAAAaaaaaccccgccctgacagg  
gcgggggttttttccaattattgaaggccgtaacgcggcctttttgtttctggtctgcctaatcaatgactaagaattcgcgccgcttctagagGG  
TCTCGGACATTTATAATTAACCCACACCTAGACCTCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtag  
cggcgcgtgcagttaactcactgattaactcggtagcaaatccagaaaagaggcctcccgaaggggggcctttttctgttttgctctttgttatcaat  
aaaaaaggggagcggtttcccgctccccttattgttctcTACAaccaataaaaaacgcccgcggaaccgagcggttctgaacaaatccagatgg  
agtctgaggtcattactggatctatcaacaggagtcgaagcgagctcgatatcatttaaattacgccccgcctgcccactcatcgagtagtctgttaa  
ttcattaagcattctgcgacatggaagccatcacaacggcatgatgaacctgaatgccagcgcatcagcaccttctgccttgctgataatattt  
gccccatggtgaaaacggggcggaagaagttgtccatattggccacatttaaatcaaaaactgggtgaaactcaccagggattggctgaaacgaaaaac  
atattctcaataaaccttttagggaaataggccaggttttaccgtaacacgccacatcttgcaatatatgtgtagaaactgccggaaatcgctgtgg  
tattcactccagagcgatgaaaacgtttcagtttgctcatggaaaacgggtgaacaagggtgaacactatcccatatcaccagctcaccgtctttcattg  
ccatacgaaattccggatgagcattcatcagcggggcaagaatgtgaataaaggccggataaaacttgtgcttattttctttacgggtctttaaaaagg  
ccgtaatatccagctgaacgggtctggttataggtagcattgagcaactgactgaaatgcctcaaatgttctttacgatgccattgggatataatcaacgg  
ggtatatccagtgattttttctcatttttagcttccttagctcctgaaaatctcgataactcaaaaaatacgcccggtagtgatcttatttcattatgggtga  
aagttggaacctcttacgtgcccgatcaatttaaataGAGTttcagttccacaGTACcagaaggtgcttCCAAcccgtagaaaagatcaaagg  
atcttcttgagatcctttttctgcgctaattctgctgcttgaacaaaaaaaaccacgctaccagcggtggtttgtttgccgatcaagagctacca  
ctctttttccgaaggtaactggcttcagcagagcgcagataccaatactgttcttagtgtagccgtagttaggccaccacttcaagaactc

#### **pIG027 RNAT111**

tacatacctcgctctgctaactcctgttaccagtggtgctgctccagtgggcgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataag  
gcgcagcggtcgggtgaacggggggttcgtgcacacagcccagcttgaggcgaaacgacctacaccgaactgagatacctacagcgtgagctatga  
gaaagcgccacgcttcccgaaggagaaaggcggacaggtatccggtgaagcggcaggggtcggaacaggagagcgacaggggagcttcagggg  
gaaacgctggatctttatagtcctgtcgggtttgccacctctgacttgagcgtcgattttgtgatgctcgtcagggggcgaggcctatggaaaaa  
cgccagcaacgcggcctttttacgggttctggccttttctgctgacctttgtctacatACGAAAAaaaaaccccgccctgacaggggggggtttttt  
ccaattattgaaggccgtaacgcggcctttttgtttctggtctgcctaatcaatgactaagaattcgcgccgcttctagagGGTCTCGGAC  
ATTCTAGATTTGCTGCCATCTATCCTCCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcggcgcgtgcag  
ttaactcactgattaactcggtagcaaatccagaaaagaggcctcccgaaggggggcctttttctgttttgctctttgttatcaataaaaaaggga  
gcggtttccgctccccttattgttctcTACAaccaataaaaaacgcccgcggaaccgagcggttctgaacaaatccagatggagtctgaggtca  
ttactggatctatcaacaggagtcgaagcgagctcgatatcatttaaattacgccccgcctgcccactcatcgagtagtctgttaattcattaagcattc  
tgccgacatggaagccatcacaacggcatgatgaacctgaatgccagcgcatcagcaccttctgccttgctgataatatttccccatgggtgaaa  
acggggggcggaagaagttgtccatattggccacatttaaatcaaaaactgggtgaaactcaccagggattggctgaaacgaaaaacatattctcaataa



accctttagggaaataggccaggtttaccgtaacacgccacatcttgcaatatatgtgtagaaactgccggaatcgctggtgattcactccaga  
gcgatgaaaacgtttcagtttgcctcatggaaaacgggtgaacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaatt  
ccggatgagcattcatcaggcgggcaagaatgtgaataaaggccggataaaaactgtgcttattttctttacgggtctttaaaggccgtaatatcca  
gctgaacggctggttataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattgggatatatcaacgggtgatatccagt  
gattttttctccatttagcttcttagctcctgaaaaatctcgataactcaaaaaatacggcgtagtgatcttatttcattatggtgaaagttggaacc  
tcttacgtgcccgatcaatttaaatGAGTttcagttccacaGTACCCagaaggtgcttCCAAccgtagaaaagatcaaaggatcttcttgaga  
tcctttttctgcgtaactctgctgcttgcacaaaaaaaccaccgctaccagcggtggtttgtttgccggatcaagagctaccaactcttttccga  
aggtaactggcttcagcagagcgagatacacaatactgttcttagtgtagccgtagttaggccaccactcaagaactctgtagcaccgcc

#### **pIG028 RNAT112**

ccagtggtgctgctccagtggtgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataaggcgagcggtcgggtgaacggggg  
gttcgtgcacacagcccagcttgagcgaacacctacaccgaactgagatacctacagcgtgagctatgagaaagcgccacgttccgaaggga  
gaaaggcggacaggtatccggaagcggcaggggtcggaacaggagagcgacgagggagcttccaggggaaacgctggtatctttatagctctg  
tcgggtttcgccacctgacttgagcgtcgattttgtgatgctcgtcagggggcgagcctatggaaaaacgccagcaacgcggccttttacggtt  
cctggccttttctggtccttttctcacatACGGaaaaaaaccccgccctgacagggcggggttttttccaattattgaaggccgtaacgcgg  
ccttttttgttctggtctgcttaataatgactaagaattcgggccgcttctagagGGTCTCGCGACATTATAGATTGCTACCATCT  
ACGCTCCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcgccgctgcagtaatactgattaactcggtaccaa  
attccagaaaagagcctccgaaagggggcctttttctgtttgtcctttgttatcaataaaaaaggggagcggtttccgctcccctattgttcg  
tcTACAaccaataaaaaacggcgcggaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggatctatcaacaggagtcc  
aagcgagctcgatatcatttaaattacgccccgctgccaactcatcgagtagtctgttaattcattaagcattctgccgacatggaagccatcaciaa  
cggcatgatgaacctgaatcgccagcgcatcagcaccttgcgccttgctgataatatttgcctatggtgaaaaacggggcggaagaagttgtccatat  
tgccacatttaatacaaaactggtgaaactcaccagggattggctgaaacgaaaaacatatctcaataaaccttttagggaaataggccaggtt  
tcaccgtaacacgccacatcttgcaatatatgtgtagaaactgccgaaatcgctggtgattcactccagagcgatgaaaacgtttcagtttgcctat  
ggaaaacgggtgaacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaattccggatgagcattcatcaggcgggca  
agaatgtgaataaaggccggataaaactgtgcttattttctttacggcttttaaaaggccgtaatatccagctgaacggctggttataggtacatt  
gagcaactgactgaaatgctcaaaatgttctttacgatgccattgggatatatcaacgggtgatatccagtgtatttttctccatttagcttccttag  
ctcctgaaaatctcgataactcaaaaaatacggcgtagtgatcttatttcattatggtgaaagttggaaccttctagtcgccgatcaatttaaatGA  
GTttcagttccacaGTACCCagaaggtgcttCCAAccgtagaaaagatcaaaggatcttcttgagatcttttttctgcgtaactctgctgctt  
gcaaaaaaaaccaccgctaccagcggtggtttgtttgccggatcaagagctaccaactcttttccgaaggtaactggcttcagcagagcgagaga  
tacaaaatactgttcttagtgtagccgtagttaggccaccactcaagaactctgtagcaccgcctacatacctcgctctgtaactcctgtta

#### **pIG029 RNAT113**

ctgccagtggtgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataaggcgagcggtcgggtgaacggggggttcgtgcaca  
cagcccagcttgagcgaacgacactacaccgaactgagatacctacagcgtgagctatgagaaagcgccacgttccgaaggagaaaggcgga  
caggtatccggaagcggcaggggtcggaacaggagagcgacgagggagcttccaggggaaacgctggtatctttatagctctgctgggttcgc  
caccttgacttgagcgtcgattttgtgatgctcgtcagggggcgagcctatggaaaaacgccagcaacgcggccttttacggttcctggcctttt  
gctggccttttctcacatACGGaaaaaaaccccgccctgacagggcggggttttttccaattattgaaggccgtaacgcggcctttttgtt  
tctggtctgcttaataatgactaagaattcgggccgcttctagagGGTCTCGCGACATTCTAGATTACTACCATCTATCCTCCTA  
GTGAAAGAGGAGAAATACTAAATGagagACtactagtagcgccgctgcagtaatactgattaactcggtaccaaattccagaaaa  
gaggcctcccgaaggggggcctttttctgtttgtcctttgttatcaataaaaaaggggagcggtttccgctcccctattgttctgcTACAacca  
ataaaaaacggcgcggaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggatctatcaacaggagtccaagcgagctcg  
atatcatttaaatagccccgcctgccaactcatcgagtagtctgttaattcattaagcattctgccgacatggaagccatcaciaacggcatgatga  
acctgaatcgccagcgcatcagcaccttgcgccttgctgataatatttgcctatggtgaaaacggggcggaagaagttgtccatattggccacattt  
aaatcaaaactggtgaaactcaccagggattggctgaaacgaaaaacatatctcaataaaccttttagggaaataggccaggttttaccgtaac  
acggcacatcttgcaatatatgtgtagaaactgccgaaatcgctggtgattcactccagagcgatgaaaacgtttcagtttgcctatggaaaacgg



**pIG030 RNAT114**

**pIG031 RNAT115**

tgctaatcctgttaccagttggctgctgccagttggcgataaagtcgtgtcttaccgggttggaactcaagacgatagttaccgggataaggcgagcggctcgg  
gctgaacgggggggttcgtgcacacagcccagcttggagcgaaacgacctacaccgaactgagatacctacagcgtgagctatgagaaagcgccacgc  
ttccgaaggggagaaaggcggacaggtatccggtaagcggcagggctcggaacaggagagcgcacgaggggagcttccagggggaaacgcctggat  
ctttatagtcctgtcgggtttcggccaccttgacttgagcgtcgattttgtgatgctcgtcaggggggcgagcctatggaaaaacgccagcaacgcgg  
cctttttacgggttcttgcccttttctggccttttctcacatACGGaaaaaaaacccccccctgacaggcggggtttttttccaattattgaagg  
ccgctaacgcggccttttttgttctggtctgccttaataatgactaagaattcgcggccgcttctagagGGTCTCGGACATTTATATATAC  
CCCACACCTAGACTCCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcgccgctgcagttaatcactgattaa  
ctcggtaccaaaattccagaaaagaggcctcccgaaggggggcctttttcgttttggctcctttgttatcaataaaaaaggggagcggtttcccgctcc  
ccttattgttcgtcTACAaccaataaaaaacgcccggcggaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggatctatca  
acaggagtcgaagcgagctcgatatcatttaaattacggccgacctgacctcatcgcagtagtgttgaattcattaagcattctgccgacatggaa  
gccatcaciaaacggcatgatgaacctgaatcgccagcggcatcagcaccttgcgccttgctataatatttgcccatggtgaaaacggggggcgaaga  
agttgtccatattggccacatttaaatcaaaactggtgaaactcaccagggttggctgaaacgaaaaacatatctcaataaaaccttttagggaaa  
taggccaggttttaccgtaacacgccacatcttgcaatatatgtgtagaactgcgggaaatcgctgtggtattcactccagagcgatgaaaacgtt  
tcagtttctcatggaaaacggtgtaacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaaattccggatgagcattca



tcaggcgggcaagaatgtgaataaaggccggataaaactgtgcttattttctttacggcttttaaaaggccgtaatatccagctgaacggcttggt  
ataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattgggatatatcaacggtggtatatccagtgattttttctcatttt  
agcttccttagctcctgaaatctcgataactcaaaaaatacggccggtagtgatcttatttcattatggtgaaagttggaacctctacgtgcccgatc  
aatttaaatGAGTttcagttccacaGTACCcagaagggtgcttCCAAccgtagaaaaagatcaaaggatcttcttgagatcctttttctgcgcg  
taatctgctgcttgcacaaaaaaaccaccgctaccagcgggtggtttgttgcggatcaagagctaccaactcttttccgaaggtaactggcttcag  
cagagcgagataccaataactgttctttagttagccgtagttaggccaccacttcaagaactctgtagcaccgctacatacctcgtc

#### **pIG032 RNAT116**

cggatcaagagctaccaactcttttccgaaggtaactggcttcagcagagcgagataccaataactgttctttagttagccgtagttaggccacc  
acttcaagaactctgtagcaccgctacatacctcgtctgctaactcgttaccagtggtgctgctccagtggtgataagtcgtgttaccgggttga  
ctcaagacgatagtaccggataaggcgagcgggtcggtgtaacggggggttcgtgcacacagcccagcttgagcgaacgacctacaccgaact  
gagatactacagcgtgagctatgagaaagcgccacgttcccgaaggagaaaggcggacaggtatccggttaagcggcagggtcggaacaggag  
agcgacaggggagcttcagggggaaacgcttggtatctttatagctcgttcgggttcgccacctgacttgagcgtcgattttgtgatgctcgtc  
aggggggaggagcctatggaaaaacgccagcaacgcggccttttacggttctggccttttctggccttttctcacatACGAAAAaaaaacc  
cgccctgacagggcggttttttccaattattgaagccgtaacgcggcctttttgttctggtctgccttaataatgactaagaattcgggc  
cgcttctagagGGTCTCGCGACATTTATACTTACCCCCACCTAGACTCCTAGTGAAAGAGGAGAAATACTAAATGaga  
gACtactagtagcggcgtcgtcagttactcgttactgattaactcgttacaaattccagaaaaggcctcccgaagggggctttttcgttttgg  
ccttttgttatcaataaaaaaggggagcgtttcccgtccccttattgttcgtTACAaccaataaaaaacgcccggcggaaccgagcgttctgaa  
caaatccagatggagttctgaggtcattactggatctatcaacaggagtcgaagcgagctcgatatcatttaaattacgccccgctgacctcatcg  
cagtactgttgaattcattaagcattctgcccagatggaagccatcacaaacggcatgatgaacctgaatcgccagcgcatcagcaccttgcgcct  
tgcgtataatatttgcctatggtgaaaacggggcggaagaagtgtccatattggccacatttaaatacaaaactggtgaaactcaccagggttggc  
tgaacgaaaaacataattctcaataaaccttttagggaataggccaggtttaccgtaacacgccacatcttgcgaatatatgtgtagaaactgcc  
ggaaatcgtcgtggtattcactccagagcgatgaaaacgtttcagtttgcctatggaaaacggtgtaacaagggtgaacactatcccatatcaccagct  
caccgtctttcattgccatacgaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccggataaaactgtgcttattttctttac  
ggcttttaaaaggccgtaatatccagctgaacggtctggttataggatcattgagcaactgactgaaatgcctcaaaatgttctttacgatccattgg  
gatatacaacggtggtatatccagtgattttttctccattttagcttccttagctcctgaaaatctcgataactcaaaaaatacggccgtagtgatctt  
atctcattatggtgaaagttggaacctcttacgtgccgatcaatttaaATGAGTttcagttccacaGTACCcagaagggtgcttCCAAccgtag  
aaaagatcaaaggatcttcttgagatcctttttctgcgcgtaactctgctgcttgcacaaaaaaaccaccgctaccagcgggtggtttgttc

#### **pIG033 RNAT117**

tggcttcagcagagcgagataccaataactgttctttagttagccgtagttaggccaccacttcaagaactctgtagcaccgctacatacctcgt  
ctgctaactcgttaccagtggtgctgctccagtggtgataagtcgtgttaccgggttgactcaagacgatagtaccggataaggcgagcggctg  
ggctgaacggggggttcgtgcacacagcccagcttgagcgaacgacctacaccgaactgagatacctacagcgtgagctatgagaaagcgccacg  
cttcccgaaggagaaaggcggacaggtatccggttaagcggcagggtcggaacaggagagcgcacgagggagcttcagggggaaacgctggt  
atctttatagctcgtcgggttcgccacctgacttgagcgtcgattttgtgatgctcgtcagggggcgagcctatggaaaaacccagcaacgc  
ggccttttacggttctggccttttctggccttttctcacatACGAAAAaaaaaccccgccctgacagggcggttttttccaattattgaa  
ggccgtaacgcggcctttttgttctggtctgccttaataatgactaagaattcgggcgttctagagGGTCTCGCGACCATTTATACT  
TACTACCTGCCCACCTCCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcggcgtcgtcagttactcgttactgatt  
aactcgttacaaattccagaaaaggcctcccgaagggggctttttcgttttggctctttgttatcaataaaaaaggggagcgggtttcccgt  
ccccttattgttcgtTACAaccaataaaaaacgcccggcggaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggatctat  
caacaggagtcgaagcgagctcgatatcatttaaattacgccccgctgacctcatcgagctactgttgaattcattaagcattctgccgacatgga  
agccatcacaaacggcatgatgaacctgaatcgccagcggcatcagcaccttgccttgcgtataatatttgcctatggtgaaaacggggcggaag  
aagttgcatattggccacatttaaataaaaactggtgaaactcaccagggttggctgaaacgaaaaacataattctcaataaaccttttagggaa  
ataggcagggtttaccgtaacacgccacatcttgcgaatatatgtgtagaaactcgcgaaatcgtcgtggtattcactccagagcgatgaaaacgt  
ttcagtttgcctatggaaaacggtgtaacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaattccggatgagcttc



atcaggcgggcaagaatgtgaataaaggccggataaaacttgcttattttctttacggcttttaaaaggccgtaatatccagctgaacggctggt  
ttataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattgggatatatcaacgggtggtatatccagtgattttttctccatt  
ttagcttccttagctcctgaaaatctcgataactcaaaaaatagcccggtagtgatcttatttcattatggtgaaagttggaacctcttacgtgccgat  
caatttaaGAGTttcagttccacaGTACcagaaggtgcttCAAaccgtagaaaagatcaaaggatcttcttgagatcctttttctgcgc  
gtaatctgctgcttgaacaacaaaaaccaccgctaccagcgggtggttgttgcggatcaagagctaccaactcttttccgaaggtaac

#### **pIG034 RNAT118**

gcaccgcctacatacctgctgctaactcgtttaccagtggtgctgccagtgggcgataagtcgtgtcttaccgggttgactcaagacgatagttac  
cggataaggcgagcgggtcgggtgaacgggggggtcgtgcacacagcccagcttgagcggaacgacctacaccgaactgagatacctacagcgtg  
agctatgagaaagcgccacgcttcccgaaggagaaaggcggacaggtatccggtacggcgaggtcggaacaggagagcgcacgaggaggct  
tccagggggaaacgctggtatctttatagctctgtcgggttccacacctgacttgagcgtcgattttgtgatgctcgtcagggggcgaggcctat  
ggaaaaacgccgcaacgcggccttttacggttctggcctttgtggtcctttgtcacatACGAAAAaaaaaccccgccctgacagggcg  
ggtttttttccaattattgaaggcgtacgcggcctttttgttctggtcgtccttaataatgactaagaattcgcgccgctttagagGCTCT  
CGCGACATTATAGATTGCTACCATCCACACTCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcgg  
ccgctgcagttaatcactgattaactcgttacaaatccagaaaagaggcctcccgaagggggctttttcgtttggcttttgttatcaataaa  
aaaggggagcgggttcccgtccccttattgttcgtTACAaccaataaaaaacgccggcggaaccgagcgttctgaacaaatccagatggagtt  
ctgaggtcattactggatctatcaacaggagtccaagcgagctcgatatcattaaattacccccccctgccactcatcgagtagtctgttaattca  
ttaagcattctgccgacatggaagccatcacaacggcatgatgaacctgaatcgccagggcatcagcacctgtcgccttgcgtataatatttccc  
atggtgaaaacggggcggaagaagttgtcatattggccacatttaatacaaaactggtgaaactcaccagggattggctgaaacgaaaaacatat  
tctcaataaaccttttagggaaataggccaggttttaccgtaacacgccacatcttgcgaatatatgttagaaactgcggaaatcgctggttattc  
actccagagcgtgaaaacgtttcagtttgcctatggaaaacgggtgaacaagggtgaacactatcccatacaccagctcaccgtctttcattgccat  
acgaaattccgatgagcattcatcaggcgggcaagaatgtgaataaaggccgataaaacttgcttatttttctttacggcttttaaaaggccgt  
aatatccagctgaacggctggttataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattgggatatatcaacgggtgta  
tatccagtgattttttctccatttttagcttcttagctcctgaaaaatctcgataactcaaaaaatagcccggtagtgatcttatttcattatggtgaaagt  
tggaacctcttacgtgccgatcaatttaaGAGTttcagttccacaGTACcagaaggtgcttCAAaccgtagaaaagatcaaaggatctt  
cttgagatcctttttctgcgcgtaatctgctgcttgaacaacaaaaaccaccgctaccagcgggtggttgttgcggatcaagagctaccaactctt  
tttccgaaggttaactggcttcagcagagcgcagataccaaatactgttctttagttagccgtagtaggaccacttcaagaactctgta

#### **pIG035 RNAT119**

cctatggaaaaacgccagcaacgcggcctttttacggttctggccttttctggtccttttctcacatACGAAAAaaaaaccccgccctgacagg  
gcggggtttttttccaattattgaaggcgtacgcggcctttttgttctggtcgtccttaataatgactaagaattcgcgccgctttagagGG  
TCTCGGACCATTTATATACTACCTGCCACCTCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtag  
cggccgctgcagttaatcactgattaactcgggtacaaatccagaaaagaggcctcccgaagggggctttttcgtttggcttttgttatcaat  
aaaaaaggggagcgggttcccgtccccttattgttcgtTACAaccaataaaaaacgccggcggaaccgagcgttctgaacaaatccagatgg  
agttctgaggtcattactggatctatcaacaggagtccaagcgagctcgatatcattaaattacccccccctgccactcatcgagtagtctgttaa  
ttcattaagcattctgccgacatggaagccatcacaacggcatgatgaacctgaatcgccagcggcatcagcacctgtcgccttgcgtataatattt  
gcccattggtgaaaacggggcggaagaagttgtcatattggccacatttaatacaaaactggtgaaactcaccagggattggctgaaacgaaaaac  
atattctcaataaaccttttagggaaataggccaggttttaccgtaacacgccacatcttgcgaatatatgttagaaactgccgaaatcgctggtg  
tattactccagagcgtgaaaacgtttcagtttgcctatggaaaacgggtgaacaagggtgaacactatccatatacaccagctcaccgtctttcattg  
ccatacgaattccggatgagcattcatcaggcgggcaagaatgtgaataaaggccgataaaacttgcttatttttctttacggcttttaaaagg  
cgtaatatccagctgaacggctggttataggtacattgagcaactgactgaaatgcctcaaaatgttctttacgatgccattgggatatatcaacgg  
ggtatatccagtgattttttctccatttttagcttcttagctcctgaaaatctcgataactcaaaaaatagcccggtagtgatcttatttcattatggtga  
aagttggaacctctacgtgccgatcaatttaaGAGTttcagttccacaGTACcagaaggtgcttCAAaccgtagaaaagatcaaagg  
atcttcttgagatcctttttctgcgcgtaatctgctgcttgaacaacaaaaaccaccgctaccagcgggtggttgttgcggatcaagagctacca  
ctcttttccgaaggttaactggcttcagcagagcgcagataccaaatactgttctttagttagccgtagtaggaccacttcaagaactctgtagc



accgcctacatacctcgctctgctaactcctgttaccagtggtgctgctccagtggtcgataagtcgtgtcttaccgggttgactcaagacgatagttaccg  
gataaggcgagcggtcggtgctgaacgggggggttcgtgcacacagcccagcttgagcggaacgacctacaccgaactgagatacctacagcgtgag  
ctatgagaaagcgccacgcttcccgaaggagaaaaggcgacaggtatccgtaagcggcagggtcggaacaggagagcgacagggagcttcc  
agggggaaacgcctggtatctttatagtcctgtcggtttgccacctctgacttgagcgtcgattttgtgatgctcgtcagggggcgag

#### **pIG037 RNAT121**

cagtggcgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataaggcgagcggtcggtgtaacgggggggttcgtgcacacag  
cccagcttgagcggaacgacctacaccgaactgagatacctacagcgtgagctatgagaaagcgccacgcttcccgaaggagaaaaggcgacag  
gtatccgtaagcggcagggtcggaacaggagagcgacgagggagcttccagggggaaacgcctggtatctttatagtcctgtcggtttcgccac  
ctctgacttgagcgtcgattttgtgatgctcgtcagggggcgagcctatggaaaaacgcagcaacgcggccttttacggttctggtcctttgtctg  
gcctttgtctacatACGAAAAAAAAaaccgccttgacagggcggttttttccaattattgaagccgctaacgcggcctttttgtttctg  
gtctgccttaataatgactaagaattcgcgccgctttagagGGTCTCGGACAAAGGATTACCCACTTTTGCAGAGAGCCTAG  
TGAAAGAGGAGAAATACTAAATGagagACtactagtagcgccgctgcagtaatactgattaactcggtaccaaatccagaaaaag  
aggcctccgaaaggggggcctttttgttttggtcctttgtatcaataaaaaaggggagcggtttccgctccccttattgttcgtcTAAccaat  
aaaaaacgccggcggaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggtatctcaacaggagtcgaagcgagctcgat  
atcatttaaattacgccccgcttgcactcatcgagtagtctgttaattcattaagcattctgagcatggaagccatcacaaacggcatgatgaac  
ctgaatcgccagcgcatcagcaccttgccttgcgtataatattgccatggtgaaaacggggcggaagaagttgcatattggccacatttaa  
atcaaaactggtgaaactcaccagggttggtgtaaacgaaaaacatatttcaataaaccttttagggaaataggccaggttttcaccgtaacag  
ccacatcttgcaatatatgtgtagaactgccggaatcgtcgtggtattcactccagagcgatgaaaacgtttcagtttgctcatgaaaaacggtgt  
aacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaattccggtgagcattcatcaggcgggcaagaatgtgaata  
aaggccggataaaacttgcttatttttcttacggtctttaaaaaggccgtaatatccagctgaacggtctggttataggtacattgagcaactgact  
gaaatgcctcaaaatgttctttacgatgccattgggatatacaacggtggtatattcagtgattttttctcatttttagcttccttagctcctgaaaatct  
cgataactcaaaaaatacggcggtagtgatcttatttattatggtgaaagtggaaaccttactgtcccgatcaatttaaGAGTttagttcca  
caGGTACCagaaggtgctCCAAccgtagaaaaatcaaaggatcttctgagatcctttttctgcgtaactctgctgcttgcacaaaaa  
aaccacgctaccagcggtggtttgttccggatcaagagctaccaactcttttccgaaggtaactggctcagcagagcgagataccaaatactg  
ttctttagtgtagccgtagttaggccaccacttcaagaactctgtagcaccgctacatacctcgctctgctaactcgttaccagtggtgctgc

#### **pIG104 Para-B0034-iaaMH-AmpR-araC-RSF1010**

gtggctgctgccagtggtcgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataaggcgagcggtcggtgtaacgggggggttc  
gtgcacacagcccagcttgagcggaacgacctacaccgaactgagatacctacagcgtgagctatgagaaagcgccacgcttcccgaaggagaaa  
ggcgagacaggtatccgtaagcggcagggtcggaacaggagagcgacgagggagcttccagggggaaacgcctggtatctttatagtcctgtcg  
gtttgccacctgacttgagcgtcgattttgtgatgctcgtcagggggcgagcctatggaaaaacgcagcaacgcggccttttacggttctg  
gcctttgtcggtttgtctacatACGAAAAAAAAaaccgccttgacagggcggttttttccaattattgaagccgctaacgcggcctt  
ttttgtttctggtctgccttaataatgactaagaattcgcgccgctttagagGGTCTCGGACATTTATATATAACCCACACCTAGA  
CCTCTAGTGAAAGAGGAGAAATACTAAATGagagACtactagtagcgccgctgcagtaatactgattaactcggtaccaaatc  
cagaaaaggcctcccgaaggggggcctttttgttttggtcctttgtatcaataaaaaaggggagcggtttccgctccccttattgttcgtcTA  
CAaccaataaaaaacggcgggcaaccgagcgttctgaacaaatccagatggagttctgaggtcattactggtatctatcaacaggagtcgaagc  
gagctcgatatcattaaattacgccccgcttgcactcatcgagtagtctgttaattcattaagcattctgagcatggaagccatcacaaacggc  
atgatgaactgaatcgccagcgcatcagcacctgtgccttgcgtataatattgccatggtgaaaacggggcggaagaagttgcatattggc  
cacatttaaataaaaactggtgaaactcaccagggttggtgtaaacgaaaaacatatttcaataaaccttttagggaaataggccaggtttcac  
cgtaacacccacatcttgcaatatatgtgtagaactgccggaatcgtcgtggtattcactccagagcgatgaaaacgtttcagttgtcatgga  
aaacggtgaacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaattccggtgagcattcatcaggcggggaaga  
atgtgaataaaggcgataaaacttgcttatttttcttacggtctttaaaaaggccgtaatatccagctgaacggtctggttataggtacattgagc  
aactgactgaaatgcctcaaaatgttctttacgatgccattgggatatacaacggtggtatattccagtgattttttctcatttttagcttccttagctcct  
gaaaatctcgataactcaaaaaatacggcggtagtgatcttatttattatggtgaaagtggaaaccttactgtcccgatcaatttaaGAGTt



cagttccacaGTACcagaaggtgcttCCAAcccgtagaaaagatcaaaggatcttcttgagatccttttttctgcgcgtaatctgctgcttgca  
aacaaaaaaaccaccgctaccagcggtggtttgttgcggatcaagagctaccaactcttttccgaaggtaactggcttcagcagagcgagatac  
caaatactgttcttctagtgtagccgtagttaggccaccacttcaagaactctgtagcaccgcctacatacctcgctctgctaactcgtttacca

**pIG115 RNAT1, mCherry2, lacI, KanR, p15A**

ACGGAaaaaaaaccccgccctgacagggcggggttttttccaattattgaaggccgctaacgcggccttttttgttctggtctgccttaatcaa  
tgactaagaattcgcgccgctttagagCGTCTCaCTTCggatccgctgcaggCTTcaattgtgagcggataacaattgacattgtgagcggat  
aacaagatactgagcacaCGACtttctcggtctcgaaagaggagaaataactAATGgtgagtaaaggagaagaaacaacttagctatcatt  
aaagagttcatgcgcttcaaagttcacatggagggttctgttaacggtcacgagttcgagatcgaaggcgaaggcgagggcctccgtatgaaggca  
cccagaccgcaaactgaaagtactaaaggcgcccgctgccttttgcgtgggacatcctgagcccgcaatttatgacggttctaagcgtatgtta  
aacaccagcggatattccggactatctgaagctgtcttttccggaagggttcaactgggaacgcgtaataatgaatttgaagatgggtgtcgtgaccg  
tactcaggactcctcctTcaggatggcgagttcatctataaagttaaactgcgtggtactaattttccatctgattggccgggtgatgcagtgtaggac  
gatgggttgggaggcgtctaccgaacgcatgtatccggaagatgggtgcgtgaaaggcgaaattaaacagcgctgaaactgaaagatggcgccca  
ttatgacgctgaagtgaaccacgtacaaagccaagaaactgtgcagctgcctggcgctacaatgtggatattaaactggacatcttatctcata  
atgaagattatacgatcgtagagcaatatgagcgcgagggtgctcattctaccggtggcatggatgaactatacaataaTGGCttcagccaa  
aaaacttaagaccgccggtctgttccactaccttgagtaaatgcggtggacaggatcgcggttttcttttcttctcaaGCTGCGTTGAGACGt  
actagtagcggcgtgcagttaatcactgattaactcggtaccaaattccagaaaaggcgctccgaaagggggccttttttctgttgcctttt  
gttatcaataaaaaaggggagcgggttcccgctccccttattgttcgtTACAgtttacaaccaattaaccaattctgattagaaaaactcatcgagc  
atcaaatgaaactgaatttattcatatcaggattatcaataccatattttgaaaaagcgtttctgtaataaggagaaaaactcaccgaggcagttc  
cataggatggcaagatcctggtatcggtctgcgattccgactcgtcaacatcaatacaacctattaatttcccctcgtaaaaaaagggtatcaagt  
agaaatcaccatgagtgacgactgaatccggtgagaatggcaaaagcttatgcatttcttccagactgttcaacaggccagccattacgctcgtcat  
caaaatcactcgcatcaacaaaaccgttattcattcgtgattgcgctgagcgaggcgaaatacgcatcgctgttaaaggacaattacaaacagg  
aatcgaatgaaccggcgaggaacactgccagcgcatcaacaatattttacactgaatcaggatattcttctaatactgggaatgctgttttccggg  
gatcgagtggtgagtaacctgcatcatcaggagtacggataaaatgcttgatggtcggaaggagcataaattccgtcagccagtttagtctgacca  
tctcatctgtaacatattggcaacgctacctttgccatgttccagaaacactctggcgcatcgggcttccatacaatcgatagattgtcgacctgat  
tgcccgacattatcgcgagccatttataccatataaatcagcatcatgttggaatttaacgcggcctggagcaagacgtttccggtgaatatggc  
tcataacacccttgtattactgtttatgaagcagacagttttattgtcatgatgatatttttatcttgatgaatgaacatcagagattttgagacac  
aacgtggcttgttgaataaatcgaacttttctgagttgaaggatcagGAGTggtgcctaagtgagtgagtaactTacattaattgcgttgctca  
ctgcccgtttccagtcgggaaacctgtcgtgccagctgcattaatgaatcgccaaacgcgaggagagcggtttgcgtattggcgccagggtgg  
tttttctttccagtgAacgggcaacagctgattgcccttaccgcctggccctgagagagttgcagcaagcggtccacgctggtttccccagca  
ggcgaaaatcctgtttgatggtggttaacggcggtatatacatgagctgtcttcggtatcgtctatccactaccgagatGtcgcgaccaacgcgca  
gcccggactcggtaatggcgcgattgcgccagcgccatctgatcgttggaaccagcatcgagtggaacgatgccctcattcagcatttgcag  
gtttgtgaaaaccggacatggcactccagtcgccttccggttccgctatcggctgaatttgattgcgagtgagatatttatgccagccagccagacgca  
gacgcgccgagacagaacttaattggggccgtaacagcgcgatttgctggtgacccaatgcgaccagatgtccacgcccagtcgctaccgtcttca  
tgggagaaaaataactgttgatgggtgtcgtgagacatcaagaataacgccggaacattagtgcaggcagcttccacagcaatggcatcct  
ggtcatccagcggatagttaatgatcagccactgacgcttgccgagaaagattgtgcaccgcgctttacaggcttcgacccgcttctgttaccat  
cgacaccaccagctggcaccagttgatcggcgagatattaatcgccgcgacaatttgcgacggcgctgcagggccagactggaggtggcaacg  
ccaatcagcaacgactgtttcccgccagttgtgtgccacgcggttggaatgtaattcagctccgcatcgccgttccacttttcccgcttttcgc  
agaaacgtggctggcctgttaccacgcgggaaacggtctgataagagacaccggcactacttgcgacatctataacgttactggtttcacattca  
ccaccctgaattgactcttccggcgctatcatgccataaccgcgaaggttttgcgcattcgatggttccgggacttcgacgctcctcttatgcga  
ctcctgcattaggaaCCAatagcggagtgtactggcttactatgttgccactgatgagggtgtcagtgaaagtcctcatgtggcaggagaaaaaa  
ggctgcaccggtgcgtcagcagaatatgtgatacaggatataattccgttctcgtcactgactcgtacgctcggtcgttcgactgcggcgagcggga  
aatggcttacgaacggggcgagatttctggaagatgccaggaagataacttaacagggaagtgaagggccgcggaagccgttttccataggc  
tcgccccctgacaagcatcacgaaatctgacgctcaaatcagtggtggcgaaacccgacaggactataaagataccaggcgtttcccctggcgg  
ctccctcgctcgtctcgttctcgttctcggttacgggtgcattccgctgttatggccgctttgtctcattccacgctgacactcagttccgggta



ggcagttcgtccaagctggactgtatgcacgaacccccgttcagtcgaccgctgcgccttatccggttaactatcgtcttgagtcgaacccggaaag  
acatgcaaaagcaccactggcagcagccactggtaattgatttagaggagttagtcctgaagtcagcgccggttaaggctaaactgaaaggacaag  
ttttggtgactgcgtcctccaagccagttacctcggttcaaagagttggtagctcagagaaccttcgaaaaaccgccctgcaaggcgggtttttcgtttt  
cagagcaagagattacgcgcagacaaaacgatctcaagaagatcatcttattaa

#### **pIG116 RNAT1, mCherry2, lacI, KanR, pSC101**

ACGGAaaaaaaacccccgccctgacagggcggggtttttttccaattattgaaggccgctaacgcggccttttttctgtgtcgtccttaatcaa  
tgactaagaattcgcggcgcttctagagCGTCTCaCTTCggatccgctgcaggCTTCaattgtgagcggataacaattgacattgtgagcggat  
aacaagatactgagcacaGACtttgctcggctgcgaaagaggagaaatactaAATGgtgagtaaaggagaagaaaacaacttagctatcatt  
aaagagttcatgcgttcaaagttcatatggagggttctgttaacggtcacgagttcgagatcgaaggcgaaggcgagggccgtccgtatgaaggca  
cccagaccgcaaaactgaaagtactaaaggcgggcccgctgccttttgcgtgggacatcctgagcccgaatttatgtacggttctaagcgtatgtta  
aacaccagcggatattccggactatctgaagctgtctttccggaaggtttcaactgggaacgcgtaataatgaagatgggtgtcgtgaccg  
tactcaggactcctcctTcaggatggcgagttcatctataaagttaaactgcgtgggtactaattttccatctgatggccgggtgatgcagtgtaggac  
gatgggttgggagcgcttaccgaacgcatgtatccggaagatgggtgcgtgaaaggcgaataaacaagcgcctgaaactgaaagatggcgggcca  
ttatgacgtgaagtgaaaaccagctacaaagccaagaaacctgtgcagctgcctggcgctacaatgtggatattaaactggacatcttatctcata  
atgaagattatacgcgtagagcaatatgagcgcgagggggtcgtcattctaccggtggcatggatgaactatacaataaTGGCttcagccaa  
aaaacttaagaccgcggtctgtccactaccttgagtaaatgcggtggacaggatcggcggttttctttcttctcaaGCTGCGTTTgAGACGt  
actagtagcggcgctgcagttactcagttactcgggtaccaaattccagaaaagaggcctccgaaaggggggcctttttcgttttggctctttt  
gttatcaataaaaaaggggagcggtttccgctccccttattgttcgtTACAggtttacaaccaattaaccaattctgattagaaaaactcatcgagc  
atcaaatgaaactgcaatttattcatatcaggattatcaataccatattttgaaaaagccgtttctgtaataagagagaaaaactcaccgaggcagttc  
cataggatggcaagatcctggatcgggtcgcgattccgactcgtccaacatcaatacaacctattaattcccctcgtcaaaaaaagggtatcaagtg  
agaaatcaccatgagtgacgactgaatccgggtgagaatggcaaaagcttatgcatttcttccagacttggtcaacaggccagccattacgctcgtcat  
caaaatcactcgcatacaaaaaccgttattcattcgtgattgcgcctgagcgaggcgaataacgcgatcgtgttaaaaggacaattacaaacagg  
aatcgaatgaaccggcgaggaacactgccagcgcatcaacaatattttcacctgaatcaggatattcttcaatacctggatgtgttttccgggg  
gatcgcagtggtgagtaacctgcacatcaggagtacggataaaatgcttgatggtcggaagaggcataaattccgtcagccagtttagtctgacca  
tctcatctgtaacatcattggcaacgctacctttgccatgtttcagaacaactctggcgcatcgggcttccatacaatcgatagattgtcgacctgat  
tgcccacattatcgcgagccatttataccatataaatcagcatccatgttggaatttaaatcgcgccgtggagcaagacgtttccggtgaaatggc  
tcataacacccttgattactgtttatgtaagcagacagtttattgttcgatgatataattttatcttgcaatgtaacatcagagattttgagacac  
aacgtggctttgtgaataaatgaacttttgcgtgagttgaaggatcagGAGTggtgcctaatagtgagtaactTacattaattgcgttgctca  
ctgcccgtttccagtcgggaaacctgtcgtgccagctgcattaatgaatcgccaaacgcgaggagagggcgtttgcgtattggcgccagggtgg  
ttttcttttaccagtgAacgggcaacagctgattgcccttaccgctggcctgagagagttgcagcaagcgggtccacgctggtttgcccagca  
ggcgaaaatcctgtttgatgtgtgtaaacggcggtatataacatgagctgtcttcggtatcgtcgtatccactaccgagatGtccgcaccaacgcgca  
gcccggactcggtaatggcgcgattgcgcccagcgccatctgatcgttggcaaccagcatcgcagtggggaacgatgccctcattcagcatttgcatg  
gtttgtgaaaaccggacatggcactccagtcgccttcccgttccgctatcggctgaatttgattgcgagtgagatattatgccagccagccagacga  
gacgcgccgagacagaacttaattgggcccgtaacagcgcatgttgctggtgacccaatgcgaccagatgctccacgcccagtcgctaccgttctca  
tgggagaaaaataactgttgatgggtgtcgtgagacatcaagaaataacgcgggaacattagtgcaggcagcttcacagcaatggcatcct  
ggcatccagcggatagttatgatcagccactgacgcgttgcgcgagaagattgtgcaccgcccgtttacaggcttcgacgccgcttcgttaccat  
cgacaccaccagctggcaccagttgatcggcgagatttaacgcgcgacaatttgcgacggcgctgcaggccagactggaggtggcaacg  
ccaatcagcaacgactgtttcccgccagttgtgtgccacgggttgggaatgtaattcagctccgccatccgcttccactttttcccggttttcgc  
agaaacgtggctggcctggttaccacgcgggaaacgggtctgataagagacaccggcatactctgcgacatcgtataacgttactggtttcacattca  
ccacctgaattgactcttccggcgctatcatgccataccgcgaaggttttgcgcattcgatgggtgcgggatctcgacgctctcccttatgca  
ctcctgcattaggaaCCAAGttacattgcgatctgttcaggtgaacagctttgaatacaccaaaaactcgtaaaagctctgatgtatctatcttttt  
acaccgttttcatctgtcatatggacagttttcccttgatatgaacggtgaacagttgttctacttttgtttgtagtcttgatgcttactgatagatac  
aagagccataagaacctcagatccttccgtatttagccagtatgttcttagtgggtcgtttgttttgcgtgagccatgagaacgaaccattgagatca  
tacttactttgatgtcactcaaaaattttgcctcaaaactggtgagctgaattttgcagttaaagcatcgtgtagtgttttcttagtccgttatgtaggt



aggaatctgatgtaatggttggttatgtcaccattcattttatctggttggtctcaagttcggttacgagatccatttctctatctagttcaacttgg  
aaaatcaacgtatcagtcgggcccctcgcttatcaaccaccaatttcatattgctgtaagtgttaaatctttacttattggttcaaaacccattggtta  
agccttttaactcatggtagttattttcaagcattaacatgaacttaaatcatcaaggctaattctctatattgcttgtagtttcttttggttagttc  
tttaataaccactcataaatcctcatagagtattgttttcaaaagacttaacatgttccagattatatttgaatttttaactggaaaagataagg  
caatatctcttactaaaaactaatttctaattttgcgttgagaacttggcatagttgtccactggaaaatctcaaagccttaaccaaggattcctga  
tttccacagttctcgtcatcagctctctggttgcttagctaatacaccataagcattttccctactgatgttcatcatctgagcgtattggttataagtga  
cgataccgtccgttcttctttaggttttcaatcgtggggttgagtagtgcacacagcataaaattagcttggttcatgctccgttaagtcagtcg  
actaatcgtagttcatttgccttgaaaacaactaattcagacatacatctcaattggtctaggtgatttaactactataccaattgagatgggtagtc  
aatgataattactagtccttttctttaggttggttatctgtaattctgtagaccttgcgtggaaaacttgtaattctgtagacctctgtaattc  
cgtagaccttctgtgttttttcttatattcaagtgttataattatagaataaagaaagataaaaaagataaaagaatagatcccagccct  
gtgtataactcactactttagtcagttccgcagattacaaaaggatgtcgaaacgctgttgcctctacaaaacagaccttaaaacctaaaggct  
taagtagcacctcgcaagctcgggcaaatcgctgaatattccttttgcctccgacctcaggcacctgagtcgctgtcttttctgacattcagttcgct  
gcgctcacggctcgtgagtgatgggggtaaatggcactacaggcgctttatggattcatgcaaggaaactaccataatacaagaaaagcccg  
tcacgggcttctcaggcgctttatggcggtctgctatgtggtgctatctgacttttgcgttcagcagttctgcctctgattttccagctctGccact  
tcggattatcccgtagcaggtcattcagactggctaatgcaccagtaaggcagcggtatcatcaacaggcttaccgtcttactgtc

## **pIG138 RNAT122**

gcttcagcagagcgagataccaaatactgttcttctagtgtagccgtagttaggccaccacttcaagaactctgtagcaccgcctacatacctcgtct  
gctaactctgttaccagtggtgctgcccagtggtgataagtcgtgtcttaccgggttgactcaagacgatagttaccggataaggcgagcggtcggg  
ctgaacggggggttctgtcacacagcccagcttgagcgaaacgacctacccaactgagatacctacagcgtgagctatgagaaagcgccagcgtt  
cccgaaggagaaaaggcgagcaggtatccggtaagcggcagggtcggaacaggagagcgcacgaggagcgttcagggggaaacgcctggtatc  
tttatagtcctgtcgggttctgccacctgacttgagcgtcgttttctgtagtctgcagggggcgagcctatggaaaaacgcagcaacgcggc  
cttttacggttctgaccttttgccttttgcctacatACGAAAAAaaacccgccctgacagggcggggttttttccaattattgaaggc  
cgtaacgcggccttttttcttctggtctgccttaataatgactaagaattcgcgccgctttagagGGTCTCGCGACTTAGATATAACT  
GCCCTAAGACTAAGCCTAGTGAAGAGGAGAAATACTAAATGagagACtactagtagcggccgctgcagttaatcactgatta  
actcggtagcaaaattccagaaaaggcctcccgaagggggcttttctggttctttgttatcaataaaaaaggggagcggtttccgcctc  
cccttattgtctgtTACAaccaataaaaaacggcggaacagcgttctgaacaaatccagatggagttctgaggtcattactggatctatc  
aacaggagtcgaagcgagctcgatatcatttaaattacgccccgcctgccactcatcgagtagtgttaattcattaagcattctgccgacatgga  
agccatcacaacggcatgatgaacctgaatcgccagcggcatcagcaccttgccttgcgtataatattgccatggtgaaaacggggcggaag  
aagttgtccatattggccacatttaaatcaaaactggtgaaactcaccagggattggctgaaacgaaaaacatatttcaataaaccttttagggaa  
ataggccaggttttaccgtaacacgccacatcttgcgaatatatgtgtagaaactcgcgaaatcgtcgtggtattcactccagagcgatgaaaacgt  
ttcagtttctcatggaacgggtgaacaagggtgaacactatcccatatcaccagctcaccgtctttcattgccatacgaattccgatgagcattc  
atcaggcgggcaagaatgtgaataaaggcgataaaacttgccttattttcttaccggtctttaaaggccgtaatatccagctgaacggtctgg  
ttataggtacattgagcaactgactgaaatgcctcaaaatgttcttacgatgccattgggatatatcaacgggtggtatatccagtgatttttctccatt  
ttagcttcttagctctgaaaatctcgataactcaaaaaatcgcccggtagtgatcttatttatttggtgaaagttggaacctcttacgtgcccgat  
caatttaaatGAGTttagttccacaGGTACCagaaggtgcttCAAccgtagaaaagatcaaggatcttcttgagatcctttttctgcgc  
gtaatctgctgctgcaaacaaaaaaaccaccgctaccagcggtggtttgttgcgggatcaagagctaccaactcttttccgaaggttaactg



# Cassette Plasmid Sequences

## pIG101 sfGFP-AmpR-araC-RK2

tGAGACCatatcgcGAAAGTGAAACGTGATTCATGcgtcattttgaacattttgtaaattctatttaataatgtgtgcggcaattcaca  
ttaaatttatgaatgttttctaactcgcggcaactcaagaaacggcaggttcggatcttagctactagagaagaggagaatactagatgcgtaaa  
ggcgaagagctgttcactgggtcgtccctattctggtggaactggatggatgtcaacggtcataagtttccgtgcgtggcgagggtgaaggtagc  
gcaactaatggtaaaactgacgtgaagttcatctgtactactggtaaaactgccggttccttggccgactctggtaacgacgctgacttatgggttcagt  
gctttgctcgttatccggaccatatgaagcagcatgacttctcaagtccgcatgccggaaggctatgtgcaggaacgcacgatttctttaaggatga  
cggcacgtacaaaacgcgtgcggaagtgaatttgaaggcgataccctggtaaaccgcattgagctgaaaggcattgactttaagaagacggcaa  
tatcctgggccataagctggaatacaattttaacagccacaatgtttacatcacgcgataaacaataaaatggcattaaagcgaattttaaaattc  
gccacaactggaggatggcagcgtgcagctggctgatcactaccagcaaaacactccaatcggtgatggctcgttctgctgccagacaatcactat  
ctgagcacgcaaagcgttctgtctaagatccgaacgagaacgcgatcatatggttctgctggagttcgtaacgcgagcgggcatcacgcatggtat  
ggatgaactgtacaaatgaccaggcatcaataaaacgaaaggctcagtcgaaagactgggccttctgtttatctgttgttgcggtgaacgctctc  
gcgatgataGCTCTCaTACgattatcaaaaaggatcttcacntagatccttttaataaaatgaagtttaaatcaatctaaagtatatatgag  
taaacttggctgacagttaccaatgcttaatcagtgaggcacctatctcagcgatctgtctatttctgtcatccatagttgcctgactccccgtcgtgtag  
ataactacgatacgggagggcttaccatctggccccagtgctgcaatgataccgcgggaccacgctcaccggctccagatttatcagcaataaacca  
gccagccggaagggcgagcgagaagtggtcctgcaactttatccgctccatccagcttattaattgttgcgggaagctagagtaagtagttccg  
agttaatagtttgcgaacgttgttgcattgctacaggcatcgtggtgtcacgctcgtcgttggtagtggcttcattcagctccggttccaacgatcaa  
ggcgagttacatgatccccatgttgtgcaaaaaagcggttagctccttcggtcctccgatcgttgtcagaagtaagttggccgagtggtatcactcat  
ggttatggcagcactgcataattcttactgtcatgccatccgaatgcttttctgtgactggtgagtactcaaccaagtcattctgagaatagtgta  
tgcggcgacggagttgctcttggccggcgtcaatacgggataataccgcgccatagcagaactttaaaagtgtcatcattggaaaaacgttcttcg  
ggcgaaaactctcaaggatcttaccgctgttgagatccagttcagatgaaccactcgtgcaccaactgatcttcagcatcttttactttaccagcgtt  
tctgggtgagcaaaaacaggaaggcaaatgcccgaaaaaagggaataaggcgacacggaaatgttgaatactcatactcttcttttcaatatt  
attgaagcatttatcagggttattgtctcatgagcggatacatatttgaatgtatttagaaaaataaacaatagggttccgcgcacatttccccgaaa  
agtgcacctgGAGTAcagaaaagccgccttccggcgggcttctgctgagttatgacaacttgacggctacatcattcatttttctcacaacccggc  
acggaaactcgtcgggctggccccggtgcattttttaataccgcgcgagaatagagttgatcgtcaaaaccaacattgcgaccgacggtggcgatag  
gcattccgggtggtgtcaaaagcagcttcgctggctgatacgttggctcctcgccagcttaagacgctaatacctaactgctggcggaagatgtg  
acagacgcgacggcgacaagcaaacatgctgtgcgacgtggcgatatcaaaattgctgtctgccaggtgatcgtgatgtactgacaagcctcgct  
accgattatccatcggtggatggagcgactcgttaatcgcttccatgcgcgcagtaacaattgtcaagcagatttatcgccagcagctccgaatag  
cgcccttccccttggcggttaatgatttgccaaacaggtcgtgaaatgggctggtgcgcttcatccggcgaaagaacccgatttgccaaat  
attgacggccagttaagccattcatgccagtaggcgcggacgaaagtaaacccactggtagaccattcgcgagcctccgatgacgaccgtagt  
gatgaatctctcctggcggaacagcaaaatatcacccggtcggaacaaattctcgtcctgatttttaccacccccctgaccggaatggtagat  
tgagaataaacctttcattcccagcggctcgtcgataaaaaaatcgagataaccgttggcctcaatcggcgttaaaccgccaccagatgggcatta  
aacgagtatccggcagcaggggatcattttcgcttcagccatacttttatactcccgcattcagagaagaaccaattgtccatattgCATggta  
tatctccttcttaaagttaaacaataattttagtagctgaaccattatcacccagaggtaaaattgtcaacacgcacggtgtagctcagcatgCC  
AAtgctgaacccccagccggaactgacccacaaggccctagcgtttgcaatgcaccaggtcattgaccaggcggttccaccaggccgctgcctc  
gcaactcttcgaggcttcgacgactgctcgcgccacttcttcacgcgggtggaatccgatccgcacatgaggcggaaggtttccagttgagcgggt  
acggctcccgtgcgagctgaaatagtcgaacatccgtcgggcccgtcgcgacagcttgcgttacttctcccatatgaatttcgtgtagtggtcgccag  
caaacAgcacgacgatttctcgtCGatcaggacctggcaacgggacgttttctgccacggtccaggacgcggaagcggtgcagcagcgacaccg  
attccaggtgccaacgcggtcgacgtgaagcccatcgccgtcgctgtaggcgcgacaggcattcctcggccttctgttaataccggccattgatcg  
accagcccaggtcctggcaagctcgtagaactgaaggtgatcggtcgccgataggggtgcgttcgctactccaacacctgctgccacaccagt  
tcgtcatcgtcgcccgagctcgacgggtgtaggtgatcttcacgtccttgtgacgtggaaaatgacctgttttgacgagcctcgcggggatttt  
cttgttgcgctggtgaacagggcgagcgggcccgtgtcgtttggcatcgctcgatcgtgtccggccacggcgcaatatcgaacaaggaaagctgca  
tttcttgcgtgctcgtgtgtttcagcaacgcggcctgcttggcctcgtgacctgttttgcaggtcctcgccggcggttttgcgttcttggctcgtc



atagttcctcgctgtcgatggatcatgacttcgccaacctgcccctcctgttcAagacgacgcgaacgctccacggcgccgatggcgcgggcag  
ggcagggggagccagttgcacgctgtcgctcgatcttggccgtagcttctggaccatcgagccgacggactggaaggtttcgcggggcgcacgc  
atgacggtgcggttgatggtttcgcatcctcgccggaacccccgcgtcgatcagttcttgctgtatgccttcgggtcaaacgtccgattcattc  
accctccttgcgggattgccccggaattccccggatccgtcgatcttgatccccctgcgcatcagatccttggcggcaagaaagccatccagtttacttt  
gcagggttcccaaccttaccagagggcgccccagctggcaattccggttcgcttgctgTccataaaaccgcccagctagctatcgccatgtaagccc  
actgcaagctaCCtGcttCtCtttgcgttgcgttttcccttgccagatagccagtaGCTgacattcatccggggtcagcaccgtttctgcggactg  
gctttctacgtgttccgcttcttagcagcccttgcgctgagtgcttgcggcagcgtgaagctgacggatccggggaattaattcacccccgaacac  
gagcagggcaccgcgaccactatgccagaatgccaaaggtaaaaattgccGgccccgccatgaagtccgtgaatccccgacggcgaagtga  
agggcaggccgccaccaggccgcccctcactgcccggcacctggctgctgaatgtcgatgccagcacctgcggcacgtcaatgcttccgggcgtc  
gcgctcggggtgatgccccatccgttactgccccgatccggcaatggcaaggactgccagcgtgccatttttggggtgaggccgttcgcgccga  
GgggcgagccCCTggggggatgggaggcccgcttaGCGGccgggagggttcgagaagggggggcaccccccttcggcgtgcgcggtcacg  
cgCAcagggcgagccctgttataaaacaaggtttataaatattggtttaaaagcaggttaaaagacaggttagcggtggccgaaaaacggcgga  
aaccttgcaaatgctggattttctgctgtgagacgcccctcaaatgtcaataggtCgccccctcatctgtcaGcactctgcccctcaagtgtcaagg  
atcgcgcccctcatctgtcagtagtcgccccctcaagtgtcaataccgagggcacttatccccaggcttgtccacatcatCtGtgggaaactcgct  
aaaatcaggcggttttcgcgatttgcgaggtggccagctccacgtcgccggccgaaatcgagcctgcccctcatctgtcaacgccgcgcccgggtgagt  
cggccccctcaagtgtcaacgtccgccccctcatctgtcagtgagggccaagttttccgAggtatccacaacgccggcGcccgcggtgtctcgacac  
ggcttcgacggcgtttACGG

#### **pIG101x sfGFP-AmpR-araC-p15A**

tGAGACCatacatcgcGAAAGTGAAACGTGATTTTCATGcgtcattttgaacattttgtaaattcttatttaataatgtgtgaggcaattcaca  
tttaattatgaatgttttcttaacatcgcggaactcaagaaacggcaggttcggatcttagctactagagaaaggagaaatactagatgcgtaaa  
ggcgaagagctgttactggtgtcgtccctattctggtggaactggatggtgatgtcaacggtcataagttttccgtgcgtggcgagggtgaagtgac  
gcaactaatggtaaactgacgctgaagtcatctgtactactggtaaactgccggttcttggccgactctggtaacgacgctgacttatggtgttcagt  
gctttgctcgttatccggaccatataagcagcatgacttctcaagtccgcatgccggaaggctatgtgcaggaacgcacgatttctttaaggatga  
cggcacgtacaaaacgctgcgggaagtgaatttgaaggcgataccctggtaaaccgcattgagctgaaaggcattgacttttaagaagacggcaa  
tatcctgggcataagctggaatacaattttaacagccacaatgtttacatcaccccgataaacaataatggcattaaagcaattttaaaattc  
gccacaacgtggaggatggcagcgtgcagctggctgatcactaccagcaaaacactccaatcggtgatggtctgttctgctgcgagacaatcactat  
ctgagcacgcaaagcgttctgtctaaagatccgaacgagaaacgcgatcatatggttctgctggagttcgtaacgcgacgggcatcacgcatggtat  
ggatgaactgtacaaatgaccaggcatcaataaaacgaaaggctcagtcgaaagactgggcctttcgttttatctgttgttgcggtgaacgctctc  
gcgatgataGGTCTCaTACagattatcaaaaaggatcttcacctagatccttttaataaaatgaagtttaaatcaatctaaagtatatatgag  
taaacttggctgacagttaccaatgcttaatcagtgaggcacctatctcagcgatctgtctatttcgttcatccatagttgcctgactccccgcgtgtag  
ataactacgatacgggagggttaccatctggccccagtgctgcaatgataccgcccagccacgctcaccggctccagatttatcagcaataaacca  
gccagccggaaggccgagcgcagaagtggctcctgcaactttatccgctccatccagcttattaattgttgcgggaagctagagtaagtagttcgcc  
agttaatagtttgcgaacgttgttgcattgtctacaggcatcgtggtgtcacgctcgtcttggtagtggcttcattcagctccggttcccaacgatcaa  
ggcgagttacatgatccccatgttgtgcaaaaaagcggttagctccttcggtcctccgatcgttgtcagaagtaagttggccgagtggtatcactcat  
ggttatggcagcactgcataattcttactgtcatgccatccgtaagatgcttttctgtgactggtgagtactcaaccaagtcattctgagaatagtgtgta  
tgcggcgaccgagttgcttctgcccggcgtaatacgggataataccgcccacatagcagaactttaaaagtctcatcattggaaaacgttcttcgg  
ggcgaactctcaaggatcttaccgctgttgatccagttcagtgtaaccactcgtgcaccaactgatcttcagcatcttttactttaccagcggtt  
tctgggtgagcaaaaacaggaaaggcaaatgccgcaaaaagggaataaggcgacacggaaatgtgaatactcatactcttcttttcaatatt  
attgaagcatttatcagggtattgtctcatgagcggatacatatttgaatgtatttagaaaaataaacaataggggttccgcgcacatttccccgaaa  
agtccacctgGAGTacaagaaagcccgcttctcgcgggcttctgctgagttatgacaacttgacggctacatcattcatttttctcacaacgggc  
acggaaactcgtcgggctggccccggtgcatttttaataaccgcgagaaatagagttgatcgtcaaaaaccaacattgcgaccgacggtggcgatag  
gcatccgggtggtgtcaaaagcagcttcgctggctgatacgttggctcctcgccagcttaagacgctaatacctaactgctggcgaaaagatgtg  
acagacgcgacggcgacaagcaaacatgctgtgcagcgtggcgatatcaaaattgctgtctgccaggtgatcgtgatgtactgacaagcctcgct  
accgattatccatcgggtgagtgagcagctgtaaatcgcttccatgcgccgagtaacaattgtctcaagcagatttatcgccagcagctccgaatag



cgcccttccccttggcggttaatgatttgcacaaacaggtcgctgaaatgggctggcgcttcatccggcgaaagaaccccgattggcaaat  
attgacggccagttaagccattcatgccagtaggcgcggacgaaagtaaacccactggtgataccattcgcgagcctccggatgacgaccgtagt  
gatgaatctctcctggcggaacagcaaaatatccccggtcggcaacaaattctcgccctgattttaccacccccctgaccgcgaatggtgagat  
tgagaataaacctttcattcccagcggtcggtcgataaaaaatcgagataacggttggcctcaatcggcgttaaaccgccaccagatgggcatta  
aacgagtatccggcagcaggggatcatttgcgttcagccatactttcatactccgccattcagagaagaaccaattgtccatattgCATggta  
tatctccttctaaagttaaacaataattattgtagtgcacacattatcaccgccagaggtaaaattgtcaacacgcagcggttagctcagcatgtC  
CAAtgtgaacccccagccggaactgacccacaaggccctagcgtttgcaatgcaccaggtcattgaccaggcggtgtccaccaggccgctgcct  
cgcaactcttcgaggcttcgacacgtctcgccacttcttcagcgggtggaatccgatccgcacatgaggcggaagggttcagcttgagcggg  
tacggctccgggtcgagctgaaatagtcgaacatccgtcgggccgtcggcgacagcttgcggtacttctccatatgaatttctgtagtggcgcga  
gcaaacAgcacgacgatttctcgtCGatcaggacctggcaacgggacgttttctgccacggtccaggacgcggaagcggtgcagcagcagacc  
gattccagggtgccaacgcggtcgacgtgaagccatcgccgtcgctgtaggcgcgacaggcattcctcggccttctgtaataccggccattgatc  
gaccagcccaggctctggcaagctcgtagaacgtgaaggtagcggctcgccgatagggtgcgcttcgctactccaacacctgctgccacacca  
gttcgtcatcgtcgcccgagctcgacgcgggtgtaggtgatcttcacgtccttgttgacgtggaaaatgacctgttttgacgcctcgcgcgggatt  
ttcttgttcgctggtgaacagggcagagcgggctgtcgtttggcatcgtcgcacgtgttcggccacggcgcaatatcgaaacaggaagctg  
catttcttgatcgtcgttctgtgtttcagcaacgcggcctgcttggcctcgtgacctgttttgccaggctcctcgccggcggttttgccttcttgctg  
tcatagtctcgcgtgtcgtatggtcatcgacttcgcaaacctgcccctcctgttcAagacgacgcgaacgctccacggcgccgatggcggggc  
agggcagggggagccagttgcacgtgtcgcctcgtatcttgccgttagcttgcggaccatcagccgacggactggaaggttcgcggggcgac  
gcatgacgggtcggttgcgatggtttcgcatcctcgccggaacccccgcgtcgatcagttcttgcctgtatgccttccggtcaaacgtccgattcat  
tcacctccttgcgggattgccccgaattccccggatccgtcgatcttgatcccctcgccatcagatccttggcggcaagaaagccatccagtttact  
ttgcagggttcccaacctaccagaggcgccccagctggcaattccggttcgctgtgTccataaaaccgccagcttagctatcgccatgtaagc  
ccactgaagctaCCTGCTttCtTttgcgttgcgttttccctgtccagatagcccagtaGCTgacattcatccggggtcagcaccgtttctgcggac  
tggtttctacgtgttcgcttcttttagcagcccttgcgcctgagtgcttgcggcagcgtgaagtgacggatccggggaattaattccccccgaac  
acgagcacggcaccgcgaccactatgccaagaatgccaaggtaaaaattgccGgccccgcatgaagtccgtgaatgccccgacggccgaagtg  
aagggcaggccgcaaccaggccgcccctcactgcccggcacctggtcgctgaatgtcgatgccagcacctgcggcacgtcaatgttcggggcgt  
cgcgctcgggctgatcccatcccgttactgccccgatccggcaatggcaaggactgccagcgtgccattttggggtagggccgttcgcccga  
GgggagcagccCCTggggggatgggaggcccgcttaGCGGccgggagggttcgagaagggggggcacccttcggcgctgcgcggtcacg  
cgcAcagggcgagccctggttaaaaaaagggtttataaatattggtttaaaagcaggttaaaagacaggttagcggtggccgaaaaacggcgga  
aaccttgcaaatgctggattttctgcctgtggacagcccccaaatgtcaataggtCgccccctcatctgtcaGcactctgccccctcaagtgtcaagg  
atcgccccctcatctgtcagtagtcgccccctcaagtgtcaataccgcagggcacttatccccaggcttgcacatcatCtGtggaactcgcgt  
aaaatcaggcggttttcgcgatttgcgaggtggccagctccacgtcgcggccgaaatcgagcctgccccctcatctgtcaacgccgcggggtgagt  
cggccccctcaagtgtcaacgtccgccccctcatctgtcagtgagggccaagttttccgcgAggtatccacaacccggcGccgcgggtgtctgcacac  
ggcttcgacggcggtttcACGG

#### **plG102 made from plG101 and linlG102**

gattatcaaaaaggatcttcacatagatccttttaaatataaatgaagtttaaatcaatctaaagtatatatgagtaaacttggctgacagttacca  
atgcttaatcagtaggacacatctcagcgatctgtctatttcttcatccatagttgctgactccccgtcgtgtagataactacgatacgggagggt  
taccatctggccccagtgctgcaatgataccgcggaaccacgtcaccggctccagatttatcagcaataaaccagccagccggaaggccgagcg  
cagaagtggctcctgcaactttatccgctccatccagcttattaattgttgcgggaagctagagtaagtagttccaggttaatagtttgcgaacgtt  
gttgccattgctacaggcatcgtggtgtcacgtcgtcgtttggtatggcttattcagctccggttccaacgatcaaggcaggttacatgatccccat  
gttgtgcaaaaaagcggttagctccttcggctcctccgatcgttgcagaagtaagttggccgagtggttatcactcatggttatggcagcactgcataat  
tctctactgtcatgccatccgtaagatgcttttctgtgactggtgagtactcaaccaagtcattctgagaatagtgtatgcggcgaccgagttgctcttg  
ccggcgctcaatacgggataataccgcgccacatagcagaactttaaaagtgtcatcattggaaaacgttcttcggggcgaaaactctcaagatct  
taccgctgttgagatccagttcgatgtaaccactcgtgcaccaactgatcttcagcatctttactttaccagcggttctgggtgagcaaaaacagg  
aaggcaaaatgccgcaaaaagggaataaggcgacaggaatgttgaatactcatactcttcttttcaatattattgaagcatttatcagggtta  
ttgtctcatgagcggatataattgaatgtatttagaaaaataacaaatagggttccgcgcacattttccccgaaaagtgccacctgGAGTAcag



aaaagcccgctttcggcgggctttgctcgagttatgacaacttgacggctacatcattcactttttctcacaaccggcacggaactcgctcgggctgg  
ccccggtgcatttttaataaccgcgagaaatagagttgatcgtaaaaccaacattgcgaccgacgggtggcgataggcatccgggtggtgctcaaa  
agcagcttcgctggctgatacgttggctcctcgccagcttaagacgctaataccctaactgctggcggaagatgtgacagacgcgacggcgaca  
gcaaacatgctgtgcgacgctggcgatatcaaaattgctgtctgccagggtgatcgctgatgtactgacaagcctcgctaccgattatccatcggtgg  
atggagcgactcgtaaatcgcttccatgcgccgagtaacaattgctcaagcagatttatcgccagcagctccgaatagcgcccttccccttggccggc  
gttaatgatttgccaaacaggctcgctgaaatgcggctgggtgcgcttcatccggcgaaagaaccccgattggcaaatattgacggccagttaagcc  
attcatgccagtaggcgcgaggcgaagtaaacccactggtgataccattgcgagcctccggatgacgaccgtagtgatgaatctctctggcggg  
aacagcaaaatatccccggtcggcaaaacaattctcgtccctgatttttaccacccctgaccgcgaatggtagattgagaatataacctttcattc  
ccagcggtcggtcgataaaaaatcgagataaccgttggcctcaatcggcgtaaacccgccaccagatgggcattaaacgagtatccggcgacgag  
gggatcattttgcgcttcagccatactttcatactcccgccattcagagaagaaaccaattgtccatattgCATggtatatctccttcttaaagttaaac  
aaaattattgctagctgaaccattatcacccgagaggtaaaattgtcaacacgcacgggtgtagctcagcatgCCAAtgctgaacccccagccgg  
aactgaccacacaaggccctagcgtttgcaatgcaccaggctattgaccaggcggtgtccaccaggccgctgcctcgcaactcttcgacggcttcgcc  
gacctgctgcgccacttcttacgcgggtggaatccgatccgcacatgaggcgggaaggtttcagcttgagcgggtacggctcccgggtgcgagctga  
aatagtgaacatccgtcgggcccgtcggcgacagcttgcggtacttctcccatgaatttcgtgtagtggctgccagcaaacAgcacgacgatttct  
cgtCGatcaggacctggcaacgggacgttttctgccaggtccaggacgcggaagcgggtgcagcagcgacaccgattccaggtgccaacgcgggt  
cggacgtgaagcccatcgcgctgcctgtaggcgcgacaggcatttctcgcccttcgtgaataccggccattgatcgaccagccaggtctcggcaa  
agctcgtagaacgtgaaggtgatcggctcgccgatagggtgcgcttcgctactccaacacctgctgccacaccagttcgtcatcgtcggcccgcag  
ctcgacgcccgggtgtaggtgatcttcacgtccttgttgacgttgaaaaatgaccttgtttgcagcgccctcgcggggattttctgttgcgctggtgaaca  
gggcagagcgggcccgtgtcgtttggcatcgctcgcatcgtgtccggccacggcgcaatatcgaacaaggaaagctgatttcttgatctgctgcttcg  
tgttttcagcaaccggcctgcttgccctgcgtgacctgttttgccaggtcctcgccggcggttttctgcttcttggtcgtcatagtctcgcgtgctgat  
ggtcatcgacttcgcaaacctgccgctcctgttcAagacgacgcgaacgctccacggcgccgatggcgcgggcagggcagggggagccagttg  
cacgctgtcgcgctgatcttgccgtagcttggtgacctcgagccgacggactggaaggtttcgcgggcgcacgcatgacgggtcgggttgca  
tggtttcggcatcctcggcggaacccccgcgtcgatcagttcttgctgtatgccttcgggtcaaacgtccgattcattcacctccttgcgggattgcc  
ccggaattccccggatccgtcgatcttgatccccgcgccatcagatccttggcggaagaaagccatccagtttactttgacgggcttccaaccttac  
cagagggcgccccagctggcaattccggttcgcttgctgTccataaaaccgccagcttagctatcgccatgaagccactgcaagctaCCtGcttt  
CtCtttgcgcttgcttttccctgtccagatagcccagtaGtGacattcatccggggtcagcacctttctgcggactggctttctacgtgttcgcttc  
ctttagcagcccttgccctgagtgcttgccgacgctgaagctgacggatccggggaattaattcacccccgaacacgagcagggcaccgcgacc  
actatgccagaatgccaaaggtaaaaaattgccGgccccgccatgaagtcctgtaatgccccgacggccgaagtgaagggcaggccgccaccag  
gccgccgctcactgcccggcacctggtcgtgaatgtcgatgccagcacctgcggcacgtcaatgcttcggggcgtcgcgctcgggctgatgccca  
tccggttactgcccgatccggcaatggcaaggactgccagcgctgccatttttggggtgaggccgttcgcgccgaGgggagcagccCCTggggg  
gatgggaggcccgcgttaGCGGccgggagggttcgagaagggggggcacccttcggcggtgcgcggtcacgcgAcagggcgagccctgg  
taaaaacaaggtttataaatattggtttaaagcaggttaaaagacaggttagcgggtggcgaaacacgggcggaaacccctgcaaatgctggatt  
ttctgcgttgagacagcccctcaaatgtcaataggtCgccccctcatctgtcaGactctgcccctcaagtgtcaaggatcgcgcccctcatctgtcagt  
agtgcgcccctcaagtgtcaataccgcagggcacttatccccaggcttgccacatcatCtGtgggaaactcgctgaaatcaggcggttttcgccgat  
ttgcgaggctggccagctccacgtcgccggcgaaatcgagcctgcccctcatctgtcaacgcgcccgggtgagtcggcccctcaagtgtcaacgt  
ccgcccctcatctgtcagtgaggccaagttttccgcgAggtatccacaacgccggcGccgcggtgtctcgacacggcttcgacggcggttcACG  
GccaattattgaaggcgcctaaccggccttttttctgtgtcgggaattcgggccgcttctagagCGTCTCaCTTCCTTtagcattttta  
tccataagattagcggatcctacgtgacgctttttatcgcaactcttactgtttctcatacccgGACctagtgaagaggagaaatactaAATGc  
gtaaaggcgaagagctgttactggtgtcgtccctattctggtggaactggatggtgatgtcaacgggtcataagttttcgtgctggcgagggtgaag  
gtgacgcaactaatggtaaaactgacgtgaagtcatctgtactactggtaaactgccggttccttggccgactctggttaacgacgtgacttatggtgt  
tcagtgtttgctgcttatccggaccatatgaagcagcatgacttctcaagtcgccatgccgaaggctatgtgcaggaacgcacgatttctttaag  
gatgacggcacgtacaaaacgcgtcgggaagtgaatttgaaggcgataccctggttaaaccgattgagctgaaaggcattgactttaagaagac  
ggcaatatcctgggcataagctggaatacaattttaacagccacaatgtttacatcacccgataaacaacaaaaatggcattaaagcgaatttaa  
aattcgccacaacgtggaggatggcagcgtgcagctggctgatcactaccagcaaacactccaatcggtgatggtcctgttctgctccagacaatc



actatctgagcacgcaaagcgttctgtctaaagatccgaacgagaaacgcatcatatggttctgctggagttcgtaaccgcagcgggcatcacgcat  
ggatggatgaactgtacaaataaTGGCttcagcaaaaaacttaagaccgccggtcttgcctactcttgagtaatgcggtggacaggatcggc  
ggttttctttctcttctcaaGCTGCGTTtGAGACGtactagtagcgccgctgcagttttgttatcaataaaaaaggggagcggtttcccgctccc  
cttattgtctgcTACA

#### **pIG102 Para-B0034-sfgfp-AmpR-araC-RK2 (casS2)**

ccaattattgaaggccgctaacgcggccttttttgttctggtctgccgaattcgcggcgttctagagCGTCTCaCTTCCTTtagcattttatc  
cataagattagcggatcctacgtgacgtttttatcgcaactcttactgttttccataaccgCGACtagtgaaagaggagaaataactaAATGcgt  
aaaggcgaagagctgttactggtgtcgtccctattctggtggaactggatggtgatgtcaacgggcataagtttccgtgcgtggcgagggtgaaggt  
gacgcaactaatggtaaactgacgtgaagttcatctgtactactggtaaactgccggtccttggccgactctggtaacgacgtgacttatggtgttc  
agtgtttgtcgttatccggaccatatgaagcagcatgacttctcaagtcgcatccggaaggctatgtgcaggaacgcacgatttctttaagga  
tgacggcagctacaaaacgcgtgcggaagtgaatttgaaggcgataccctggttaaaccgcattgagctgaaaggcattgactttaagaagacgg  
caatatctgggccataagctggaatacaattttaacagccacaatgtttacatcaccgccgataaacaataaaatggcattaaagcgaattttaaaa  
ttccgcaacgtggaggatggcagcgtgcagctggctgatcactaccagcaaaactccaatcgggtgatggtcgttctgctgccagacaatcac  
tatctgagcacgcaaagcgttctgtctaaagatccgaacgagaaacgcgatcatatggttctgctggagttcgtaaccgcagcgggcatcacgcatgg  
tatggatgaactgtacaaataaTGGCttcagcaaaaaacttaagaccgccggtcttgcctactccttgagtaatgcggtggacaggatcggcgg  
ttttctttctcttctcaaGCTGCGTTtGAGACGtactagtagcgccgctgcagttttgttatcaataaaaaaggggagcggtttcccgctcccctt  
attgttcgtTACAgattatcaaaaaggatcttcacttagatccttttaattaaaaatgaagtttaaatcaatctaagtatatatgagtaaaactgg  
tctgacagttaccaatgcttaatcagtgaggcacctatctcagcgatctgtctatttcgttcatccatagttgcctgactccccgtcgttagataactacg  
atacgggagggttaccatctggcccgatgctgcaatgataccggggaccacgctcaccgggtccagatttatcagcaataaaccagccagccg  
gaaggccgagcgcagaagtggctcgtcaactttatccgcctcatccagtcatttaattgttgcgggaagctagagtaagtagttcgcaggttaata  
gtttgcgaacgttgttgcattgctacaggcatcgtggtgtcacgctcgtcgtttggtatggcttcattcagctccggttccaacgatcaaggcgagtt  
acatgatccccatgttgtgcaaaaaagcggttagctccttcggtcctccgatcgttgcagaagtaagtggccgagtggttatcactcatggttatgg  
cagcactgcataattcttactgtcatgccatccgtaagatgcttttctgtgactggtgagtactcaaccaagtcattctgagaatagtgtatcgggcga  
ccgagttgctcttcccgccgtcaatacgggataataccgcgccacatagcagaactttaaaagtgtcatcattggaaaacgttcttcggggcgaaa  
actctcaaggatcttaccgctgttgagatccagttcgtatgaaccactcgtgcaccaactgatcttcagcatcttttactttaccagcgtttctgggtg  
agcaaaaacaggaaggcaaaatgccgcaaaaaagggaataaggggcacaggaatgtgaataactcatactcttcttttcaatattattgaagc  
atttatcagggttattgtctatgagcggatacatatttgaatgtatttagaaaaataaacaataggggttcgcgcacatttccccgaaaagtcca  
cctgGAGTAcagaaaagcccgcctttcggcgggcttgcctgagttatgacaacttgacggctacatcattcactttttctcacaaccggcacggaa  
ctcgcctcgggtcggccccggtgcattttttaatacccgcgagaaatagagttgatcgtcaaaaccaacattgcgaccgacggtggcgataggcatcc  
gggtggtgctcaaaagcagcttcgctggtgatacgttggctcgcgccagcttaagacgctaatacctaactgctggcgaaaagatgtgacaga  
cgcgacggcgacaagcaaacatgctgtgcgacgtggcgatatcaaaattgctgtcgtccaggtgatcgtgatgtactgacaagcctcgcgtacccg  
attatccatcgggtggatggagcgactcgtaatcgcttccatgcgccgagtaacaattgtcaagcagatttatcgccagcagctccgaatagcggcc  
ttccccttccccggcggttaatgatttcccaaacaggtcgtgaaatgcggctggtgcgcttcatccggcgaaaagaacccgatttggcaaatattga  
cggccagtttaagccattcatgccagtaggcgcggacgaaagtaaaccactggtgataccattcgcgagcctccgatgacgaccgtatgtatga  
atctctcctggcggaacagcaaaatatcaccgggtcggcaaaacaattctcgtcctgatttttaccacccccctgaccgcaatggtgagattgaga  
atataaccttttattccagcgggtcggctcgataaaaaaatcgagataaccgttggcctcaatcggcgttaaacccgccaccagatgggcattaaacga  
gtatcccggcagcaggggatcattttgcgttcagccatacttttatactcccgccattcagagaagaacaattgtccatattgCATggtatatctc  
cttcttaaagttaaaaaattattgtagctgaaccattatcacgccagaggtaaaattgtcaacacgcacggtgttagctcagcatgCAAatgc  
tgaacccccagccggaactgacccacaaaggccctagcgtttgcaatgcaccaggtcattgacccaggcgtgttccaccaggccgctgcctcgcaact  
cttcgacggcttcgccgacctgctcgcgccatttctcacgcggtggaatccgatccgcacatgaggcggaaggtttcagcttgagcgggtacggct  
cccgggtgcgagctgaaatagtgaacatccgtcgggcgctggcgacagcttgcggtaacttctcccatatgaatttcgtgtagtgtgccagcaaac  
AgcacgacgatttctcgtCGatcaggacctggcaacgggacgttttctgccacggtccaggacgcggaagcggtgcagcagcgacaccgattcca  
ggtgccaacgcggtcggacgtgaagccatcgccgtcgctgtaggcgcacaggcattcctcgccctcgtgaataccggccattgatcgaccag  
cccaggtcctggcaagctcgtagaacgtgaaggtgatcggtcgcggataggggtgcgcttcgctactccaacactgctgccacaccagttcgtc



atcgctggcccgagctcgacgcccgtgtaggtgatcttcacgtccttgttgacgtggaaaatgacctgttttgacgacctcgcgccgggattttctgt  
tgcgctgggtgaacagggcagagcgggcccgtgtcgtttggcatcgctcgcatcgtgtccggccacggcgcaatatcgaacaaggaaagctgcatttcc  
ttgatctgtcgttctgtgtttcagcaacgcgccgtgcttggcctcgtagctgttttgccaggtcctcgccggcgggttttcgcttcttggtcgtcatag  
ttcctcgctgtgatggatcgacttcgcaaacctgcccctcctgttcAagacgacggaacgctccacggcgccgatggcgccggcagggca  
gggggagccagttgcacgtgtcgctcgatcttggcctagcttctggaccatcgagccgacggactggaagggttcgccccggcgacgcatgac  
ggtggcgcttgcatggttctggcatcctcgccggaacccccgctcgatcagttcttgcctgtatgccttcgggtcaaactccgattcattcacctc  
cttgcgggattgccccgaattccccgatccgtcgatcttgatccccctgcgccatcagatccttggcggaagaaagccatccagtttactttgcaggg  
cttcccaacctaccagagggcgccccagctggcaattccggttcgcttgcgtTccataaaaccgcccagcttagctatcgccatgtaagcccactgca  
agtaCCTGCTttCtCtttgcgttgcgttttcccttgcagatagcccagtaGCTgacatttatccggggtcagcaccgtttctgcggactggcttct  
acgtgttccgcttctttagcagcccttgcgccctgagtgcttgcggcagcgtgaagctgacggatccggggaattaattacccccgaacacgagcac  
ggcaccgcgaccactatgccaagaatgccaaggtaaaaattgccGccccgccatgaagtccgtgaatgccccgacggccgaagtgaaggga  
ggccgccacccagggccgcccctactgccccggcacctggtcgctgaatgtcgatgccagcacctgcccacgtcaatgcttccggcgctcgctc  
gggctgatcgccatcccgttactgccccgatccgggaatggcaaggactgccagcgtgccattttggggtagggcgttcgccccgaGggggc  
cagccCCTggggggatgggaggcccggttaGCGGccggggagggttcgagaaggggggacccccctcgcgctgcgggtcacgcgAca  
ggcgcgagccctggttaaaaacaaggtttataaatattggtttaaaagcaggttaaaagacaggttagcggtggccgaaaaacggcggaacccctt  
gcaaatgctggattttctgcctgtggacagccccctcaaatgtcaataggtCgccccctcatctgtcaGactctgccccctcaagtgtcaaggatcgcg  
ccctcatctgtcagtagtcgccccctcaagtgtcaataaccgagggcacttatccccaggcttgcacatcatCtGtgggaaactcgctaaaatca  
ggcggtttcggcatttgcgaggctggccagctccacgtcgccggccgaatcgagcctgccctcatctgtcaacgccgcgccccgtgagtcggcccc  
tcaagtgtcaactcgccccctcatctgtcagtgaggccaagtttccgcgAggtatccacaacgccggcGcccggtgtctcgcacacggcttcg  
acggcggtttACGG

#### **pIG104 Para-B0034-iaaMH-AmpR-araC-RSF1010**

gattatcaaaaaggatcttcacntagatccttttaaatataaaatgaagtttaaatcaatctaaagtatatatgagtaaacttggtctgacagttacca  
atgcttaatcagtgaggcacctatctcagcgatctgtctatttcttcatccatagttgcctgactccccgtcgttagataactacgatacgggagggt  
taccatctggccccagtgctgcaatgataccgccccgaccacgctcaccggctccagatttatcagcaataaaccagccagccggaaggccgagcg  
cagaagtggctcctgcaactttatccgctccatccagctattaattgttgcgggaagctagagtaagtagttcgccagttaatagtttgcgcaacgtt  
gttgccattgtacaggcatcgtggtgtcacgctcgtgttggtaggttcattcagctccggttccaacgatcaaggcgagttacatgatccccat  
gttgtcaaaaaacgggttagctccttcggtcctccgatcgttgcagaagtaagttggccgcagtggttatcactcatggttatggcagcactgcataat  
tctctactgtcatgccatccgtaagatgcttttctgtgactggtgagtactcaaccaagtattctgagaatagtgtatgcccgcaccgagttgctcttg  
cccggcgtcaatacgggataataccgccccacatagcagaactttaaaagtgtcatcattggaaaacgttcttcggggcgaaaactctcaaggatct  
taccgctgttgagatccagttcgatgtaaccactcgtgcaccaactgatcttcagcatctttactttaccagcgtttctgggtgagcaaaaacagg  
aaggcaaaatgccgcaaaaagggaataaggcgacacggaatgtgaataactcatacttctcttttcaatattattgaagcatttatcagggtta  
ttgtctcatgagcggatacatattgaatgtatttagaaaaataacaaatagggttccgcgcacattttccccgaaaagtgccacctgGAGTaaaa  
aaaaGCCCCGCTtttGGCGGGCtttGCCAttattatgacaactgacggctacatcattcatttttcttcacaaccggcagcgaactcgctcg  
ggctggccccggtgcatttttaataaccgcgagaaatagagttgatcgtaaaacacattgcgaccgacgggtggcatagggcatccgggtggtg  
ctcaaaagcagcttcgctgggtgatacgttggctcctcgccagcttaagacgctaactcctaactgctggcgaaaagatgtgacagacgcgacgg  
cgacaagcaaacatgctgtgacgctggcgatatcaaaattgctgtcgcagggtgatcgctgatgtactgacaagcctcgctacccgattatccat  
cgggtggatggagcgactcgttaatcgcttccatgcgccgagtaacaattgctcaagcagatttatcgccagcagctccgaatagcgcccttcccttg  
cccggcgttaatgatttgcacaaacaggtcgctgaatgcccgtggtgcgttcacccggcgaaagaaccccgtattggcaaatattgacggccagt  
taagccattcatgccagtaggcgcgacgaaagtaaacccactggtgataccattcgcgagcctccggatgacgaccgtagtgaatctctcct  
ggcggggaacagcaaaatatccccggctggcaaaaattctgcctctgattttaccaccccctgaccgcaatggtgagattgagaatataacc  
tttcatccagcggctggtcgataaaaaaatcgagataaccgttggcctcaatccggcgttaaacccgccaccagatgggcattaaacgagatcccg  
gcagcaggggatcatttgcgttcagccatactttcatactcccGcattcagagaagaacaaattgtccatattgcatcagacattgccgtcactg  
cgtctttactggcttctcgttaaccAaacggtaacccgcttataaaagcattctgttaacaaagcgggaccaaagccatgacaaaaacgcgta  
acaaaagtgtctataatcacggcagaaaagtccacattggccgcctgttgagtaatagtcaaaagcctccggctggaggctttgactttctgcttacC



CAAagaaatcatccttagcgaaagctaaggattttttatctgaattaattctcgcgagggccgacatgaggcatgttccgctccttgcaatact  
gtgtttacatacagctatcgcttagcggaaagtcttttacctcagccgaaatgcctgccgttgctagacattgccagccagtccccgtcactcccgt  
ctaactgtcacgaacctgtcaataactgtcacgccccctgaataactgtcacgaacctgtcaataactgtcacgccccaaacctgcaaaccca  
gcaggggcgggggtggcggggtgttgaaaaatccatccatgattatctaagaataatccactagggcggttatcagcgcccttgtggggcgctgc  
tgcccttgccaatatgccggccagaggccggatagctggtctattcgtcgcgtaggctacacaccgccccaccgctgcgcggcagggggaagg  
cgggcaaaagcccgtaaaacccacaccaaaccgcagaaatagctggagcgcttttagccgcttagggcctttccccctaccgaagggtggg  
ggcgctgtgcagccccgaggcctgtctcggtcgatcattcagccggctcatccttctggcgtggcgagaccgaacaaggcgcggtcgtggtc  
gcgttcaaggtagcatccattgccgcatgagccgatcctccggccactcgtcgtgttaccttggccaaaatcatggccccaccagcaccttgcg  
ccttgttctgttctgcgctcgtgctgttcccttggccgcAcccgctgaatttcggcattgattcgcgctcgttcttctcagcttggccagccgatcc  
ggcgcttgttgccttaccatcttgacacccattgttaatgtgctgtctcgtaggctatcatggaggcacagcgggcggaatcccgcacctactt  
ttaggggagggcgcacttaccggttcttctcgagaaactggcctaaccggccacccttggggcggtgcgctcctcaggggccattgcatggagccga  
aaagcaaaagcaacagcgaggcagcatggcgatttatcaccttacggcgaaaaccggcagcaggtcggcgccaatggccagggccaaggccg  
actTcatccagcggaaggcaagtagtcccgcgacatggatgaagtcttgacgccgaatccgggcacatgccggagtctcgcagcgcccgccga  
ctactgggatgctgccacctgtatgaacgcgcaatggggcggtgttcaaggaggtcgaatttgcctgccggtcgagctgacctcgaccagcaga  
aggcgctggcgctcgagttcgccagcacctgaccggtgccgagcgctcggtatagctggccatccatgccggtggcgcgagaacccgcactg  
ccacctgatgatctcgcagcgatcaatgacggcatcgagcgcccgcgctcagtggttcaagcggtacaacggcaagaccccgagaaaggcg  
ggcacagaagaccgaagcgctcaagcccaaggcatggcttgagcagaccgcgaggcatggcgccgacctgccaaccgggcattagagcgggcA  
ggccacgacgcccgcattgaccacagaacacttgaggcgaggcgatcgagcgctgccggtgttacctggggccgaacgtggtggagatggaa  
ggccggggcatccgaccgaccggcgagacgtggcctgaacatcgacaccgccaacgccagatcatcgacttacaggaataccgggaggcaata  
gacctgaacgaatcgacagagtgaagaaatccagaggcatcaacgagttagcggagcagatgaaccgctggccagagcatggcgacactgg  
ccgacgaagcccggcaggtcatgagccagaccCagcaggccagcgaggcgaggcgcgagtggtgaaagcccagcgccagacagggcgggc  
atgggtggagctggccaaagagttgcgggaggtagcccgaggtgagcagcgccgcgagagcgcccgagcgctgcgggggtggcactgga  
agctatggctaaccgtgatgtggttccatgatgcctacggtggtgctgctgatcgcatcgttgccttgcctgacactgacgccactgacaaccgagga  
cggctcgatctggctgcgcttggggccgatgaagaacgacaggactttgcaggccatagggcgacagctcaaggccatgggctgtgagcgcttcg  
atatcgcgctcaggagcgcCAccaccggccagatgatgaaccgggaatggtcagccgccgaagtgtccagaacacgccatggctcaagcggatg  
aatcccagggaatgacgtgtatatcaggcccgcgagcaggagcgcatggtctggtgctggtggacgacctcagcgagttgacctggatgaca  
tgaaagccgagggccgggagcctgccctggtagtggaaaccagcccgaagaactatcaggcatgggtcaagggtggcgacgcccagggcggtgaa  
cttcgggggagattgccggagcgctggccagcgagtacgacgcccggccagcgccgacagcgccactatggccgcttggcgggcttcacca  
accgaaggacaagcacaccacccgcgggttatcagccgtgggtgctgctgcgtgaatccaagggaagaccgccaccgctggccggcgctggt  
gcagcaggctggccagcagatcgagcaggccagcggcagcaggagaaggcccgcaggctggccagcctgaactgccgagcggcagcttagcc  
gccaccggcgacggcgctggacgagtaccgcagcgagatggccgggtggtcaagcgcttcggtGatgacctcagcaagtgcgactttatcgccgc  
gcagaagctggccagccggggccgagtgccgaggaaatcggaaggccatggccgaggccagcccagcgctggcagagcgcaagcccggccac  
gaagcggattacatcgagcgacccgtcagaaggtcatgggtctgccagcgctccagcttgcgcgggcgagctggcacgggcaccggcaccggcc  
agcgaggcatggacagggcgggccagatttcagcatgtagtcttgcttggttactcacgcctgttatactatgagtactcacgcacagaagggggt  
tttatggaatacgaaaaaagcgcttcagggtcggtctacctgatcaaaagtgaagaaggctattggttcccgggtggttgggtatactgaacaag  
gccgaggctggccgcttttcagtcgctgatatggccagccttaaccttgacggctgcaccttgccttgttccggaagacaagcctttcgcccgga  
agtttctcggtgactgatataagacaaaaggacaagcagaccggcgacctgtggccagcctgacgctgtacccaagcgcatatgccgagc  
gcatgaaggccaaagggtgcgtcagcgcaagtcttggtgacgcagcagaatacaggcgctgcgcgagtgcttgggaagaactcagagcggcg  
cagggcggggtagtgaacccgccagcgctaaccaccaactgcctgcaaaggaggcaatcaatggctaccataagcctatcaatatctggaggc  
gttcgcagcagcgccccaccgctggactacgttttcccaacatggtggccggtacggtcggggcgctggtgtcggcggtggtgccgtaaatccat  
gctggccctgcaactggccgacagattgcaggcgggccggtatctgctggaggtggcggaactgccaccggcccggtgatctactgcccgcgaa  
gacccgccaccgcatcaccgctgcacgccttggggcgacctcagcgccgagggaacggcaagcgtgggtgacggcctgctgatccagc  
cgctgatcggcgacctgccaacatcatggccccgagtggttcgacggcctcaagcgcgcccgaggggcccgctgatggtgctggacagct  
gcgccggttcacatcgaggaagaaaacgccagggccccatggccaggtcatcggtcgcagtgaggccatcgccggcataccgggtgctctatc



gtgttcctgcaccatgccagcaagggcgggccatgatgggcgaggcgaccagcagcagccagccggggcagctcggtactggtcgataacatc  
cgctggcagtcctacctgtcgagcatgaccagcgccgaggccgaggaatgggggtgtggacgacgaccagcgccggttcttctgctccgttcggtgtgag  
caaggccaactatggcgaccggttcgctgatcgggtggttcaggcgccatgacggcggggtgctcaagcccgcgtgctggagaggcagcgcaagag  
caaggggggtccccgtggtgaagcctaagaacaagcacagcctcagccacgtccggcacgacccggcgactgtctggccccggcctgttccgtgc  
cctcaagcggggcgagcgcaagcgagcaagctggacgtgacgtatgactacggcgacggcaagcggatcgagttcagcgccggagccgctgg  
gcgctgatgatctgcatcctgcaagggctggtggccatggctgggcctaattggcctagtgttggccccggaaccaagaccgaaggcgagcgca  
gctccggctgttctggaaccaagtgggaggccgtcaccgtgaTGCcATGgtggtcaaaggtagctatcggcgctggcaaaggaaatcgggg  
cagaggtcgatagtgtggggcgctcaagcacatacaggactgcatcgagcgctttggaaggtatccatcatcgcccagaatggccgcaagcggca  
ggggtttcggctgctgtcgagtagcaccagcgacgaggcgagcgggcgctgtacgtggccctgaacccttgatcgcgacggccgtcatgggtggcg  
gccagcatgtgcatcagcatggacgaggtgcgggcgctggacagcgaaaccgcccgcctgctgcaccagcggtgtgtggctggatcgaccccg  
caaaaccggcaaggcttccatagataccttgtcggtatgtctggccgtcagaggccagtgttgcaccatgcgaagcgccgcCagcgggtgctgc  
gaggcgttccggagctggtcgctgggtggacggtaacgagttcgcgggcgaggcaagtacgacatcacccggcccaaggcggcaggctgaccc  
ccccactctattgACGAAAAaaaaacccgcccctgacagggcggggttttttccaattattgaaggccgctaacgcggccttttttgttctgg  
tctgccttaataatgactaagaattcgcgccgcttctagagCGTCTCaCTTCggatccgtgcaggCTTctagcattttatccataagattagc  
ggatcctacctgacgtttttatcgaaactcttactgtttctCATAACCCGACctagtgaagaggagaaataactaAATGtttgaccggatt  
tccggttgcatgtgattggatcgaaatcctaaggacttgggtcaattccggcagaaaatcacggcgctgaggttgcaattatcggggccggca  
ttgacggcttagtagcagcatatgaattaatgaagatgggtctgaaacctgtagtctatgaggcctcaaaatgggaggtcgcttacggtcacaggaa  
tttgaaggagcgaagggaattgttgcggaactggcggtatgcgtttccagctcctccacagcgttctttcattacgttgataaactgggccttga  
gtcgtccgttccctaaccctttgacggcgccagtgagcagcgggtgattgacctggaaggtaccacgtactatgcacagatgttatcagatctccag  
ccctgttcaagaagtggcggtatgcatggcgagcgccttagaatcaggctctcaatttgagatattcaacaggccattctgtattctgacgtaccgc  
gtctTaaggaaactgtggaacaaactcgtgcctttgtgggacgatcgacatttctatgactttgtagcgacctcaaaggcctttgcgaattaagcttta  
ccatcgtgaggttttcggacaagtgttgggtacaggggggtgggattctgattttccaaatagtagttagaaatcttctgtgtgtgatgacgaatt  
gtgatgagcaccagcatctgattgttgggtggcgtacagcaagtgcctgtaggcctgtggtcgacgtgcctgaacgtgctgcacattggccaaagggt  
acgtcCcttctcacttcatcggggtgccccgcgccaggtgtcaaacgtattgcagtgctgaagatgggtcatttacggttacagataattggggcg  
atacagctcaatacgtcgctgtttgacaacctgtcaatcgtggctgttacaacgcagattgaatgtgaggaatcttgttttcacagaagatgtgat  
ggcgtggatcgacgcgttacatgcagtcttctaaaactttgtgatggttgatcgccggttttgaaggacaaagatccggaacgggtcgcatct  
tatgtccatgacccctaccgatcgcttaacgcgggcacatacttattgataatggcgacgacaagccaggcggtatttgcctgagttactcatggatg  
agtgcagctttaaaaaatgttaccgcaaccgatcgagaaacgcgtcaaaattagcttttagatgcccttaaaaagatttaccgaaagtggatcgccgc  
acgtattattgggtgacccgattactgtgagttgggaagcggatccgcatttctgggggcatttaaaggcggttaccgggcatcattaccgttacaacca  
gcgcatgtacgcgcatttatgcagcaggacatgccgtcagaacagcgtggcatgtttattgccggtgatgatgtatcttgacacggcatgggtga  
gggagcagtacaaacgtcattgaacgcggtgtgggcatcatgaaccatttcggagggaaaaccacgcagagaatccgggtcctggcgacgtttc  
catgagattggaccgatcgcgctgggggactaataatcgtgggacgccccccctagaaaaggaggactaaaaatgcgcgaaatgattacgcttga  
atctctgtgcgcgcatggcagacgaacagattgccgcagaagaattgcgcgagcgcgctggatacagaggctcgcttaacactgttaaattgct  
tcattcgcaaggcgacgccgaagccaattcggtgaagcggatcaggcgcgtaaaaggaaacttcaatttgggggtgcctgtgagtttaaggataac  
atctgtgttcgcggtgctccactgacggcgggatcccgcgcatgagcggttattgccgatcaggatgcagcaatcgtgacccagttaaaagcatt  
gggagctgtggtcggggcaaaaataacatgcatgagctgtcatttggcgtcacgagcatcaatccacattggggcgcggttggaacccgggtggctc  
caggatattgcgccgaggttctagcggaggtccgctgcggcggtcgcatctggaattgtcccgtcagcgtcgggacggacacaggcggtcaatc  
cgtattccggcggttttgcggcattacgggttttcgcctactacaggtcgcttgagtacggcggggatcattccggtcagccacgaaggattgtg  
tcggcctcctgacgcgcagctggcgacgtgaatttgtgtatgggctgctgtcaggaaaacagcagagtttccctttaatcgacgggaccttgc  
gcatcgccctgcgggtgagcatgtggtctgacttagatggcgaagtagaacgtgcctgtatcaatgcgctgagcctttacgaaaaacgggcttgaat  
ttgttgagatcgacgatgcggacattgtggaattgaaccagacattaaccttcacggtgccgctgtacgaatttttcgcgattttgtcaatcctgttg  
tccttaggttgaaacatggcatccatcatattttgcacaagtggatgatgcaaatgtgaaaggcattattaatcccatctgggagaggcgcgatt  
aagccggcacattatctgagttctctcagaatggagagctgctgaaacgcaagatggatgagcttttgcgcgccatcacattaacttttagggtat  
ccgacggtcccgtgtcggtgcctcatctggacatgcagatcgtccggaatttttagccaggccatccgtaacacagacctcgcaagcaacgcgatg



ttaccaagcattacaattccggctcggtccggaaggccgctgccggctggccttagttttgatgcgctcgtgctcgtgatcggtttctttaagcaatgt  
tagtttgatcgaaaaagtgttaaaaggctaataaTGGCgacgaacaataaggcctcctaacggggggcctttttattgataacaaaaGCTGCG  
TTtGAGACGtactagtagcgccgctgcagttaactgattaaactcggtaccaaattccagaaaagaggcctcccgaaggggggcctttttc  
gttttggctcctttgttatcaataaaaaaggggagcggtttcccgcctcccttattgttcgctTACA

#### **pIG105 Para-B0034-acdS-AmpR-araC-RSF1010**

gattatcaaaaaggatcttcacntagatccttttaaatataaaatgaagttttaatcaatctaaagtatatatgagtaaacttggtctgacagttacca  
atgcttaatcagtgaggcacctatctcagcgatctgtctatttcgttcacatagttgcctgactccccgctgtagataactacgatacgggagggct  
taccatctggccccagtgctgcaatgataccgcggggacccacgctcaccggctccagattatcagcaataaaccagccagccggaaggccgagcg  
cagaagtggctcgtcaactttatccgctccatccagcttattaattgttgcgggaagctagagtaagttagttccaggttaatagtttgcgcaacgtt  
gttgccattgctacaggcatcgtggtgtcacgctcgtcgtttggtatggcttcattcagctccggttccaacgatcaaggcgagttacatgatccccat  
gttgtcaaaaaagcggttagctccttcggctcctccgatcgtgtgcagaagtaagtggccgcagtggtatcactcatggttatggcagcactgcataat  
tctcttactgtcatgccatccgtaagatgcttttctgtgactggtgagtactcaaccaagtcattctgagaatagtgtatgcggcgaccgagttgctcttg  
cccggcgtaatacgggataataccgcgccacatagcagaactttaaaagtgtcatcattggaaaacggttcttcggggcgaaaactctcaaggatct  
taccgctgttgagatccagttcgatgtaacccactcgtgcacccaactgatcttcagcatcttttactttaccagcggttctgggtgagcaaaaacagg  
aaggcaaaatgccgcaaaaaagggaataaggcgacacggaaatgtgaataactcatactcttcttttcaatattattgaagcatttatcagggtta  
ttgtctcatgagcggatacatatttgatgtatttagaaaaataacaaatagggggtccgcgcacatttccccgaaaagtccacctgGAGTaaaa  
aaaaGCCCCCtTtcGGCGGGCtttGCCAttattatgacaactgacggctacatcattcatttttctcacaaccggcacggaaactcgtctg  
ggctggccccggtgcatttttaatacccgcgagaaatagagttgatcgtcaaaaccaacattgcgaccgacgggtggcagataggcatccgggtggtg  
ctcaaaagcagcttcgctggctgatacgttggtcctcgccagcttaagacgctaactcctaactgctggcggaagagatgtgacagacgcgacgg  
cgacaagcaaacatgctgtgcgacgctggcgatatcaaaattgctgtctgcagggtgatcgtgatgtactgacaagcctcgctgacccgattatccat  
cggtggatggagcgactcgttaatcgcttccatcgccgcagtaacaattgtcaagcagatttatcgccagcagctccgaatagcgcccttccccttg  
cccggcgtaatgatttgcctaaacaggtcgctgaaatcgcggtggtgcgcttcacccggcgaaagaaccccgatttgcaaatattgacggccagt  
taagccattcatgccagtaggcgcgaggacgaaagtaaacccactggtgataccattcgcgagcctccggatgacgaccgtagtgatgaatctctcct  
ggcgggaacagcaaaaatcacccggctcggaacaaattctcgtccctgatttttaccacccctgaccgcgaatggtgagattgagaatataacc  
tttattccagcggtcggtcgataaaaaaatcgagataaccgttggcctcaatcgcggttaaacccgccaccagatgggcattaaacgagtatcccg  
gcagcaggggatcattttgcgttcagccatactttcatactcccGccattcagagaagaaaccaattgtccatattgcatcagacattgccgtcactg  
cgtcttttactggtccttctcgtaaccAaacggtaaccccgcttataaaagcattctgtaacaaagcgggaccaaagccatgacaaaaacgcgta  
acaaaagtgtctataatcacggcagaaaagtcacattggcgcctgttgagtaatagtcaaaagcctccggctcggaggcttttgactttctgttacC  
CAAgaatcatccttagcgaaagtaaggattttttatctgaattaattctcgcgagggccgccacatgaggcatgttccgctccttgcaatact  
gtgtttacatacagctatcgcttagcgaaagtcttttacctcagccgaaatgctcgctgtgtagacattgccagccagtgcccgctcactccgta  
ctaactgtcacgaacccctgcaataactgtcacgccccctgcaataactgtcacgaacccctgcaataactgtcacgccccaaacctgcaaaccca  
gcagggcgggggctggcggggtgttggaataatccatccatgattatctaagaataatccactaggcgcggttatcagcgcccttgtggggcgctgc  
tgcccttgccaatatgcccgccagaggccggatagctggtctattcgtcgcgtaggctacacaccgcccaccgctgcgcgagggggaaagg  
cgggcaaaagcccgtaaacccacaccaaaccgcagaaatagctggagcgcttttagccgcttttagcggcctttccccctaccgaagggtggg  
ggcgcgtgtgcagccccgaggcgctgtctggctgatcattcagccggctcatccttctggcgtggcgagaccgaacaaggcgcggtcgtggtc  
gcgttcaaggtagcatccattgccgcatgagccgatcctccggcactcgtgctgtttaccttggccaaatcatggccccaccagcaccttgcg  
ccttgttcgttcttgcgctcttgcgtgttcccttggccgcAcccgctgaatttcggcattgattcgcgctcgttcttcgagcttgccagccgatcc  
ggcgcttgttgccttaccatcttgacacccattgttaattgtgtgtctcgttaggctatcatggaggcacagcgggcggaatcccgcacctactt  
tgtaggggagggcgacttacgggttcttctcgagaaactggcctaaccggccacccttcggggcggtgcgctctccaggggccattgcatggagccga  
aaagcaaaagcaacagcgaggcagcatggcgatttatcacttacggcgaaaacggcgagcaggtcggcggaatcgccagggccaaggccg  
actTcatccagcggaaggcaagtagtcccgcgacatggatgaagtcttcacgcggaatccgggcacatgccggagttcgtcgagcgcccgccga  
ctactgggatgctgccacctgtatgaacgcgcaatggcgggctgttcaaggaggtcgaatttgcctgccggtcgagctgacctcgaccagcaga  
aggcgctggcgtccgagttcgccagcacctgaccggtgccgagcgctgcgtatagctggccatccatccgggtggcgcgagaacccgcactg  
ccacctgatgatctccgagcggatcaatgacggcatcgagcgcccgcgctcagtggttcaagcggtacaacggcaagaccccgagaaaggcg



ggcacagaagaccgaagcgctcaagcccaaggcatggcttgagcagacccgcgaggcatggccgacatgccaaacgggcattagagcgggcA  
ggccacgacgcccgcattgaccacagaacacttgaggcgagggcatcgagcgctgccgggttcacctggggccgaacgtggtggagatggaa  
ggccggggcatccgaccgaccgggcagacgtggccctgaacatcgacaccgccaacgccagatcatcgacttacaggaataccgggaggcaata  
gaccatgaacgcaatcgacagagtgaagaaatccagaggcatcaacgagttagcggagcagatcgaaccgtggcccagagcatggcgacactgg  
ccgacgaagcccggcaggtcatgagccagaccCagcaggccagcgaggcgaggcgggcggagtggtgaaagcccagcgccagacagggcgggc  
atgggtggagctggccaaagagttgcgggaggtagccgccaggtgagcagcgccgcgagagcgcccggagcgcgtcgcggggtggcactgga  
agctatggctaaccgtgatgctggcttcatgatgcctacggtggtgctgctgatcgcatcgttcttctgctgacctgacgccactgacaaccgagga  
cggctcgatctggctcgcttggggccgatgaagaacgacaggactttgaggccataggccgacagctcaaggccatgggctgtgagcgcttcg  
atatggcgctcagggacgcCAccaccggccagatgatgaaccgggaatggtcagccgcgaagtgtccagaacacgccatggctcaagcggatg  
aatgccagggcaatgacgtgtatatcagggccgcgagcaggagcggcatggtctggtgctggtggacgacctcagcgagttgacctggatgaca  
tgaagccgagggccgggagcctgccctgtagtggaaccagcccgaagaactatcaggcatgggtcaagggtggcgacgccgagggcggtgaa  
cttcgggggacagattgccggacgctggccagcgagtagcagccgaccggccagcgccgacagccgactatggccgcttggcgggcttcacca  
accgaaggacaagcacaccacccgcgccggttatcagccgtgggtgctgctcgctgaatcaagggcaagaccgccaccgctggcccggcgctggt  
gcagcaggctggccagcagatcgagcaggccagcggcagcaggagaaggcccagggctggccagcctcgaactcccagcgggcagcttagcc  
gccaccggcgacggcgctggacgagtagccgagcgagatggccggcggtgtaagcgcttcggtGatgacctcagaagtgcgactttatcgccgc  
gcagaagctggccagcccggggccgagtgccgaggaaatcggcaaggccatggccgaggccagcccagcgctggcagagcgcaagcccggccac  
gaagcggattacatcgagcgaccgtcagcaaggtcatgggtctgccagcgctccagcttgcgcgggccgagctggcacgggcaccggcaccccgcc  
agcgaggcatggacagggcgggccagatttcagcatgtagtcttgcgttggtactcacgctgttatactatgagtactcacgcacagaagggggt  
tttatggaatacgaaaaaagcgcttcagggtcggtctacctgatcaaaagtgaagggtattggttcccgggtggcttgggtatactgaacaaag  
gccgaggctggccgcttttcagtcgctgataggccagccttaacctgacggctgcaccttgccttgttcggaagacaagcctttcgccccggca  
agtttctcggtgactgatataagacaaaaggacaagcagaccggcgacctgctggccagccctgacgctgtacgccaagcgcatatgccgagc  
gcatgaaggccaaaggatgcgtcagcgcaagttctggctgaccgacgacgaatacaggcgctgctgcgagtgcttggagaactcagagcggcg  
cagggcggggtagtgaccccgccagcgctaaccaccaactgctgcaaaggaggcaatcaatggctaccataagcctatcaatattctggaggc  
gttcgacgagcgcgccaccgctggactacgttttgcgaacatggtggcggtacggtcgggcgctggtgtcgccggtggtgcccgttaatccat  
gctggccctgcaactggccgcacagattgcaggcgggccggatctgctggaggtggcgaaactgccaccggcccggtgatctacctgcccgcgaa  
gaccgcccaccgcccattcatcaccgctgcacgccttggggcgacctcagcgccgaggaaacggcaagccgtggctgacggcctgctgatccagc  
cgctgatcggcagcctgccaaacatcatggccccggagtggttcgacggcctcaagcgcgccgagggccgcccctgatggtgctggacagct  
gcgcccgttccacatcgaggaagaaaacggcagcgggccccatggcccaggtcatcggtcgatggaggccatcgccgcgataccgggtgctctatc  
gtgttctgcacatgccagcaagggcgcgccatgatggcgcgaggcgaccagcagcaggccagccggggcagctcggtactggtcgataacatc  
cgctggcagtcctacctgtcgagcatgaccagcgccgaggccagggaatggggtgtggacgacgaccagcgccggttcttctgcttccgcttgcgtgtag  
caaggccaactatggcgacccgttcgtgatcggtggttcaggcgccatgacggcggggtgtcaagcccgcgtgctggagaggcagcgcaagag  
caaggggggtccccgtggtgaagcctaagaacaagcacagcctcagccacgtccggcacgacccggcgactgtctggccccggcctgttccgtgc  
cctcaagcggggcgagcgcaagcgagcaagctggacgtgactacggcgacggcaagcggatcgagttcagcgccggagcgcgtgg  
gcgctgatgatctgcgcatctgcaaggggtggtggccatggctgggcctaattggcctagtgttggccggaacccaagaccgaaggcggaaggca  
gctccggctgttctggaaccaagtgggagggcgtcaccgctgaTGCCATGgtggtcaaaggtagctatcggcgctggcaaaaggaaatcgggg  
cagaggtcgatagtgggtggggcgctcaagcacatacaggactgcatcgagcgcttggaaaggtatccatcatcgccagaatggccgcaagcggca  
ggggttccggctgctgctggagtagccagcgacgagggcgacggcgctgtacgtggccctgaaccccttgatcgcgaggccgtcatgggtggcg  
gccagcatgtgcatcagcatggacgaggtgccccgctggacagcgaaacggcccgcctgctgcaccagcggtgtgtggctggatgaccccg  
caaaacgggcaaggcttccatagataccttgtcggtatgtctggccgtcagaggccagtggttcgacctgcgaagcgccgcCagcgggtgctgc  
gaggcgttgcggagctggtcgctgggtggacggttaaccgagttcgcgcgggcaagtacgacatcaccggcccaaggcggaaggctgaccc  
ccccactctattgACGAAAAAaaccggccctgacagggcggggttttttccaattattgaaggccgctaacgcggccttttttcttctg  
tctgcctaatcaatgactaagaattcgcgccgttctagagCGTCTCaCTTGgattccgtgcaggCTTctagcttttatccataagattagc  
ggatcctacctgacgcttttatcgcaactcttactgtttctCATACCCGCGACctagtgaagaggagaaatactaAATGaacttaaatcgtt  
ttgaacgctaccggttaacatttggaaccagtcgattactccttaaacgtttgtctgaacacctggggcggaaggtagagctgtatgccaaacgtga



agattgcaattcggggcttgcttcgggggtaataagacgcgcaaattagaataccttattcccaggcgattgagcagggatgcgacaccttggttc  
aatcggcgccattcagagtaataaaccgtcaagtcgccgagttgagctcatttaggtatgaagtgtgttggccaagaaaactgggtcaatta  
tagcgatgccgtgtatgaccgcgtgggaaatattgaaatgagccgtattatgggggctgatgtacgcttagacgcagcaggattcgatattggcattcg  
tccttcattgggaaaaagctatgtcggatgtcgtggaacgtgggggtaaacggttcccgatccccgcggctgctctgaacatccttatgggggttagg  
gttcgttggatttcggaagaggtccgtcaacaggaaaaagaattgggcttcaaattcgactatatcgtagtttgcagtaacgggctccacgcaggc  
aggtatggctgtaggggttccgcccgatgggcttctaagaatttatcggcgtcgacgccagtgcaaaagcctgaacagacaaaagcccagatcttac  
gtattgcacgtcatacggctgaattggtcgaacttggcgtgaaatcactgaggaggatgtcgtgctggacactcgcttgcataccggagtacggctt  
gccaaatgaaggaaactcttgaggcaatccgtttatgtggttctctgaaggagtattgacggacccggttacgaagggaagtcgatgcacgggatga  
tcgagatggctcgtcgcgggaatttcccgatggctcaaaggattgtacgcgcattcggcggggctccagcgtaaacgcttactcgttcttattcgt  
aatgggtaataaTGGCgacgaacaataaggcctccctaacggggggcctttttattgataacaaaaGCTGCGTTtGAGACGtactagtagc  
ggcgcgtgcagttaatcactgattaactcggtaccaaattccagaaaagaggcctcccgaaggggggcctttttcgttttggctctttgttatcaata  
aaaaaggggagcggttcccgtccccttattgttcgtTACA

#### plG106 Para-B0034-otsBA-AmpR-araC-RSF1010

gattatcaaaaaggatcttcacntagatccttttaataaaaatgaagtttaaatcaatctaaagtatatatgagtaaacttggctgacagttacca  
atgcttaatcagtgaggcacctatctcagcgatctgtctatttcgttcattccatagttgctgactccccgtcgttagataactacgatacgggagggct  
taccatctggccccagtgctgcaatgataccgcgggacccacgctcaccggctcagatttatcagcaataaaccagccagccggaaggcgagcg  
cagaagtggctcgtcaactttatccgctccatccagcttattaattgttccgggaagctagagtaagtagttcgccagttaatagtttgcgcaacgtt  
gttgccattgctacaggcatcgtgggtgtcacgctcgtcgttggatggcttattcagctcgggtccaacgatcaaggcgagttacatgatccccat  
gttgtgcaaaaaagcggttagctccttcggctcctcgatcgttgcagaagtaagttggcgcagtggttatcactcatggttatggcagcactgcataat  
tctcttactgtcatgccatccgtaagatgcttttctgtgactggtagtactcaaccaagtcattctgagaatagtgtatgcggcgaccgagttgctcttg  
cccggcgtcaatacgggataataccgcgccacatagcagaactttaaaagtgtcatcattggaaaacgttcttcggggcgaaaactctcaaggatct  
taccgctgttgagatccagttcgatgaaccactcgtgcacccaactgatcttcagcatcttttactttaccagcggttctgggtgagcaaaaacagg  
aaggcaaatgccgcaaaaagggaataagggcgacacggaaatgtgaatactcatactcttcttttcaatattattgaagcatttatcagggtta  
ttgtctcatgagcggaatacatttgaatgtatttagaaaaataacaaataggggttcgcgcacatttccccgaaaagtgccacctgGAGTaaaa  
aaaaGCCCCCtcttGCGGGCtttGCGGGCtttGCCAttattatgacaactgacggctacatcattcatttttctcacaaccggcacggaactcgtcgc  
ggctggccccggtgcattttttaataaccgcgagaaatagagttgatcgtcaaaaccaacattgcgaccgacggtggcgataggcatccgggtgggtg  
ctcaaaagcagcttcgctggctgatacgttggctcgcgcgagcttaagacgctaactccctaactgctggcgaaaagatgtgacagacgcgacgg  
cgacaagcaaacatgctgtgcgacgtggcgatatcaaaattgctgtctgccaggtgatcgtgatgtactgacaagcctcgcgtaccgattatccat  
cggtggatggagcgactcgttaatcgcttccatcgccgcgagtaacaattgtcaagcagatttatcgccagcagctccgaatagcgcccttccccttg  
cccggcgttaatgatttgccaaacaggtcgtgaaatgcggctgggtgcgttcatccggcgaaagaacccgtattggcaaatattgacggccagt  
taagccattcatccagtaggcgcggacgaaagtaaacccactggtgatacattcgcgagcctccggatgacgaccgtagtgatgaatctctcct  
ggcgggaacagcaaaatatcaccggctcggcaacaaattctcgtccctgattttaccacccctgaccgcgaatggtagattgagaatataacc  
tttcattcccagcggtcggtcgataaaaaaatcgagataaccgttggcctcaatcggcgtaaaccgccaccagatgggcattaaacgagtatccg  
gcagcaggggatcatttgcgcttcagccatacttttcatactcccGccattcagagaagaaccaattgtccatattgcatcagacattgccgtcactg  
cgtcttttactggctcttctcgtaaccAaaccgtaaacccgcttattaaaagcattctgtaaaaaagcgggaccaaagccatgacaaaaacgcgta  
acaaaagtgtctataatcacggcagaaaagtcacattggccgcctgttgagtaatagtaaaagcctccggtcggaggcttttgactttctgcttacC  
CAAgaaatcatccttagcgaaagctaaggatttttttctgaattaattctcgcgagggcgccacatgaggcatgttcgcgtccttgcaatact  
gtgtttacatacagctatcgttagcggaagttcttttacctcagccgaaatgctgcggttgctagacattgccagccagtgccgtcactccgta  
ctaactgtcacgaaccctgcaataactgtcacgccccctgcaataactgtcacgccccaaacctgcaaaccca  
gcagggcgggggctggcggggtgttgaaaaatccatccatgattatctaagaataatccactaggcgcggttatcagcgcccttgtggggcgctgc  
tgcccttgcccaatatgcccgccagaggccgagatgctgtctattcgtcgcgtaggctacacaccgccccaccgctgcgcggcagggggaaagg  
cgggcaaaagcccgtaaacccacaccaaaccgcgagaaatcgcgtggagcgttttagccgcttttagcggcctttcccctacccgaagggtggg  
ggcgcgtgtgcagccccgagggcctgtctcggctgatcattcagcccggctcatccttctggcgtggcgagaccgaacaaggcgcggtcgtggtc  
gcgttcaaggtacgcattccgcatgagccgatcctcggccactcgtcgtgttcaccttgccaaaatcatggccccaccagcaccttgcg



ccttgtttcgttcttgcgctcttgctgctgttcccttgcccgcAcccgctgaatttcggcattgattcgcgctcgttgttcttcgagcttggccagccgatcc  
gccgccttgttgcctcccctaaccatcttgacacccattgttaatgtgctgtctcgtaggctatcatggaggcacagcggcggaatcccgaccctactt  
tgtaggggagggcgcacttaccggtttcttcgagaaactggcctaacggccacccttcgggcggtgcgctctccgagggccattgcatggagccga  
aaagcaaaagcaacagcgaggcagcatggcgatttatcaccttacggcgaaaacgggcagcaggtcgggcggaatcgccaggggccaaggccg  
actTcatccagcgcaaggcaagtatgccgcgacatggatgaagtcttgacgcgaatccgggcacatgccggagttcgtcgagcggcccccgga  
ctactgggatgctgccacctgtatgaacgcgcaatgggcggtgttcaaggaggtcgaatttgccctgccggtcgagctgacctcgaccagcaga  
aggcgctggcgctccgagttcgccagcacctgaccggtgccgagcgctgccgtatacgtggccatccatgccggtggcgcgagaacccgcaactg  
ccacctgatgatctccgagcggatcaatgacggcatcgagcggcccccgctcagtggttcaagcgggtacaacggcaagaccccgagaaaggcg  
ggcacagaagaccgaagcgctcaagccaaggcatggcttgagcagacccgcgaggcatggcgccacatgccaacggggcattagagcgggcA  
ggccacgacgcccgcattgaccacagaacacttgaggcgaggccatcgagcgctgccgggtgtcacctggggcggaacgtggtggagatggaa  
ggccggggcatccgaccgaccgggcagacgtggccctgaacatcgacaccgccaacgccagatcatcgacttacaggaataccgggaggcaata  
gacctgaacgcaatcgacagagtgaagaaatccagaggcatcaacgagttagcggagcagatcgaaccgctggcccagagcatggcgacactgg  
ccgacgaagcccggcaggtcatgagccagaccCagcaggccagcgaggcgaggcgccggagtggtgaaagcccagcgccagacagggcggc  
atgggtggagctggccaaagagttcgggaggtagccgccagggtgagcagcgccgcgagagcgcccggagcgctcgcgggggtggcactgga  
agctatggctaaccgtgatgtggttccatgatgcctacggtggtgctgctgatcgcatgttgccttctgctgacactgacgccactgacaaccgagga  
cggctcgatctggctgcgcttggtggccgatgaagaacgacaggactttgcaggccataggccgacagctcaaggccatgggctgtgagcgcttcg  
atatcgcgctcagggacgcCAccaccggccagatgatgaaccgggaatggtcagccgccgaagtgtccagaacacgccatggtcaagcggatg  
aatgccagggcaatgacgtgtatatcaggcccccgagcaggagcggtatggttgcgtggtggacgacctcagcgagttgacctggatgaca  
tgaaagccgaggggccgggagcctgccttgtagtggaaccagcccgaagaactatcaggcatgggtcaagtgggcgacgcccagggcggtgaa  
cttcgggggagattgcccggacgtggccagcgagtagcagccgaccggccagcgccgacagccgactatggccgcttgcggggcttcacca  
accgaaggacaagcacaccacccgcgccggttatcagccgtgggtgctgctgcgtgaatccaagggaagaccgccaccgctggccggcgctggt  
gcagcaggctggccagcagatcgagcaggcccagcggcagcaggagaaggcccgcaggctggccagcctgaactcccgcagggcagcttagcc  
gccaccggcgacggcgctggacgagtagccgagcgagatggccggcggttaagcgcttcggtGatgacctcagaagtgcgactttatcgcgc  
gcagaagctggccagccggggccgcagtgccgaggaaatcggaaggccatggccgaggccagcccagcgctggcagagcgcaagcccggccac  
gaagcggattacatcgagcgaccgtcagaaggtcatgggtctgccagcgctccagcttcgcggggcgagctggcacgggcaccggcacccccgc  
agcaggcatggacagggggcgggccagatttcagcatgtagtgtgcttggtactcacgcctgttatactatgagtactcacgcacagaagggggt  
tttatggaatacgaaaaaagcgcttcagggtcggtctacctgatcaaaagtgaagggtattggttcccgggtggctttggttatactgaacaag  
gccgaggctggccgctttttagtgcgtgatatggccagccttaaccttgacgggtgcaccttgccttgttccggaagacaagccttcggccccggca  
agtttctcggtgactgatatgaaagacaaaaggacaagcagaccggcgacctgtggccagccctgacgtgtacccaagcgcatatgccgagc  
gcatgaaggccaaagggtgcgtcagcgcaagtcttggtgacgcagacgaatacaggcgctgcgcgagtgcttgaagaactcagagcggcg  
cagggcggggtagtgaccccgccagcgctaaccaccaactgcctgcaaaggaggcaatcaatggctaccataagcctatcaatattctggaggc  
gttcgagcagcgccgccaccgtggactacgttttgccaacatggtggccggtacggtcggggcgctggtgtcgcccggtggtgcggtaaatccat  
gctggccctgcaactggccgcacagattgcaggcgggcggatctgctggaggtgggggaactgccaccggcccggtgatctacctgcccgcgaa  
gacccgccaccgccattcatcaccgctgcagcccttggggcgacctcagcgccgaggaaacggcaagcctggtgacggcctgtgatccagc  
cgctgatcggcagcctgccaacatcatggccccggagtggttcgacggcctcaagcgcgccgagggccgcccgtgatggtgctggacagct  
gcgcccgttccatcgaggaagaaaacgccagcgcccccatggcccaggtcatcggtcgatggaggccatcgcccgataccgggtgctctatc  
gtgttctgaccatgccagcaagggcgccgcatgatgggcgaggcgaccagcagcagccagccggggcagctcggtactggtcgataacatc  
cgctggcagctctacctgtcgagcatgaccagcgccgaggccagggaatgggggttgagcagcagaccagcgccggttcttctgctcgttcggtgtgag  
caaggccaactatggcgaccgttcgtgatcggtggttcaggcgccatgacggcggggtgctcaagcccgcgtgctggagaggcagcgcaagag  
caagggggtgccccgtggtgaagcctaagaacaagcacagcctcagccacgtccggcacgacccggcgactgttgcccccgccgtgttcgtgc  
cctcaagcggggcgagcgcaagcgagcaagctggacgtgacgtatgactacggcgacggcaagcggatcgagttcagcggccccggagccgctgg  
gcgctgatgatctgcgatctgcaagggctggtggccatggctgggcctaattggcctaagtgttggccggaaaccaagaccgaaggcgagcgca  
gctccggctgttctggaaccaagtgggagggcgtcaccgctgaTGCcATGtggtgcaaggttagctatcgggcgctggcaaggaaatcgggg  
cagaggtcgatagtgttggggcgctcaagcacatacaggactgcatcgagcgcttgggaaggtatccatcatcgccagaatggccgcaagcgga



ggggtttcggctgctgtcggagtacgccagcgacgaggcggacggcgccgtgtacgtggccctgaaccccttgatcgcgcaggccgtcatgggtggcg  
gccagcatgtgcgcacatcagcatggacgaggtgcggcgctggacagcgaaacgcccgcctgtgcaccagcggctgtgtggctggatgaccccg  
caaaacgggcaaggcttccatagataccttgtcggctatgtctggccgtcagaggccagtgttcgaccatgcgcaagcggcgcCagcgggtgcgc  
gaggcgttgccggagctggctgcgctgggctggacggttaaccgagttcgcggcgggaagtacgacatcacccggcccaaggcggcaggctgaccc  
ccccactctattgACGAAAAAaaccgccctgacagggcgggtttttttccaattattgaaggccgtaacgcggcctttttgttctgg  
tctgccttaatcaatgactaagaattcgcggcgttctagagCGTCTCaCTTCggatccgtgcaggCTTtagcattttatccataagattagc  
ggatcctacctgacgctttttatcgcaactcttactgtttctcCATACCCGCGACctagtgaagaggagaaatactaAATGacagaaccgtta  
accgaaacccctgaactatccgcgaaatagcctggtttttgatcttgatggaacgtggcggaatcaaaccgcatcccgatcaggctgctgctgcct  
gacaatattctgcaaggactacagctactggcaaccgcaagtgtggtgacgttggtgacgtgacgtgacgtgacgtgacgtgacgtgacgtgac  
aaaaccttatcgcttcccgttagcgggctgcatggggcggagcgcgtgacatcaatggtaaaacacatatcgttcatctgccgatgcgattgcgc  
gtgatattagcgtgcaactgcatacagtcacgtcagtcacgtcagtcacgtcagtcacgtcagtcacgtcagtcacgtcagtcacgtcagtcac  
cgagcatgaagacgcattaatgacattagcgaacgtattactcagatctggccacaaatggcgttacagcagggaagtggtgtgtgcgatcaa  
accgagaggtaccagtaaaggtaggcaattgcagctttatgcaggaagctccctttatcgggcgaacgcccgtatttctggcgatgatttaaccga  
tgaatctggcttcgagctgtaaacgactgggcggaatgtcagtaaaatggcacaggtgcaactcaggcatcatggcagactggcgggtgtgccgg  
atgtctggagctggctgaaatgataaccaccgcattacaacaaaaagagaaaaataacaggagtgatgactATGAGTCGTTAGTCGTAG  
TATggattgcaccaccagacgagcacgccccagtgccggtggccttgcgttggcatactgggggcactgaaagccgcaggcggactgtggtttgg  
ctggagtggtgaaacagggaatgaggatcagccgtaaaaaaggtagaaaaaggtaacattacgtgggccttttaacctcagcgaacaggacctt  
gacgaatactacaaccaatttccaatgccgttctctggcccgttttattatcggctcgtatctggtgcaatttcagcgtcctgctgggacggctatct  
acgcgtaaatgcgttgctggcagataaattactgccgtgttgcaagacgatgacattatctggatccacgattatcacctgttgccatttgcgatgaa  
ttacgcaaacggggagtgataatcgattggtttcttctgcataattccttccgcacacggaaatctcaacgcgtcggacatatgacaccttgct  
tgaacagctttgtgattatgatttctgggtttccagacagaaaacgatcgtctggcgttctggattgtcttctaacctgacccgcgtcacgacacgta  
gcgcaaaaagccatacagcctggggcaaagcatttcgaacagaagctacccgatcggcattgaaccgaaagaaatagccaaacaggctgccggg  
ccactgccgcaaaaactggcgcaacttaagcggaactgaaaaacgtacaaaatatcttttctgtcgaacggctggattattccaaaggtttgcaga  
gcgttttctgcctatgaagcgttgctggaataatccgcagcatcatggtaaaattcgttataccagattgcaccaacgtcgcgtggtgatgtgcaa  
gcctatcaggatattcgtcatcagctcgaataatgaagctggacgaatgaatggttaatacgggcaattaggctggacgccgtttattatttgaatcag  
cattttgaccgtaaattactgatgaaaatattccgctactctgacgtgggcttagtgacgccactgcgtgacgggatgaacctggtagcaaaagagtat  
gttgctgctcaggaccagcaatccgggcgttctgttcttctcgaatttcggggagcggcaaacgagttaacgtcggcgttaattgttaaccttacg  
atcgtgacgaagttgcagctgcgtggatcgtgacgtgacgtgacgtgacgtgacgtgacgtgacgtgacgtgacgtgacgtgacgtgacgtgac  
acgatattaaccactggcaggagtgcttcattagcgacctaaagcagatagttccgcgaagcgcggaaagccagcagcgcgataaagttgctacctt  
ccaaagcttgctagtaataaTGGCgacgaacaataaggcctccctaacggggggcctttttattgataacaaaaGCTGCGTTTgAGACGta  
ctagtagcggccgctgcagttaatcactgattaactcggtagcaaaatccagaaaaggcctcccgaaggggggcctttttcgttttgctctttgt  
tatcaataaaaaaggggagcggtttccgcgtccccttattgttcgtTACA

#### **pIG107 Para-RNAT1-aracΔ-sfgfp-AmpR-araC-RK2 (casS2)**

cgtaaaggcgaagagctgttactggtgtcgtccctattctggtggaactggatggtgatgtcaacggtcataagttttccgtgcgtggcgagggtgaa  
ggtgacgcaactaatggtaaactgacgtgaagttcatctgtactactggtaaactgccggtccttggccgactctggttaacgacgctgacttatggtg  
ttcagtgcttctgctgtatccggaccatatgaagcagcatgacttcttaagtcgccatgccggaaggctatgtgcaggaacgcacgatttcctttaa  
ggatgacggcacgtacaaaacgcgtgcggaagtgaatttgaaggcgataccctggtaaacgcattgagctgaaaggcattgactttaaagaaga  
cggcaatatctgggccataagctggaatacaattttaacagccacaatgtttacatcacccgataaacaacaaaaaatggcattaaagcgaatttta  
aaattcggccacaacgtggaggatggcagcgtgcagctggctgatcactaccagcaaaactccaatcggtgatggtcctgttctgctgccagacaat  
cactatctgagcacgcaaagcgttctgtctaaagatccgaacgagaacgcgatcatatggttctgctggagttcgtaaccgcagcgggcatcacgca  
tggtatggatgaactgtacaaataaTGGCttcagcaaaaaaacttaagaccgccggtctgtccactaccttgagtaaatcggtggacaggatcgg  
cggttttcttttcttctcaaGCTGCGTTTgAGACGtactagtagcggccgctgcagttttgttatcaataaaaaaggggagcgggtttccgctcc  
ccttattgttcgtTACAgattatcaaaaaggatcttcacatagatccttttaataaaaaatgaagttttaaatcaatctaaagtatatatgagtaaac  
ttggtctgacagttaccaatgcttaatcagtgaggcacctatctcagcgtatgtctatcttctgctcatccatagttgctgactccccgcgtgtagataac



tacgatacgggagggcttacatctggccccagtgctgcaatgataccgcgggaccacgctcaccggctccagatttatcagcaataaaccagccag  
ccggaaggcgagcgagcagaagtggctcgaactttatccgctccatccagcttattaattgttgccgggaagctagagtaagtagttcgccagtta  
atagtttgcgcaacgttgttgccattgctacaggcatcgtgggtcacgctcgtcgttttggtatggcttcattcagctccggttcccaacgatcaaggcga  
gttacatgatccccatgttgtcaaaaaagcggttagctccttcggtcctccgatcgttgtcagaagtaagttggccgagtggttatcactcatggttat  
ggcagcactgcataattcttactgtcatgccatccgtaagatgcttttctgtgactggtgagtactcaaccaagtcattctgagaatagtgtatgcggc  
gaccgagttgctcttgcggcgctcaatacgggataataccgcgccacatagcagaactttaaaagtgtcatcattggaaaacgttcttcggggcga  
aaactctcaaggatcttaccgctgttgagatccagttcgatgtaaccactcgtgcaccaactgatcttcagcatcttttactttcaccagcgtttctgg  
gtgagcaaaaacaggaaggcaaaatgccgcaaaaagggaataaggcgacacggaaatgtgaatactcatacttctcttttcaatattattga  
agcatttatcagggtattgtctcatgagcggatacatatttgaatgtatttagaaaaataaacaataaggggtccgcgcacatttccccgaaaagt  
ccacctgGAGTAcagaaaagcccgccttccggcggttctgctgagttatgacaacttgacggctacatcattcacttttctcacaaccggcacgg  
aactcgtcgggtcgccccgggtgcatttttaatacccgcgagaaatagagttgatcgtcaaaaccaacattgcgaccgacggtggcgataggcat  
ccgggtggtgctcaaaagcagcttcgctggctgatacgttggtcctcgcgcagcttaagacgctaatacctaactgctggcggaagatgtgaca  
gacgcgacggcgacaagcaaacatgctgtgcgacgctggcgatatcaaaattgctgtcgtccagggtatcgcgtgatgtactgacaagcctcggtacc  
cgattatccatcggtggatggagcgactcgttaatcgcttccatgcgccgagtaacaattgctcaagcagatttatcccgacgactccgaatagcgc  
ccttcccttgcggcggttaatgatttcccaaacaggtcgtgaaatgcggctggtgcgttcacccggcgaaagaaccccgattggcaaatatt  
gacggccagttaagccattcatgcccagtaggcgcgcggacgaaagtaaaccactgggtgataccattcgcgagcctccggatgacgaccgtagt  
gaatctctcgtggcggaacagcaaaatatcccggtcggcaaaaattctcgtccctgattttcaccacccctgaccgcgaatggtgagattga  
gaataaacctttcattccagcggtcgtgcgataaaaaatcgagataaccgttggcctcaatcggcggttaaacccgccaccagatgggcattaaac  
gagtatcccggcagcaggggatcattttgcgcttcagccatactttcactcccgccattcagagaagaaaccaattgtccatattgCATggtatat  
ctccttctaaagttaaacaataatttctgtagtgcaccattatcccgccagaggtaaaattgtcaacacgcacgggtgttagctcagcatGCCAA  
tgctgaacccccagcgggaactgacccacaaggccctagcgtttgcaatgcaccaggtcattgacccaggcgtgttcaccaggccgctgcctcgca  
actcttcgacggcttcgccgacgtcgtcgcgccacttctcacgcggtggaatccgatccgcacatgaggcggaaggtttccagcttgagcgggtacg  
gtccccggtgcgagctgaaatagtcgaacatccgtcgggcccgtcggcgacagcttcggtacttctcccatatgaatttcgtgtagtgtgcgacgaa  
acAgcacgacgatttctcgtCGatcaggacctggcaacgggacgttttctgccaggtccaggacgcggaagcggtgcagcagcgacaccgattc  
caggtgcccaacgcggtcggacgtgaagccatcgccgtcgcctgtaggcgcgacaggcattcctcggccttcgtgtaataccggccattgatcgacc  
agcccaggtcctggcaagctcgtagaacgtgaaggtgatcggctcgcgatagggtgcgcttcgctactccaacacctgctccacaccagttcg  
tcacgtcggcccgacgtcagcgggtgtaggtgatcttcacgtccttgttgacgtggaaaatgacctgttttgacgcctcgcgcgggattttctt  
gttgcgcgtgtgaacagggcagagcgggcccgtcgtttggcatcgtcgcacgtgtccggccacggcgcaatatgaacaaggaaagctgcattt  
ccttgatctgctgcttctgtgtttcagcaacgcgcctgcttggcctcgtgacctgttttgccaggtcctcgcggcggtttttcgttcttggctgcat  
agttctcgcgtgtcgtatggtcatcgacttcgcaaacctgcgcctcctgttcAagacgacgcgaacgctccacggcgcgccgatggcggggcaggg  
cagggggagccagttgcacgtgtcgcgtcgtatctggccgtagcttgctggaccatcgagccgacggactggaaggttcgcggggcgacgcatg  
acgggtgcggcttgcgatggtttcgcatcctcggcggaacccccgcgtcagtcagttcttgcctgtatgccttccggtcaaacgtccgattcattacc  
ctccttgcgggattgccccggaattccccggatccgtcgtatcttgcctcgcctcagatccttggcggaagaaagccatccagtttactttgca  
gggcttccaaccttaccagaggcgccccagctggcaattccggttcgcttgcgtTccataaaaccgcccagctagctatcgccatgtaagccact  
gcaagctaCCtGCTtCtTttgcgcttgcgttttcccttgcagatagcccagtaGCTgacattcatcgggggtcagcaccgtttctgcggactggct  
ttctacgtgttcgcttctttagcagcccttgcgcctgagtgcttgcggcagcgtgaagctgacggatccggggaattaattacccccgaacacgag  
cacggcaccgcgaccactatgccaagaatgccaaggtaaaaattgccGccccgcctgaagtccgtgaatccccgacggccgaagtgaaggg  
caggccgccccaccaggccgcccctcactgccggcacctggtcgtgaatgtcgtatgccagcacctgcggcacgtcaatgcttcgggctgcgcgc  
tcgggctgatcccatcccgttactccccgatccggcaatggcaaggactgccagcgtgccatttttggggtgaggccgttcgcgccgaGggg  
cgagccCCTggggggatgggaggcccggttaGCGGgcccggagggttcgagaagggggggcacccttcggcggtgcgcggtcacgcgcA  
cagggcgacccctgggttaaaaacaagggttataaatattgggttaaaaagcaggttaaaaagacaggttagcggtggccgaaaaacggcggaacc  
cttgcaaatgtggattttctgcctgtggacgccctcaaatgtcaataggtCgccccctcatctgtcaGcactctgccctcaagtgtcaaggatcgc  
gccctcatctgtcagtagtcgcgccctcaagtgtcaataccgcagggcactatccccaggcttgcacatcatCtGtgggaaactcgcgtaaaat  
caggcggttttcgcccatttgcgaggctggccagctccacgtcgcggcggaatcgagcctgccctcatctgtcaacgcgcgcgggtgagtcggcc



cctcaagtgtcaacgtccgccccctcatctgtcagtgaggccaagttttccgAggtatccacaacgccggcCgccgcggtgtctgcacacggcttc  
gacggcggtttACGGccaattattgaaggccgctaacggcggttttttttctggtctgccgaattcgggcggttctagagCGTCTCaCTTC  
CTTtagcattttatccataagattagcggtacctgacgtttttatcgaaactcttactgtttctccatacccgGACtttgctcggtctgcga  
aagaggagaaatactaAATGGCTGAAGCGCAAAATGatcccctgctgccgggatactcgtttaacgcccatctggtggcggtttaacgccg  
attgaggccaacggtgATCT

**pIG118 RNAT3, mCherry2, lacI, KanR, pSC101**

cgcagaaacgtggctggcctggttcaccacgcgggaaacggctgataagagacaccggcatactctgcacatcgataacgttactggtttcacat  
tcaccaccctgaattgactctctccggcgctatcatgccataccgcgaaggttttgcgcattcgatggtgtccgggatctgcacgtctcccttatg  
cgactcctgcattaggaaCCAgttacattgtcgatctgttcaggtgaacagctttgaatacaccaaaaactcgtaaaagctctgatgtatctatcttt  
tttacaccgttttcatctgtgcataaggacagttttccctttgatatgtaacgggtaacagttgttacttttgtttagtcttgatgcttactgatagat  
acaagagccataagaacctcagatccttccgtatttagccagtatgttcttagtggttcgttgttttgcgtgagccatgagaacgaaccattgagat  
catacttactttgcatgtcactcaaaaatttgcctcaaaactggtagctgaattttgcagttaaagcatcgtagtgttttcttagtccgttatgtag  
gtaggaatctgatgtaatggttgttggatatttgcaccattcattttatctggttgttctcaagttcggttacgagatccatttgtctatctagtccaactt  
ggaaaatcaacgtatcagtcggcgccctcgcttatcaaccaccaatttcatattgtgtaagtgtttaaatctttacttattggtttcaaaacccattgg  
ttaagccttttaaaactcatggtagttatttcaagcattaacatgaacttaaatcatcaaggctaattcttatatttgccttgtgagttttctttgtgtag  
ttcttttaataaccactcataaatcctcatagagtatttgtttcaaaagacttaacatgttccagattatatttgaatttttaactggaaaagataa  
ggcaatatcttctactaaaaactaattctaatttctgcttgagaacttggcatagtttgcactggaaaatctcaaagccttaaccaaaggattcct  
gatttccacagttctcgtcatcagctctctggttgccttagctaatacaccataagcattttccctactgatgttcatcatctgagcgtattggttataagtg  
aacgataccgtccgttcttctttaggggtttcaatcggtgggttgagtagtgcacacagcataaaattagcttgggttcatgtccgttaagtata  
gcgactaatcgtagttcatttgccttgaaaaactaattcagacatacatctcaattgggtctaggtgatttaatactataccaattgagatgggcta  
gtcaatgataattactagtccttttctttagttgtgggtatctgtaaatctgtagaccttctggtgaaaacttgaattctgtagacctctgtaaa  
ttccgtagacctttgtgtgttttttgtttatattcaagtgttataattatagaataaagaaagataaaaaaagataaaagaatagatcccagc  
cctgtgtataactcactacttttagtcagttccgcagattacaaaaggatgtcgaaacgctgtttgctcctctacaaaacagaccttaaaacctaag  
gcttaagtagcacctcgcaagctcgggcaaatcgctgaatattcctttgtctccgacctcaggcacctgagtcgctgtcttttctgacattcagttc  
gctgcgctcacggctctggcagtgaaatgggggtaaatggcactacaggcgcttttatggattcatgcaaggaaactaccataatacaagaaaagc  
ccgtcacgggcttctcagggcggtttatggcggtctgctatgtggtgctatctgacttttctgttcagcagttcctgacctgtatttccagtcgtGcc  
acttcggattatccgtgacaggtcattcagactggctaatgcacccagtaaggcagcggtatcatcaacaggcttaccgtcttactgtcACGAAA  
aaaaaaccgccccctgacagggcggggttttttccaattattgaaggccgctaacggcgcttttttgttctggtctgcctaatcaatgactaag  
aattcgcgccgcttctagagCGTCTCaCTTCggatccgctcgaggCTTcaattgtgagcggataacaattgacattgtgagcggataacaagat  
actgagcacaCGACattgaaataaagaggagaaatactaAATGgtgagtaaaggagaagaaaaaacttagctatcattaaagagttcatgcg  
cttcaaagttcacatggagggttctgttaacggtcacgagttcgagatcgaaggcgaaggcgaggccgtccgtatgaaggcaccagaccgcaaaa  
ctgaaagtactaaaggcgcccgctgccttttgcgtgggacatctgagcccgaatttatgtacggttctaaagcgtatgttaaaccacccagcggat  
atcccggactatctgaagctgtcttttccggaaggttcaactgggaacgcgtaatgaatttgaagatgggtgtgtgacgtcactcaggactcct  
ccctTcaggatggcgagttcatctataaagttaaactgcgtgttactaattttccatctgatggccgggtgatgcagtgtaggacgatgggttgggagg  
cgtctaccgaacgcagtgatccggaagatggtgcgctgaaaggcgaattaaacagcgctgaaactgaaagatggcgccattatgacgtgaagt  
gaaaaccacgtacaaagccaagaaacctgtgcagctgcctggcgctacaatgtggatattaaactggacatcttctcataatgaagattatacga  
tcgtagagcaatatgagcgcggagggtcgtcattctaccggtggcatggatgaactatacaataaTGGCttcagcaaaaaacttaagaccgc  
cggtcttgcactaccttgagtaatgcggtggacaggatcgcggttttcttttcttctcaaGCTGCGTTGAGACGtactagtagcggccgc  
tgagttaatcactgattaaactcggatccaaaattccagaaaagaggcctcccgaagggggcctttttcgttttggctctttgttatcaataaaaaa  
ggggagcggtttcccgtccccttattgttcTACAggttacaaccaattaaccaattctgattagaaaaactcatcgagcatcaaatgaaactgc  
aatttattcatatcaggattatcaataccataattttgaaaaagccgttctgtatgaaggagaaaaactcaccgaggcagttccataggatggcaaga  
tcctggtatcggtctgcgattccgactcgtccaacatcaatacaacttataatttcccctcgtcaaaaaaagggttatcaagtgagaaatcacatgag  
tgacgactgaatccggtgagaatggcaaaagcttatgcatttcttccagactgttcaacaggccagccattacgctcgtcatcaaaatcactcgcatc  
aaccaaacggttattcattcgtgattgcgctgagcgaggcgaaatacgcgatcgtgttaaaaggacaattacaacaggaatcgaatgaaccggg



cgcaggaacactgccagcgcacatcaacaatattttcacctgaatcaggatattcttctaatacctggaatgctgttttccggggatcgagtggtgagta  
accatgcatcatcaggagtacggataaaatgcttgatggcggaagaggcataaattccgtcagccagtttagtctgacatctcatctgaacatcat  
tggcaacgctacctttgccatgtttcagaacaactctggcgcatcgggctcccatacaatcgatagattgtcgacatgattgcccacattatcgcg  
agccattataacccatataaatcagcatccatgttgaattaatcgcggcctggagcaagacgtttccgttgaatatggctcataaacacccttgta  
ttactgtttatgaagcagacagttttattgttcatgatgatattttatcttgcaatgaacatcagagatttgagacacaactggctttgttgaa  
taaatcgaacttttctgagttgaaggatcagGAGTggtgcctaatagtgagtaactTacattaattgcgttgcgctcactgccgctttccagtcg  
ggaaacgtgctgctgccagctgcattaatgaatcgccaacgcgcggggagaggcggtttgctgattggcgccagggtgggttttctttcaccagtga  
Aacgggcaacagctgattgcccttcaccgcctggccctgagagagttgagcaagcgggtccacgtggtttgcccagcaggcgaaaaatcgtttga  
tggtggttaacggcgggatataacatgagctgtcttcggtatcgctgatccactaccgagatGtccgcaccaacgcgcagccggactcggtaatg  
gcgcgcattgcccagcgccatctgatcttggaaccagcatcgagtggaacgatgccctcattcagcatttgcatggtttgtgaaaaccggac  
atggcactccagtcgcttccgctatcggtgaatttgattgcgagtgagatatttatccagccagccagacgcagacgcgcggagacaga  
actaatgggcccgtaacagcgcatgttgctggtgacccaatgcgaccagatgctccacgcccagtcgctaccgtcttcatgggagaaaataac  
tgttgatgggtgtctggtcagagacatcaagaaataacgccggaacatttagtcaggcagcttccacagcaatggcatcctggtcatccagcggatag  
ttaatgatcagccactgacgcgttgcgcgagaagattgtgcaccgccgtttacaggcttcgacgcgcttcgttctaccatcgacaccaccagctg  
gcaccagttgatcggcgagatttaatcgccgcgacaatttgcgacggcgctgcagggccagactggaggtggcaacgccaatcagcaacgact  
gtttgcccgcagttgttgccacgcggttggaatgaattcagctccgcatcgccgcttccacttttccgcggttt

#### **pIG119 RNAT4, mCherry2, lacI, KanR, p15A**

ACGAAAAAAAAccccgcccctgacagggcggggttttttccaattattgaaggccgctaacgcggcctttttgttctggtctgccttaataca  
tgactaagaattcgcgccgcttctagagCGTCTCaCTTCggatccgctgcaggCTTcaattgtgagcgataacaattgacattgtgagcggat  
aacaagatactgagcacaGACtTatggttcggcgtggaagaggagaaataactaAATGgtgagtaaaggagaagaaaaaacttagctatcat  
taaagagttcatgcttcaaagttcacatggagggttctgttaacgggtcacgagttcgagatcgaaggcgaaggcgaggccgctccgtatgaaggc  
accagaccgccaactgaaagtactaaaggcgccgctgccttttgcgtgggacatcctgagcccgaatttatgtacggttctaaagcgtatgtt  
aaaccccagcggatatccggactatctgaagctgtctttccggaagggttcaactgggaacgcgtaataatgaatttgaagatggtggtgctgacc  
gtcactcaggactcctccctCaggatggcgagttcatctataaagttaaactgcgttggtactaattttccatctgatggccggtgatgcagtgtagga  
cgatgggttgggaggcgtctaccgaacgatgtatccggaagatggtgcgctgaaaggcgaataaaacagcgctgaaactgaaagatggcggcc  
attatgacgctgaagtgaaccacgtacaaagccaagaaacctgtgcagctgcctggcgctacaatgtggatattaactggacatcttatctcat  
aatgaagattatacgatcgtagacaaatagagcgcgagggtcgcttactaccggtggcatggatgaactatacaaaataTGGCttcagcca  
aaaaacttaagaccgcccgttctgtccactaccttgagtaaatgcggtggacaggatcgccggttttctttcttctcaaGCTGCGTTtGAGAC  
Gtactagtagcggccgctgcagttaatcactgattaactcggtaccaaattccagaaaaggcctcccgaaggggggcctttttcgtttggctctt  
ttgttatcaataaaaaaggggagcgggttccgctccccttattgttctgcTACAggttacaaccaattaaccaattctgattagaaaaactcatcga  
gcatcaaatgaaactgaatttattcatatcaggattatcaatacatattttgaaaaagccgtttctgtaatgaaggagaaaactcaccgaggcag  
tccataggtggcaagatcctggtatcggtctgcgattccgactcgccaacatcaatacaacctattaatttcccctcgtaaaaaataaggttatcaag  
tgagaaatccatgagtgcactgaatccggtgagaatggcaaaagcttatgcatttcttccagacttgttaacaggccagccattacgctcgtc  
atcaaaatcactcgcatcaaccaaaccgttattcattcgatgtgcctgagcgaggcgaaatacgcgatcgctgttaaaaggacaattacaacag  
gaatcgaatgcaaccggcgaggaacactgccagcgcacatcaacaatattttcacctgaatcaggatattcttctaatacctggaatgctgtttccgg  
ggatcgcatggtgagtaaccatgcatcatcaggagtacggataaaatgcttgatggtcggaagaggcataaattccgtcagccagtttagtctgacc  
atctcatctgaacatcattggcaacgctacctttgccatgtttcagaacaactctggcgcatcgggctcccatacaatcgatagattgtcgacactg  
attgccgacattatcgcgagccatttatacccatataaatcagcatccatgttggaatttaacgcggcctggagcaagacgtttccggtgaatatg  
gctcataacacccttgtattactgtttatgaagcagacagttttattgttcatgatgatattttatcttgtgcaatgaacatcagagatttgagac  
acaacgtggcttgtgaataaatcgaacttttgcgtgagttgaaggatcagGAGTggtgcctaatagtgagtaactTacattaattgcgttgcgct  
cactgcccgtttccagtcgggaaacctgtcgtgccagctgcattaatgaatcgccaacgcgcggggagaggcggtttgcgtattggcgccagggt  
gggttttctttcaccagtgaAacgggcaacagctgattgcccttcaccgctggccctgagagagttgcagcaagcgggtccacgctgggttccccag  
caggcgaaaaatcgtttgatggtggttaacggcgggatataacatgagctgtcttggtatcgctgatccactaccgagatGtccgcaccaacgcg  
cagcccgactcggtaatggcgcgattgcgccagcgccatctgatcttggaaccagcatcgagtggaacgatgccctcattcagcatttgcat



ggtttgtgaaaaccggacatggcactccagtcgccttcccgttccgctatcggctgaatttgattgcgagtgagatatttatgccagccagccagacgc  
agacgcgccgagacagaacttaatgggcccgtacacagcgcgatttgctggtgacccaatgcgaccagatgctccacgccagtcgctaccgtcttc  
atgggagaaaataactgttgatgggtgtctggtcagagacatcaagaaataacgccggaacatttagtcaggcagcttcacagcaatggcatcc  
tggtcatccagcggatagttaatgatcagcccactgacgcgttgcgcgagaagattgtgcaccgcccgtttacaggcttcgacgccgttcgttctacca  
tcgacaccaccacgctggcaccagttgatcggcgcgagatttaacgcccgcgacaatttgcgacggcgcgtgcagggccagactggaggtggcaac  
gccaatcagcaacgactgtttgccgccagttgtgtgccacgcggttggaatgtaattcagctccgcatcgcgcttccactttttccgcgttttcg  
cagaaacgtggctggcctgggtcaccacgcgggaaacggctctgataagagacaccggcactactctgcgacatcgtataacgttactggttcacattc  
accaccctgaattgactctctccgggcgctatcatgccataccgcgaaaggtttgcgccattcgatggtgtccgggatctgcagctctcccttatgcg  
actcctgcattaggaaCCAAtagcggagtgatactggcttactatgttggcactgatgaggggtgcagtgaaagtcttcatgtggcaggagaaaaa  
aggctgcaccggtgcgtcagcagaatatgtgatacaggatatactcgttctcgtcactgactcgtacgctcggctggttcgactcggcgagcgg  
aaatggcttacgaacggggcgagatttctggaagatgccaggaagatacttaacaggggaagtgaaggggccgcggaagccgtttttccatag  
gctccgccccctgacaagcatcacgaaatctgacgctcaaatcagtggtggcgaacccgacaggactataaagataaccaggcgtttccccctggc  
ggctccctcgtgcgctctcgttctcgttccgtttaccgggtgtcattccgctgttatggccgctttgtctcattccacgcctgacactcagttccggg  
taggcagttcgtccaagctggactgtatgcacgaacccccgttcagtcggacgcgtgcgccttatccggtaactatcgtcttgagccaacccggaa  
agacatgcaaaagcaccactggcagcagccactggaattgatttagaggagttagtcttgaagtcatgcgccggttaaggctaaactgaaaggaca  
agtttgggtgactgcgctcctcaagccagttacctcggttcaaagagttggtagctcagagaaccttcgaaaaaccgcctgcaaggcgtttttcgt  
tttcagagcaagagattacgcgcagacaaaacgatctcaagaagatcatcttattaa

#### **pIG120 RNAT4, mCherry2, lacI, KanR, pSC101**

aatgtaattcagctccgcatcgcgcttccactttttccgcgttttcgagaaacgtggctggcctgggtcaccacgcgggaaacggctgataagag  
acaccggcactactctgcgacatcgtataacgttactggtttcacattcaccaccctgaattgactctctccgggcgctatcatgccataccgcgaaagg  
ttttgcgcattcgatggtgtccgggatctgcagctctcccttatcgactcctgcattaggaaCCAAgttacattgtcgatctgttcatggtgaacag  
ctttgaatacaccaaaaaactcgtaaaagctctgatgtatctatctttttacaccgttttcatctgtcatatggacagttttccctttgatatgaacggtg  
aacagttgttacttttgtttgttagtcttgatgcttactgatagatacaagagccataagaacctcagatcctccgtatttagccagtatgttcttag  
tgtggtcgttgttttgcgtgagccatgagaacgaaccattgagatcatacttactttgcatgtcactcaaaaatttgcctcaaaactggtgagctgaa  
ttttgcagttaaagcatcgtgtagtgttttcttagtccgttatgtaggtaggaatctgatgtaatggttgttggtattttgtcaccattcattttatctggt  
tgttctcaagttcggttacgagatccatttgtctatctagttaacttgaaaaatcaacgtatcagtcgggcggcctcgttatcaaccaccaatttcata  
ttgctgtaagtgtttaaacttttacttattggtttcaaaaccattggttaagccttttaaaactcatggtagttattttcaagcattaacatgaacttaaat  
catcaaggctaattctctatatttgccttgtgagttttctttgtgttagttcttttaataaccactcataaatcctcatagagtatttgtttcaaaagactta  
acatgttcagattatattttatgaattttttaactggaaaagataaggcaatatcttctactaaaaactaattctaattttcgttgagaacttgga  
tagtttgcactggaaaaatcctaagcctttaaccaaggattcctgatttccacagttctcgtcatcagctctcgttggtgctttagctaatacaccataa  
gcattttccctactgatgttcatcatctgagcgtattggttataagtgaacgataccgtccgttcttctttaggggttttaactcgtggggtgagtagtg  
ccacacagcataaaaattagcttgggttcatgctccgttaagtcagtagcactaatcgtagttcatttgctttgaaaacaactaattcagacatacatctc  
aattggtctaggtgattttaatcactataccaattgagatgggctagtcaatgataattactagtccttttctttagttgtgggtatctgtaaattctgct  
agaccttctgctgaaaaacttgtaaattctgtagacctctgtaaattccgctagacctttgtgtgttttttgtttatattcaagtgttataattataga  
ataaagaaagaataaaaaaagataaaaaagaatagatcccagccctgtgtataactcactacttttagtcagttccgcagattacaaaaggatgtcgc  
aaacgctgtttgtcctctacaaaacagaccttaaaaccctaaaggcttaagtagcacctcgcaagctcgggcaaatcgctgaatattcctttgtctc  
cgaccatcaggcacctgagtcgctgtcttttctgtacattcagttcgtcgcctcacggctctggcagtgaaatgggggtaaatggcactacaggcgct  
tttatggattcatgcaaggaaactaccataatacaagaaaagccgtcacgggcttctcagggcgttttatggcgggtctgctatgtggtgctatctga  
cttttctgttctcagcagttcctgcccctgattttccagttctgGccacttcggattatcccgtagacaggtcattcagactggctaataccaccagtaaggc  
agcggatcatcaacaggcttaccgtcttactgtcACGGaaaaaaaaccccgcccctgacagggcggggttttttccaattattgaaggccgct  
aacggcgcttttttgttctggtctgccttaataatgactaagaattcggggcgcttctagagCGTCTCaCTTCggatccgctgcaggCTTCa  
attgtgagcggataacaattgacattgtgagcggataacaagatactgagcacaCGACTtatggttcggcgtggaagaggagaaatactaAATG  
gtgagtaaaggagaagaaaacaacttagctatcattaaagagttcatgcgttcaaagttcacatggagggttctgttaacggtcacgagttcgagat  
cgaaggcgaaggcgagggccgtccgtatgaaggcaccagaccgcaaaactgaaagtgactaaaggcgcccgctccttttgcgtgggacatcct



gagcccgcaatttatgtacggttctaaagcgtatgttaaaccaccagcggatatcccgactatctgaagctgtctttccggaagggttcaactgggaa  
cgcgtaatgaattttgaagatgggtgtcgtgaccgtcactcaggactcctccctTcaggatggcgagttcatctataaagttaaactgcgtggtacta  
atttccatctgatggccggtgatgcagtgtaggacgatgggttgggagcgctaccgaacgcatgtatccggaagatgggtgcgtgaaaggcgaa  
attaaacagcgctgaaactgaaagatggcggccattatgacgctgaagtgaaccacgtacaaagccaagaaactgtgcagctgcctggcgcg  
tacaatgtggatattaaactggacatcttatctcataatgaagattatacgtatgtagagcaatatgagcgcgcgagggtcgtcattctaccggtggc  
atggatgaactatacaataaTGGCttcagccaaaaaacttaagaccgcggtctgtccactaccttgagtaatgcggtggacaggatcggcggt  
tttcttttcttctcaaGCTGCGTTtGAGACGtactagtagcgccgctgcagttaatcactgattaactcggtagcaaatccagaaaagggc  
ctcccgaaggggggtcttttctgttttggctctttgttatcaataaaaaaggggagcggtttcccgctccccttattgttcTACAgttacaac  
caattaaccaattctgattagaaaaactcatcgagcatcaaatgaaactgcaattattcatatcaggattatcaataccatattttgaaaaagcgtt  
tctgtaatgaaggagaaaaactcaccgaggcagttccataggatggcaagatcctggatcgggtcgtcgattccgactcgtccaacatcaataacct  
attaatttcccctcgtcaaaaaataaggttatcaagtgagaaatcacatgagtgacgactgaatccggtgagaatggcaaaagcttatgcatttcttc  
cagacttgttaacaggccagccattacgctcgtcatcaaaatcactcgcatacaaaaacggttattcattcgtgattgcgctgagcgaggcgaaat  
acgcgatcgtgttaaaggacaattacaaacaggaaatcgaatgcaaccggcgaggaacactgccagcgcatcaacaatattttcacctgaatcag  
gatattcttctaatacctggaatgctgttttccggggatcgagtggtgagtaacctgcacatcaggagtagcgataaaatgcttgatggtcgga  
gaggcataaattccgtcagccagtttagtctgaccatctcatctgtaacatcattggcaacgctacctttgccatgttcagaaacaactcggcgcatc  
gggcttccatacaatcgatagattgtcgacactgattgccgacattatcgcgagccatttataccatataaatcagcatccatgttggaatttaac  
gcggcctggagcaagacgtttccggtgaatatggctcataacacccttgtattactgtttatgtaagcagacagttttattgtcatgatgatatttt  
tatcttgtgcaatgtaacatcagagattttgagacacaacgtggcttgttgaataaatcgaacttttgcgtgagttgaaggatcagGAGTggtgcctaa  
tgagtgcgtaactTacattaattgcgttgcgctcactgcccgtttccagtcgggaaacctgtcgtgccagctgcattaatgaatcgcccaacgcgcg  
gggagaggcggtttgcgtattggcgccagggtgggttttttccaccagtgaAacgggcaacagctgattgcccttaccgcctggcctgagagag  
ttgcagcaagcgggtccacgctggtttgcccagcaggcgaaaaatcctgtttgatggtggttaacggcgggataacatgagctgtcttcggtatcgtc  
gtatccactaccgagatGtccgcaccaacgcgcagcccgactcggtaatggcgcgcatgtgcgccagcgccatcgtatcgttggaaccagcatc  
gcagtgagggaacgatgccctcattcagcatttgcattggtttgtgaaaacggacatggcactccagtcgcttccggttccgctatcgggtgaattgatt  
gcgagtgcagatattatgccagccagccagacgcagacgcgcgagacagaactaatgggcccgtaacagcgcgatttgcgtggtgaccaatgcg  
accagatgctccagcccagtcgctaccgtcttcatgggagaaaaataactgttgatgggtgtcgtgagacatcaagaataacgccggaac  
attagtcaggcagcttccacagcaatggcatcctggtcatccagcggatagttaatgatcagccactgacgcgttgcgcgagaagattgtgcaccg  
ccgctttacaggcttcgacgccgttcttaccatcgacaccacacgctggcaccagttgatcggcgcgagatttaacgccgcgacaatttgcg  
acggcgctgcagggccagactggaggtggcaacccaatcagcaacgactgtttgcccgccagttgttgccacgcggttggg

#### **pIG122 RNAT6, mCherry2, lacI, KanR, pSC101**

ACGGaaaaaaaccccgcccgtacagggcggggttttttccaattattgaaggccgctaacgcggccttttttctgtgtccttaataca  
tgactaagaattcgcgccgctttagagCGTCTCaCTTCggatccgctgcaggCTTcaattgtgagcgataacaattgacattgtgagcggat  
aacaagatactgagcacaCGACggacaagcaatgcttgccttgaatagtaactttgaatagtattcaggaggAATGgtgagtaaggagaag  
aaaacaacttagctatcattaaagagttcatgcgttcaaagttcacatggagggttctgttaacggtcacgagttcgagatcgaaggcgaaggcgag  
ggcgttccgtatgaaggcaccagaccgcaaaactgaaagtactaaaggcgcccgctgcttttgcgtgggacatcctgagcccgaatttatgta  
cggttctaagcgtatgttaaaccaccagcggatatcccgactatctgaagctgtctttccggaagggttcaactgggaacgcgtaatgaatttgaa  
gatggtggtgtcgtgaccgtcactcaggactcctccctTcaggatggcgagttcatctataaagttaaactgcgtggtactaattttccatctgatggc  
cggtgatgcagtgtaggacgatgggttgggagcgcttaccgaacgcagtgatccggaagatgggtgcgctgaaaggcgaaattaaacagcgctga  
aactgaaagatggcgccattatgacgtgaagtgaaccacgtacaaagccaagaacactgtgcagctgcctggcgctacaatgtggatattaa  
actggacatcttatctcataatgaagattatacgtatgtagagcaatatgagcgcgaggaggtcgtcattctaccggtggcatggatgaactataca  
aataaTGGCttcagccaaaaaacttaagaccgcggttcttccactaccttgagtaatgcggtggacaggatcggcggttttcttttcttctcaa  
GCTGCGTTtGAGACGtactagtagcgccgctgcagttaatcactgattaactcggtagcaaatccagaaaaggcctcccgaaggggg  
cctttttcgttttggctctttgttatcaataaaaaaggggagcggtttcccgctccccttattgttcTACAgttacaaccaattaaccaattctg  
attagaaaaactcatcgagcatcaaatgaaactgcaatttattcatatcaggattatcaataccatattttgaaaaagcgttctgtaatgaaggag  
aaaactcaccgaggcagttccataggatggcaagatcctggatcgggtcgtcgattccgactcgtccaacatcaatacaacctaatttcccctcgtc



aaaaataaggttatcaagtgagaaatcaccatgagtgacgactgaatccgggtgagaatggcaaaagcttatgcattttcttccagacttggtcaacag  
gccagccattacgctcgtcatcaaaatcactcgcatcaaccaaaccgttattcattcgtgattgcgctgagcggcgaaatacgcgatcgtgttaa  
aaggacaattacaaaacaggaatcgaatgcaaccggcgaggaacactgccagcgcatcaacaatattttcacctgaatcaggatattcttctaatacc  
tggaatgctgtttcccggggatcgagtggtgagtaacatgcatcatcaggagtagcgataaaatgcttgatggtcggaagaggcataaattccgt  
cagccagtttagtctgacatctcatctgtaacatcattggcaacgctacctttgccatgttcagaaacaactctggcgcatcgggcttccatacaatc  
gatagattgtcgacactgattgccgacattatcgcgagccatttataccataataatcagcatccatgttggaatttaacgcggcctggagcaag  
acgtttcccggttgaatatggctcataacaccccttgattactgtttatgtaagcagacagttttattgttcattgatgatataattttatcttgcaatgtaa  
catcagagattttgagacacaacgtggctttgttgaataaatcgaacttttgctgagttgaaggatcagGAGTggtgcctaagtagtgagctaactTa  
cattaattgcgttcgctcactgccgctttccagtcgggaaacctgtcgtgccagctgcattaatgaatcggccaaacgcgcggggagaggcggttgc  
gtattggcgccagggtggtttttttcaccagtgaAacgggcaacagctgattgcccttcaccgctggccctgagagagttgcagcaagcggtcc  
acgctggtttcccccagcaggcgaaaatcctgtttgatggtggttaacggcggggatataacatgagctgtcttcggtatcgtctatcccactaccgag  
atGtccgcaccaacgcgcagcccggactcggtaatggcgcgcatctgcccagcgccatctgatcgttggaaccagcatcgagtggaacgatgc  
cctcattcagcatttgcatggtttgttgaanaacggacatggcactccagtcgccttcccgttcgctatcggctgaatttgattgcgagtgagatattat  
gccagccagccagacgcagacgcgagacagaacttaatgggcccctaacagcgcgatttgctggtgacccaatgcgaccagatgctccacgc  
ccagtcgctgacgtcttcatgggagaaaataactgttgatgggtgctggtcagagacatcaagaaataacccggaacattagtgcaggcagct  
tccacagcaatggcatcctggtcatccagcggatagttatgatcagccactgacgcttgcgcgagaagattgtgcaccgccgtttacaggcttcg  
acgccgcttcgttaccatcgacaccaccagctggcaccagttgatcggcgagatttaatcgccgcgacaatttgcgacggcgctgcagggc  
cagactggaggtggaacgccaatcagcaacgactgtttgcccgccagttgttgccacgcggttggaatgtaattcagctccgccatcgccgcttc  
cactttttcccgcttttgcagaaacgtggctggcctggttcaccacgcgggaaacggctgataagagacaccggcatactctgcgacatcgtataa  
cgttactggtttcacattcaccacctgaattgactctctccggcgctatcatccataccgcgaaaggttttgcgccattcgatggtgtccgggatct  
cgacgctctcccttatgcgactcctgcattaggaaCAAgttacattgtcgatctgttcattggtgaacagctttgaatacaccaaaaactcgtaaaagc  
tctgatgtatctatctttttacaccgttttcatctgtgcataatggacagttttcccttgatataacgggtgaacagttgttctacttttgtttagtcttg  
atgcttcactgatagatacaagagccataagaacctcagatccttccgtatttagccagatgttctctagtgtggttcgtgttttgcgtgagccatga  
gaacgaaccattgagatcatacttactttgcatgtcactcaaaaatttgcctcaaaaactggtgagctgaattttgagttaaagcatcgtgtagtgtt  
ttcttagtccgttatgtaggttaggaatctgatgtaatggttgttggtattttgtcaccattcattttatctggttgttctcaagttcggttacgagatccatt  
gtctatctagttcaacttggaanaacgatatcagtcggcgccctcgcttatcaaccaccaatttcatattgctgtaagtgtttaacttttactattg  
gtttcaaaaccattggttaagccttttaactcatggtagttattttcaagcattaacatgaactaaattcatcaaggctaattcttatatttgcttgtg  
agttttctttgtgttagttcttttaataaaccactcataaatcctcatagagtatttgtttcaaaagacttaacatgttccagattatattttatgaattttt  
taactggaagataaggcaatatcttctactaaaaactaattctaattttcgttgagaacttgcatagttgtccactggaanaactcaaaagcct  
ttaaccaaaggatttctgatttccacagttctcgtcatcagctctctggttcttagctaatacaccataagcattttccctactgatgttcattcatctgag  
cgtattggttataagtgaacgataccgtccgttcttctttaggggtttcaatcgtgggggttagtagtgccacacagcataaaattagcttggttcat  
gtccgttaagtcatagcactaatcgtagttcatttgcttgaanaaactaattcagacatacatctcaattgggttaggtgattttaactatac  
caattgagatgggctagtcataatgataattactagtccttttctttaggttggtggtatctgtaaaattctgtagacctttgctggaanaactgtaaattct  
gtagaccctctgtaaaatccgctagacctttgtgtgtttttttgttatattcaagtggttataatttatagaataaagaaagaataaaaaaagataaa  
aagaatagatcccagccctgtgtataactactacttttagtcagttccgcagattatacaaaaggatgtcgcaaacgctgtttgtcctctcaaaaacag  
accttaaaaccctaaaggcttaagtagcaccctcgcaagctcgggcaaatcgtgaatattcctttgtctccgacctcaggcacctgagtcgtgtct  
ttttcgtgacattcagttcgtcgtcacggctctggcagtgatgggggtaaatggcactacaggcgctttatggattcatgaaggaaactaccc  
ataatacaagaaaagcccgtcacgggcttctcaggcgcttttatggcggtctgctatgtggtgctatctgacttttgcgtgttcagcagttcctgcctct  
gattttcagtcgtGccacttcggattatcccgtagacaggtcattcagactggctaatacaccagtaaggcagcggtatcatcaacaggcttaccgct  
cttactgtc

#### **pIG123 RNAT7, mCherry2, lacI, KanR, p15A**

tGAGACCataCATCGGaaagtgaacgtagtttcatgctcattttgaacattttgtaaatcttatttaataatgtgtgcggcaattcacatttaatt  
ttatgaatgttttctaactcgcggcaactcaagaaacggcaggttcggatcttagctactagagaaagaggagaaataactagatgcgtaaaggcga  
agagctgttactggtgtcgtccctatttctggtggaactggatggtgatgaacggtcataagtttccgtgcgtggcgagggtgaaggtagcgaact



aatggtaaactgacgctgaagttcatctgtactactggtaaactgccggttccttgccgactctggtaacgacgctgacttatgggttcagtgctttgc  
tcgttatccggaccatatgaagcagcatgacttcttcaagtcgccatgccggaaggctatgtgcaggaacgcacgatttctttaaggatgacggcac  
gtacaaaacgctgcggaagtgaatttgaaggcgataccctggtaaaccgcattgagctgaaaggcattgactttaagaagacggcaatatcctg  
ggccataagctgggaatacaattttaacagccacaatgtttacatcaccgccgataaacaataaaggcattaaagcgaattttaaatccgccaca  
cgtggaggatggcagcgtgcagctggctgatcactaccagcaaaacactccaatcggtgatggctctgtctgctgccagacaatcactatctgagca  
cgcaaagcgttctgtctaaagatccgaacgagaaacgcgatcatatggttctgctggagttcgaaccgcagcgggcatcacgcatggtatggatgaa  
ctgtacaaatgaccaggcatcaaataaaacgaaaggctcagtcgaaagactgggcctttcgttttatctgttgttgcggtgaacgctctcCAAAcc  
gtagaaaagatcaaaggatcttcttgagatcctttttctgcgcgtaatctgctgcttGCAACAAAAAACACCGCTACCAGCGGTG  
GTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTTCCGAAGGTAAGTGGCTTCAGCAGAGCGCAGATACCAAATA  
CTGTTCTTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACTCTGTAGCACCGCCTACATACCTCGTCTGCTA  
ATCCTGTTACCAGTGGCTGCTGCCAGTGGCGATAAGTCGTGTCTTACCGGTTGGACTCAAGACGATAGTTACCGG  
ATAAGGCGCAGCGGTCGGGCTGAACGGGGGGTTCGTGCACACAGCCCAGCTTGGAGCGAACGACCTACACCGAA  
CTGAGATACCTACAGCGTGAGCTATGAGAAAGCGCCACGCTTCCGAAGGGAGAAAGCGGGACAGGTATCCGGT  
AAGCGGCAGGGTCGGAACAGGAGAGCGCACGAGGGAGCTTCCAGGGGGAAACGCCTGGTATCTTTATAGTCTCTG  
TCGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCAGGGGGGCGGAGCCTATGGAAaaccgc  
agcaacgcggcctttttacgggtcctggccttttctggccttttctcacatGCGATGataGGTCTCaTACagattatcaaaaaggatcttcacc  
tagatccttttaataaaaaatgaagtttaaatcaatctaaagtatatatgagtaaacttggctgacagttaccaatgcttaatcagtgaggcaccta  
tctcagcgtatctgtatcttctgttcattcatatggtcctgactccccgcgtgtagataactacgatacgggagggccttacatctgccccagtgctgca  
atgataccgcgggacccacgctcaccggctcagatttatcagcaataaacagccagccggaagggccgagcgcagaagtggctcgtcaactttat  
ccgcctccatccagctctattaattgttgccgggaagctagagtaagtagttgccagttaatagtttgcgaacgttgttgccattgctacaggcatctg  
gtgtcacgctcgtcgtttggatggcttcattcagctccggttcccaacgatcaaggcgagttacatgatcccatgttgtgcaaaaaagcggttagct  
ccttcggtcctccgatcgttgcagaagtaagttggccgagtggtatcactcatggttatggcagcactgcataattctctactgtcatgccatccgta  
agatgcttttctgtgactggtagtactcaaccaagtcattctgagaatagtgtagcgcgaccgagttgctcttggccggcgtcaatacgggataata  
ccgcgccacatagcagaactttaaaagtgtcatcattggaacggttcttcggggcgaaaactctcaaggatcttaccgctgttgagatccagttcga  
tgtaaccactcgtgcaccaactgatcttcagcatctttactttcaccagcgtttctgggtgagcaaaaacaggaaggcaaatgccgcaaaaag  
ggaataaggcgacacggaaatgttgaatactcactcttcttttcaatattattgaagcatttatcagggttattgtctcatgagcggatacatatt  
tgaatgtatttagaaaaataaacaatatggggttccgcgcacattccccgaaaagtgccacctgGAGTggtgcctaagtagtgagtaactTacat  
taattgcgttgcgctcactgccgcttccagtcgggaaacctgtcgtgcagctgcattaatgaatcggccaacgcgcggggagaggcggttgcgta  
ttgggcccaggggtggttttcttttaccagtgAacgggcaacagctgattgcccttcaccgcctggccctgagagagttgcagcaagcggtccag  
ctggttggcccgagcaggcgaatacctgtttgatggtggttaacggcgggatataacatgagctgtcttcggtatcgtctatccactaccgagatGt  
ccgcaccaacgcgcagcccggactcggtaatggcgcgattgcgccagcgccatctgatcgttggcaaccagcatcgagtggaacgatgcctc  
attcagcatttgatggtttgtgaaaaccggacatggcactccagtcgccttccggttccgctatcggtgaatttgatgcagtgagatatttatgcc  
agccagccagacgcagacgcgcgagacagaacttaaggcccgctaacagcgcgatttgcgttgtagccaatgcgaccagatgctccacgcca  
gtcgcgtaccgtcttcatgggagaaaaataactgttgatgggtgtctggtcagagacatcaagaaataacgccggaacattagtcaggcagcttcc  
acagcaatggcatcctggtcatccagcgatagttaatgatcagccactgacgcgttgcgcgagaagattgtgcaccgcgctttacaggcttcgac  
gccgcttctgttaccatcgacaccaccagctggcaccagttgatcggcgcgagatttaatcgccgcgacaatttgcgacggcgcggtgcaggcca  
gactggaggtggcaacccaatcagcaacgactgtttcccgccagttgtgtgccacgcggttgggaatgtaattcagctccgccatcgccgcttcca  
cttttccgcggttttcgagaacgtggctggcctggttaccacgcgggaaacggtctgataagagacaccggcatactctgcgacatcgataacg  
ttactggtttcacattcaccacctgaattgactcttccgggcgtatcatgccataccgcgaaaggttttgcgcatctgaggtgtccggatctcg  
acgctctcccttatgcgactcctgcattaggaaCAAaagaatcatccttagcgaaagctaaggattttttatctgaattaattctcgagaggccg  
ccacatgaggcatgttccgcgtccttgaatactgtgtttacatacagctctatcgcttagcggaagttctttaccctcagccgaaatgctgcggttc  
tagacattgccagcagtgccgctactccgctactaactgtcacgaacccctgcaataactgtcacgccccctgcaataactgtcacgaacccctgc  
aataactgtcacgccccaaacctgcaaacccagcagggcggggctggcggggtgttgaaaaatccatccatgattatctaagaataatccact  
aggcgcggttatcagcgcccttggggcgctgctgcccttcccaatatgccggccagaggccggatagctggctattcgtcgcgctaggctacac



accgccccaccgctgcgcgagggggaaaggcgggcaaagcccgttaaaccacaccaaaccgagaaatacgtggagcgcttttagccgc  
tttagcggcctttccccctaccgaagggtggggcgcggtgtgagccccgagggcctgtctcggtcgatcattcagcccggtcatccttctggcgtg  
gcggcagaccgaacaaggcgcggtcgtggtcgcgttcaaggtagcatcattgccgcatgagccgatcctccggccactcgtgctgttcaccttgg  
ccaaaatcatggccccaccagcaccttgcgccttgttctgtcttgcgtcttgcgtgttcccttggccgcAcccgctgaatttcggcattgattcgcg  
ctcgttgttctcgagcttggccagccgatccgcccttgttgccttcaaccatcttgacacccattgttaatgtgctgtctcgtaggtcatcatgg  
aggcacagcggcggaatcccgaccctactttagggggagggcgacttaccggttcttctcagaaactggcctaaccggccaccccttggggcgt  
gcgctctccgagggccattgcatggagccgaaaagcaaaagcaacagcagggcagcatggcgatttatcaccttacggcgaaaaccggcagcaggt  
cggggggccaatcgccagggccaaggccgactTcatccagcgcgaaggcaagtatcccgcgacatggatgaagtcttgacgccgaatccgggc  
acatgccggagtctcgtcagcggccccgcgactactgggatgctgcgacctgtatgaacgcgccaatgggcggtgttcaaggaggtcgaatttgc  
ctgccggtcagctgacctcgaccagcagaaggcgctggcgtccgagttcggccagcacctgaccggtgcgagcgctgcgtatacgtggccat  
ccatgccggtggcgcgagaaccgcactgccacctgatgatctccgagcggatcaatgacggcatcagcggccccgcgctcagtggttcaagcgg  
tacaacggcaagacccccggagaaggcggggcacagaagaccgaagcgctcaagcccaaggcatggcttgagcagaccgcgagggcatggggcg  
accatgccaaccgggcattagagcgggcAgggcacgacgcccgcattgaccacagaacacttgaggcgagggcatcagcgctgccccggtgttc  
acctggggccgaacgtgtgtggagatggaaggccggggcatccgcaccgaccgggcagacgtggccctgaacatcgacaccgccaacgccagatc  
atcgacttacaggaataccgggaggcaatagacctgaacgaatcgacagagtgaagaatccagaggcatcaacaggttagcggagcagatcg  
aaccgctggcccagagcatggcgacactggccgacgaagcccggcaggtcatgagccagaccCagcaggccagcagggcgagggcgggcggagt  
gctgaaagcccagcgccagacagggcgggcatgggtggagctggcgaagagttgcgggaggtagccgagggtgagcagcgccgcgagagc  
gcccggagcgctcggggggtggcactggaagctatggctaaccgtgatgctggcttccatgatgcctacggtggtgctgctgatcgatcgctgtc  
ttgctcgacctgacgccactgacaaccgaggacggctcgatctggctgcgttgggtggccgatgaagaacgacaggactttgaggccataggccg  
acagctcaaggccatgggctgtgagcgcttcgatatcggcgtcagggacgcCAccaccggccagatgatgaaccgggaatgtcagccgccgaagt  
gctccagaacacgccatggctcaagcggatgaatgccagggaatgacgtgtatatcaggcccgcgagcaggagcggcatggtctggtgctggtg  
gacgacctcagcaggtttgacctggtgacatgaaagccgagggccgggagcctgccctggtagtggaaccagcccgaagaactatcaggcatgg  
gtcaaggtggcgacgccgaggcggtgaacttcgggggcagattgccggacgtggccagcagtagcagcgccgaccggccagcgccgacagc  
cgccactatggcgcttggcgggcttcaccaaccgcaagacaagcacaccaccgcgcccgttatcagccgtgggtgctgctgctgaatccaagg  
gcaagaccgccaccgctggccccgcgctggtgcagcaggtggccagcagatcagcagggccagcggcagcaggagaaggcccgaggtggcc  
agcctgaactgcccagcgagcagcttagccgccaccggcgcacggcgctggacgagtaccgcagcagatggccgggctggtcaagcgcttcggt  
Gatgacctcagcaagtgcgactttatcgccgcgagaagctggccagccggggccgagtgccgaggaaatcggcaaggccatggccgaggccag  
cccagcgctggcagagcgcaagcccggccagaagcggattacatcagcgcaccgtcagcaaggatcatgggtctgccagcgctccagcttgcgcg  
ggccgagctggcacgggcaccggcacccccccagcgagggcatggacagggcgggccagatttcagcatgtagtctgctgtgtactcacgctg  
ttatactatgagtactcacgcacagaagggggttttatggaatacgaaaaaagcgcttcagggtcgggtctacctgatcaaaagtgaagggtattg  
gttcccgggtgcttggttatcgtcaaaacaaggccgaggtggccgcttttcagtcgctgatatggccagccttaacctgacggctgcacctgtcct  
tgttccgcgaagacaagccttccgccccggcaagtttctcggtgactgatgaaagacaaaaggacaagcagaccggcgacctgtggccagcc  
ctgacgctgtacgcaagcgcatatgccgagcgcatgaaggcgaagggtatgctgcagcgaagtcttggtgacggacgacgaatacaggcgc  
tgcgcgagtgctggaagaactcagagcggcgagggcggggtagtgaccccgccagcgctaaccaccaactgctgcaaggaggcaatcaat  
ggctaccataagcctatcaatattctggaggcgttcgcagcagcgccgaccgctggactacgttttcccaacatggtggccgtacggtcgggg  
cgctggtgtgcccgtggtgcccgtaaatccatgctggccctgcaactggccgcacagattgcaggcgggccggatctgctggaggtggcgaaactg  
cccaccggccccgtgatctacctgcccgcaagacccgccaccgcatcaccgcctgcacgccttggggcgacctcagcgccgaggaaac  
ggcaagccgtgggtgacggcctgctgatccagcgctgatcgccagctgcccaacatcatggccccggagtgggttcagcggcctcaagcgcgccgc  
cgaggggccgctgatggtgtgacacgctgcgcgggttcacatcgaggaagaaaacgccagggccccatggccaggtcatcggtcgatg  
gaggccatcgcccgataaccgggtgctctatcgtgttcctgcacatgccagcaaggcgcgccatgatgggcgagggcagaccagcagcagcca  
gccggggcagctcggtactggtcgataacatccgctggcagtcctacctgtcagcatgaccagcgccagggccgaggaatggggtgtggacgacga  
ccagcgccggttctcgtccgcttcggtgtgagcaaggccaactatggcgaccggttcgctgatcggtggttcaggcgccatgacggcggggtgctcaa  
gcccgcgtgctggagaggcagcgcaagagcaagggggtgcccgtggtgaagcctaagaacaagcacagcctcagccagctccggcacgaccg  
gcgactgttggccccggcctgttccgtgccctcaagcggggcgagcgcaagcgagcaagctggacgtgacgtatgactacggcgacggcaagc



ggatcgagttcagcgcccgagccgctggcgctgatgatctgcgcacatctgcaaggctggggccatggctgggcctaattggcctagtgttggc  
ccggaaccaagaccgaaggcggacggcagctccggctgttctggaaccaagtgggaggccgtcaccgctgaTGcCATGgttggtcaaaggta  
gctatcggcgctggcaaaggaaatcggggcagaggtcgatagtgggtggcgctcaagcacatacaggactgcatcgagcgctttggaaggatc  
catcatcgccagaatggccgcaagcggcaggggttcggctgctgtcggagtagccagcgacgaggcggacggcgctgtacgtggccctgaac  
cccttgatcgcgagccgtcatgggtggcgccagcatgtgcgcacagcatggacgaggtgcggcgctggacagcgaaaccgcccgtgtgc  
accagcggctgtgtggctggatcgaccccgcaaaaccggcaaggcttccatagataccttgcggctatgtctggccgtcagaggccagtgttcg  
accatgcgaagcggcgCagcgggtgcgcgagggcgttgcgggagctggcgctggcgctggacggtaaccgagttcgcgcgggcaagtacgac  
atcaccggcccaaggcggcaggtgacccccccactctattgACGG

**pIG124 RNAT7, mCherry2, lacI, KanR, pSC101**

tGAGACCataCATCGcgaagtgaacgtgatttcatgctcatttgaacatttgaatatctttaaataatgtgtgcggcaattcacatttaatt  
ttatgaatgttttctaactcgcggcaactcaagaaacggcaggttcggatcttagctactagagaaagaggagaaatactagatgcgtaaaggcga  
agagctgttactggtgtcgtccctatttctgggaaactggatggatgtatcaacggtcataagtttccgtgctggcgagggtgaaggtagcgaact  
aatggtaactgacgctgaagttcatctgtactactggtaactgccggttccttggccgactctggttaacgacgctgacttatggtgttcagtgtttgc  
tcgttatccggaccatatgaagcagcatgacttctcaagtcgccatgccgaaggctatgtgcaggaacgcacgatttcccttaaggatgacggcac  
gtacaaaacgctgcggaagtgaatttgaaggcgatacctggttaaaccgattgagctgaaaggcattgactttaagaagacggcaatatcctg  
ggcataagctggaatacaattttaaaccgcaaatgtttacatcaccgccgataaacaataaataatggcattaaagcgaattttaaattccgcacaa  
cgtggaggatggcagcgtgcagctggctgatcactaccagcaaaacactccaatcggtgatggtcctgttctgctgagacaaatcactatctgagca  
cgcaaagcgttctgtctaagatccgaacgagaaacgcgatcatatggttctgctggagttcgtaacgcagcgggcatcacgcatggtatggatgaa  
ctgtacaaatgaccaggcatcaataaaacgaaaggctcagtcgaaagactgggcctttcgtttatctgttgttgcggtgaacgctctcCCAAccc  
gtagaaaagatcaaaggatcttcttgatcctttttctgcgcgtaatctgctgcttGAAACAAAAAACACCGCTACCAGCGGTG  
GTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTTCCGAAGGTAAGTGGCTTCAGCAGAGCGCAGATACCAAATA  
CTGTTCTTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACTCTGTAGCACCGCTACATACCTCGCTCTGCTA  
ATCCTGTTACCAGTGGCTGCTGCCAGTGGCGATAAGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTTACCGG  
ATAAGGCGCAGCGTCCGGCTGAACGGGGGGTTCGTGCACACAGCCAGCTTGGAGCGAACGACCTACACCGAA  
CTGAGATACCTACAGCGTGAGCTATGAGAAAGCGCCACGCTTCCCGAAGGGAGAAAGGCGGACAGGTATCCGGT  
AAGCGGCAGGGTCGGAACAGGAGAGCGCACGAGGGAGCTTCCAGGGGGAAACGCCTGGTATCTTTATAGTCTGT  
TCGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCAGGGGGGCGGAGCCTATGGAAaaccg  
agcaacgcggccttttacggttctggccttttctggtccttttctcacatGCGATGataGGTCTCaTACagattatcaaaaaggatcttcacc  
tagatccttttaataaaatgaagttttaaatacaatctaaagtatatatgagtaaacttggctgacagttaccaatgcttaatcagtgaggcaccta  
tctcagcgtatgtctatttctgtcatcctatgttgctgactccccgtgtgtagataactacgatacgggagggcttaccatctggccccagtgtgca  
atgataccgcgggacccagctcaccggctcagatttatcagcaataaacgaccagccggaaggcgagcgcagaagtggctcgtcaactttat  
ccgcctccatccagcttattaattgttgccgggaagctagagtaagtagttcgccagttaatagtttgcgcaacgttgttgccattgctacaggcatctg  
gtgtcacgctcgtcttggatggcttattcagctccggtcccaacgatcaaggcgagttacatgatccccatgttgcaaaaaagcggttagct  
ccttcggctcctccgatcgttgtcagaagtaagttggccgagtggtatcactcatggttatggcagcactgcataattcttactgtcatgccatccgta  
agatgcttttctgtgactggtgagtactcaaccaagtcattctgagaatagtgtatgcggcgaccgagttgctcttggccgctcaatacgggataata  
ccgcgccacatagcagaactttaaagtgtcatcattggaacgttcttcggggcgaaaactctcaaggatcttaccgctgttgagatccagttcga  
tgaaccactcgtgcaccaactgatcttcagcatctttactttcaccagcgttctgggtgagcaaaaacaggaaggcaaaatgccgcaaaaaag  
ggaataaggcgacacggaaatgtgaatactcatacttctcttttcaatattatgaagcatttatcagggttattgtctcatgagcggatacatatt  
tgaatgtatttagaaaaataaataaataagggttccgcgcacatttcccgaaaagtgccacctgGAGTggtgcctaagtgtgagtaactTacat  
taattgcgttcgctcactgccgcttccagtcgggaaacctgtcgtgccagctgcattaatgaatcggccaacgcgcggggagaggcggttgcgta  
ttgggcgcagggtgtgttttcttttaccagtgAacgggcaacagctgattgcccttcaccgcctggccctgagagagttgcagcaacggtccacg  
ctggttggcccagcaggcgaaaatcctgtttagtggtggttaacggcgggatataacatgagctgtcttcggtatcgtcgatccactaccgagatGt  
ccgcaccaacgcgcagccggactcggtaatggcgcgattgcgccacgcctatctgatcgttggaaccagcatcgagtggaacgatgcctc  
attcagcatttgatggtttgtgaaaaccggacatggcactccagtcgccttccggttccgctatcggtgaatttgattgcagtgagatatttatgcc



agccagccagacgcagacgcgcccagacagaacttaatgggcccgtaacagcgcgatttgcgtgtagccaatgcgaccagatgctccacgcca  
gtcgcgtaccgtcttcatgggagaaaataactgttgatgggtgtctggtcagagacatcaagaaataacgccggaacattagtgcaggcagcttc  
acagcaatggcatcctggatccagcggatagttaatgatcagccactgacgcgttgccgagaagattgtgcacccgctttacaggcttcgac  
gccgtctcgttctaccatcgacaccaccacgctggcaccagttgatcggcgcgagatttaacgccgcgacaatttgcgacggcgcgtgcagggcca  
gactggaggtggcaacgccaatcagcaacgactgtttcccgccagttgttgccacgcggttggaatgtaattcagctccgcatcgccgttcca  
cttttcccgcttttcgagaaacgtggctggctgttaccacgcgggaaacggctgataagagacaccggcactactcgacatcgataacg  
ttactggttccacattaccaccctgaattgactcttccgggcgtatcatgccataccgcgaaaggttttgcgccattcgatggtgtccgggatctcg  
acgtctctcccttatgcgactctgcattaggaaCAAagaaatcatccttagcgaaagctaaggattttttatctgaattaattctcgcgaggcg  
cccatgaggcatgttccgctccttgcaatactgtgtttacatacagctatcgcttagcggaaagtctttaccctcagccgaaatgcctgccgttgc  
tagacattgccagccagtgccgtcactccgtactaactgtacgaacccctgcaataactgtcacgccccctgcaataactgtcacgaacccctgc  
aataactgtcacgccccaaactgcaaaccagcagggcgggggtggcggggtgttgaaaaatccatccatgattatctaagaataatccact  
aggcgcggttatcagcgccttgtggggcgctgctgcccttgccaatatgccggccagaggccggatagctggtctattcgtcgcgtaggctacac  
accgccccaccgtcgcgagggggaaggcgggcaagcccgctaaacccacaccaaaccgcgagaatacgtggagcgcttttagccgc  
tttagcggcctttccctaccgaagggtggggcgcggtgtgcagcccgagggcctgtctcggtcgatcattcagccggctcatcttctggcggtg  
gcggcagaccgaacaaggcgcggtctggtcgcgttcaaggtagcatccattgccgcatgagccgatcctccggccactcgtgctgttcaccttg  
ccaaaatcatggccccaccagcaccttgcgccttgttcttgcgtcttgcgtgttcccttgccgcAcccgctgaatttcggcattgattcgcg  
ctcgttgttctcgagcttgccagccgatccgcccttgttgccttaaccatcttgacacccattgttaattgtgtgtctcgtaggctatcatgg  
aggcacagcggggcaatcccgacctacttttaggggagggcgacttaccggttcttctcgagaaactggcctaaccggccaccttcggcggt  
gcgctctcgaggggcattgcatggagccgaaaagcaaaagcaacagcagggcagcatggcgatttatcaccttaccggcgaacaccggcagcaggt  
cggggcggaatcgccagggccaaggccgactTcatccagcgcgaaggcaagtatcccgcgacatggatgaagtcttgacgccgaatccgggc  
acatgccggagttcgtcgagcggcccgactactgggatgtgccgacctgtatgaacgcgccaatgggcggctgttaaggaggtcgaattgcc  
ctgccggtcgagctgacctcgaccagcagaaggcgctggcgctccgagttcgccagcacctgaccggtccgagcgctcgctatacgtggccat  
ccatgccggtggcgcgagaaccgcactgccacctgatgatctccgagcggatcaatgacggcatcgagcggcccgctcagtggttcaagcgg  
tacaacggcaagaccccgagaaaggcggggcacagaagaccgaagcgctcaagccaaggcatggcttgagcagacccgagggcatggggcg  
accatccaacggggcattagagcgggcAgggcacgacggcgattgaccacagaacacttgaggcgagggcatcgagcgctgcccgtgttc  
acctggggccgaacgtggtggagatggaaggccggggcatccgcaccgaccgggcagacgtggccctgaacatcgacaccgccaacgccagatc  
atcgacttacaggaataaccgggaggcaatagaccatgaacgaatcgacagagtgaagaaatccagaggcatcaacgagttagcggagcagatcg  
aaccgctggcccagagcatggcgacactggccgacgaagcccgaggtcatgagccagaccCagcaggccagcagggcgagggcgggagtg  
gctgaaagcccagcgccagacagggcgggcatgggtggagctggccaaagattgcccggaggtagcccgaggtgagcagcgccgcgagagc  
gcccggagcgctcggggggtggcactggaagctatggctaaccgtgatgctggcttccatgatgctacggtggtgctgctgatcgatcgttgc  
ttgctcgacctgacgccactgacaaccgaggacggctcgatctggctgcgttgggtggccgatgaagaacgacaggacttgcaggccataggccg  
acagctcaaggccatgggctgtgagcgcttcgatatcggcgtcagggacgcCAccaccggccagatgatgaaccgggaatggtcagccgccaagt  
gtccagaacacgccatggctcaagcggatgaatgccaggggcaatgacgtgtatatcaggcccgagcaggagcggcatggtctggtgctggtg  
gacgacctcagcgagtttgacctggtgacatgaaagccgagggcggggagcctgccctggtagtgaaaccagcccgaagaactatcaggcatgg  
gtcaaggtggcgacgccgagggcggtgaacttcgggggcagattgccggacgttgccagcgagtacgacgccgaccggccagcgccgacagc  
cgccactatggccgttggcgggcttcaccaaccgaaggacaagcacaccaccgcgcccgttatcagccgtgggtgctgctgctgaatcaagg  
gcaagaccgcccaccgctggcccggcgctggtgcagcaggctggccagcagatcgagcaggccagcggcagcaggagaaggcccagcgctggcc  
agcctcgaactgccgagcggcagcttagccgccaccggcgacggcgctggacgagtaccgcagcgagatggccgggctggtcaagcgcttcggt  
Gatgacctcagcaagtgcgactttatcgccgcgagaagctggccagccggggccgagtgccgaggaaatcggaaggccatggccgaggccag  
cccagcgctggcagagcgcaagcccggccacgaagcggattacatcgagcgcaccgtcagcaaggtcatgggtctgccagcgctccagcttgcgcg  
ggccgagctggcagggcaccggcaccggccagcgaggcatggacagggcgggccagatttcagcatgtagtgcttgcgttggtactcacgcctg  
ttatactatgagtactcacgcacagaagggggtttatggaatacgaaaaaagcgcttcagggtcggtctacctgatcaaaagtgaagggtattg  
gttggccggtggcttgggtatctgaaacaaggccgaggtggcgcttctcagtcgctgatatggccagccttaacctgacggctgcacctgtcct  
tgttccggaagacaagccttccggccccggcaagtttctcggtgactgatgaaagacaaaaggacaagcagaccggcgacctgtggccagcc



ctgacgctgtacgccaagcgcatatgccgagcgcatgaaggccaaagggatgctgcagcgcaagttctggctgaccgacgacgaatacagggcgc  
tgcgcgagtgcttgaagaactcagagcggcgagggcggggtagtgaccccgccagcgctaaccaccaactgctgcaaaggaggcaatcaat  
ggctaccataagcctatcaatattctggagggcttcgagcagcgccgaccgctggactacgttttcccaacatggtgccggtaggctgggg  
cgctgggtgctgcccgggtggcgccgtaaatccatgctggccctgcaactggccgcacagattgaggcgggcgggatctgctggaggtggcgaaactg  
cccaccggcccggtagctacctgccgccaagacccgccaccgcatcaccgctgcagcccttggggcgacctcagcgccgaggaac  
ggcaagcctgggtgacggcctgctgatccagcggctgatcggcagcctgcccaacatcatggcccggagtggttcgacggcctcaagcgcgccgc  
cgagggccgcccgtgatggtgctggacacgctgcgcgggtccacatcgaggaagaaaacgccagcgcccatggcccaggtcatcggtcgc  
gagggccatcgcccgataccgggtgctctatcgtgttcctgcacatgccagcaagggcgccgcatgatgggcgagggcgaccagcagcgagcca  
gcccggggcagctcggtactggtcgataacatccgctggcagtcctacctgctgagcatgaccagcgccgagggcgaggaatgggggtggagcagca  
ccagcgccgggttcttgcgtccgttcggtgtgagcaaggccaactatggcgaccggttcgctgatcggtggttcaggcgccatgacggcggggtgctcaa  
gcccgcgtgctggagaggcagcgcaagagcaaggggggtccccgtggtgaagcctaagaacaagcacagcctcagccacgtccggcacgaccg  
gcgcactgtctggccccggcctgttccgtgccctcaagcggggcgagcgcaagcgagcaagctggacgtgacgtatgactacggcgacggcaagc  
ggatcgagttcagcgcccgagccgctggcgctgatgatctgcgcacatcctgcaagggtggtggccatggctgggcctaattggcctagtctggc  
ccggaaccaagaccgaaggcgagcggcagctccggctgttccctggaaccaagtgggaggccgtcaccgctgaTGCCATGgtggtcaaaggta  
gctatcgggcgctggcaaaggaaatcggggcagaggtcgatagtggtggggcgctcaagcacatacaggactgcatcgagcgctttggaaggtatc  
catcatcgcccagaatggccgcaagcggcaggggttccggtgctgtcggagtacgccagcgacgagggcgagggcgccgtgtacgtggccctgaac  
cccttgatcgcgagggcgtcatgggtggcgccagcatgtgcgcacagcatggacgaggtgcggcgctggacagcgaaaccgcccgcctgctgc  
accagcggtgtgtggctggatgacccccgcaaaaccggcaaggcttccatagataccttgtgcggctatgtctggccgtcagaggccagtgttcg  
accatgcgcaagcggcgCagcggggtgcgagggcgttgcggagctggtgcgctgggctggacggtaaccgagttcgcgggcgggcaagtacgac  
atcaccggcccaaggcggcaggtgacccccccactctattgACGG

**pSPB872 ~(*gfp*-pUC) KanR *lacI* p15A (1-6r.0))**

tGAGACCataCATCGgaaagtgaacgtgatttcatgctcattttgaacattttgtaaatcttatttaataatgtgtgcggaattcacattta  
ttatgaatgttttctaactcgcggcaactcaagaaacggcaggttcggatcttagctactagagaaaggagaaatactagatgcgtaaaggcga  
agagctgttactggtgtcgtccctatttctggtggaactggatggtgatgtcaacggtcataagtttccgtgctggcgaggggtgaaggtagcgaact  
aatggtaaactgacgctgaagttcatctgtactactggtaaactgccggttccttggccgactctggttaacgacgctgacttatggtgttcagtgctttgc  
tcgttatccggaccatatgaagcagcatgacttctcaagtcgccatgccggaaggctatgtgcaggaacgcacgatttcccttaaggatgacggcac  
gtacaaaacgcgtgcggaagtgaatttgaaggcgataccctggttaaaccgattgagctgaaaggcattgactttaagaagacggcaatatcctg  
ggccataagctggaatacaattttaacagccacaatgtttacatcaccgccgataaacaataaaggcattaaagcgaattttaaaattccgcacaa  
cgtggaggatggcagcgtgacgctggctgatcactaccagcaaaacactccaatcggtgatggtcctgttctgctgccagacaaatcactatctgagca  
cgcaaagcgttctgtctaagatccgaacgagaaacgcgatcatatggttctgctggagttcgttaaccgcagcgggcatcacgcatggtatggtgaa  
ctgtacaaatgaccaggcatcaataaaacgaaaggctcagtcgaaagactgggcctttcgttttatctgttgttgcgtgaacgctctcCCAAccc  
gtagaaaagatcaaaggatcttctgagatcctttttctgcgcgtaatctgctgcttGCAACAAAAAACACCGCTACACGCGGTG  
GTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTTCCGAAGGTAAGTGGCTTCAGCAGAGCGCAGATACCAAATA  
CTGTTCTTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACTCTGTAGCACCGCTACATACCTCGCTCTGCTA  
ATCCTGTTACCAAGTGGCTGCTGCCAGTGGCGATAAGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTTACCGG  
ATAAGGCGCAGCGGTGCGGCTGAACGGGGGGTTCGTGCACACAGCCAGCTTGAGCGAACGACCTACACCGAA  
CTGAGATACCTACAGCGTGAGCTATGAGAAAGCGCCACGCTTCCGAAGGGAGAAAGGCGGACAGGTATCCGGT  
AAGCGGCAGGGTCGGAACAGGAGAGCGCACGAGGGAGCTTCCAGGGGGAACGCCTGGTATCTTTATAGTCCTG  
TCGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCAGGGGGGCGGAGCCTATGGAAAaacgcc  
agcaacgggcctttttacggttctggccttttctggtccttttctcacatGCGATGataGGTCTCaTACAgttacaaccaattaaccaattc  
tgattagaaaaactcatcgagcatcaaatgaaactgaatttattcatatcaggattatcaataccatattttgaaaaagcgtttctgtaataagga  
gaaaactcaccgaggcagttccataggatggcaagatcctggtatcggtctgcgattccgactcgtccaacatcaataaacctattaattccctcgt  
caaaaataagggttatcaagtgagaaatcaccatgagtgacgactgaatccggtgagaatggcaaaaagcctatgcatttcttccagacttgttcaaca  
ggccagccattacgctcgtcatcaaaatcactcgcatcaacaaaccgttattcattcgtgattgcgctgagcgaggcgaaatacgcgatcgctgta



aaaggacaattacaaacaggaatcgaatgcaaccggcgaggaacactgccagcgcacatcaacaatattttcacctgaatcaggatattcttctaata  
cctggaatgctgttttccggggatcgagtggtgagtaacatgcatcatcaggagtagcgataaaatgcttgatggcgaagaggcataaattcc  
gtcagccagtttagtctgacctctcatctgtaacatcattggcaacgctacctttgcatgttcagaaacaactctggcgcacgggcttcccatataa  
tcgatagattgtcgacactgattgcccagacattatcgcgagccatttatacccatataaatcagcatccatgttggaattaatcgcggcctggagcaa  
gacgtttccggtgaatatggctcataacaccccttgattactgtttatgtaagcagacagttttattgttcatgatgatataattttatcttgcaatgta  
acatcagagattttgagacacaacgtggccttgtgaataaatcgaacttttctgagttgaaggatcagGAGTggcctaatagtagtgactaactT  
acattaattgctgtgcgctcactgcccgtttccagtcgggaaacctgtcgtgccagctgcattaatgaatcgcccaacgcgcggggagaggcggttg  
cgtattggcgccagggtggttttttccaccagtgaAacgggcaacagctgattgcccttcaccgctggccctgagagagtgcagcaagcggtc  
cacgctggtttgcccagcaggcgaaaaatcctgtttgatggtggttaacggcgggatataacatgagctgtcttcggtatcgtcgtatcccactaccgag  
atGtccgcaccaacgcgcagcccggactcggtaatggcgcgattgcgccagcgccatctgatcgttggcaaccagcatcgagtggaacgatgc  
cctcattcagcatttgcaggtttgtgaaaaaccggacatggcactccagtcgccttcccgttccgctatcggctgaatttgattgcgagtgatatttat  
gccagccagccagacgcagacgcgcggagacagaacttaattgggcccgttaacagcgcgatttgctggtgacccaatgcaccagatgtccacgc  
ccagtcgctgacgtcttcatgggagaaaaataactgttgatgggtgtctggtcagagacatcaagaaataacgccggaacatttagtcaggcagct  
tccacagcaatggcatcctggtcatccagcggatagttaatgatcagccactgacgcgttgccgagaagattgtgacccgccgtttacaggcttcg  
acgccgttctgttaccatcgacaccaccagctggcaccagttgatcggcgagatattaatcgccgcgacaatttgcgacggcgctgcagggc  
cagactggaggtggcaacgccaatcagcaacgactgtttcccgcagttgttggccacgcggttgggaatgtaattcagctccgccatcgccgttc  
cactttttcccgcttttcgagaaacgtggctggcctggttcaccacgcgggaaacggtctgataagagacaccggcatactctgcgacatcgataa  
cgttactggtttacattcaccacctgaattgactcttccggcgctatcatgccataccgcgaaaggttttgcgccattcgatggtgtccgggatct  
cgacgctctcccttatgcgactctgcattaggaaCAAtagcggagtgtatactggcttactatgttggcactgatgagggtgtcagtgaagtgttc  
atgtggcaggagaaaaaaggctgcaccggtcgtcagcagaatatgtgatacaggatatattccgcttctcgtcactgactcgtacgctcggtcgt  
tcgactgcggcgagcggaatggcttacgaacggggcgagatttctggaagatgccaggaagatacttaacagggaagtgcagggcgccggc  
aaagccgttttccataggtcgcggccctgacaagcatcacgaaatctgacgctcaaatcagtggtggcgaacccgacaggactataaagatacc  
aggcgtttcccctggcggtccctcgtgcgctcctgttctgccttccggtttaccggtgtcattccgctgttatggccgctttgtctattccacgcct  
gacactcagttccgggtaggcagttcgtccaagctggactgtatgcacgaacccccgttcagtcggaccgctgcgccttatccgtaactatcgtctt  
gagtccaacccggaagacatgcaaaagcaccactggcagcagccactggtaattgatttagaggagttagtctgaagtcatgcgggttaaggc  
taaactgaaaggacaagtttggtagctgcgctcctcaagccagttacctcggttcaaagagttggtagctcagagaacctcgaaaaaccgcctg  
caaggcggtttttcgttttcagagcaagagattacgcgcagacaaaacgatcctaagaagatcatcttattaaACGG

#### **pSPB873 ~(gfp-pUC) KanR lacI pSC101**

tGAGACCataCATCGgaaagtgaacgtgatttcatgcgtcattttgaacattttgtaaatcttatttaataatgtgtgcggcaattcacatttaatt  
ttatgaatgttttctaacatcgcggaactcaagaaacggcaggttcggatcttagctactagagaaagaggagaaatactagatgcgtaaaggcga  
agagctgttactggtgtcgtccctattctggtggaactggatggtgatgtaacggtcataagtttccgtgcgtggcgagggtgaaggtagcgaact  
aatggtaactgacgctgaagttcatctgtactactggttaaactgccggttccttggccgactctggttaacgacgctgacttatggtgttcagtgtttgc  
tcgttatccggaccatatgaagcagcatgacttctcaagtccgcatgccggaaggctatgtgcaggaacgcacgatttctttaaggatgacggcac  
gtacaaaacgcgtgcggaagtgaatttgaaggcgataccctggttaaaccgattgagctgaaaggcattgactttaagaagacggcaatatcctg  
ggccataagctggaatacaattttaacagccacaatgtttacatcaccgccgataaacaataaataatggcattaaagcgaatttttaaaatccgcacaa  
cgtggaggatggcagcgtgcagctggctgatcactaccagcaaaacactccaatcggtgatggtcctgttctgctgccagacaatcactatctgagca  
cgaaaagcgttctgtctaagatccgaacgagaaacgcgatcatatggttctgctggagttcgaaccgcagcgggcatcacgcatggtatggatgaa  
ctgtacaaatgaccaggcatcaataaaacgaaaggctcagtcgaaagactgggcctttcgttttatctgttgttgcggtgaacgctctcCAAAcc  
gtagaaaagatcaaaagatcttcttgatcctttttctgcgcgtaatctgctgcttGAAACAAAAAACACCGCTACCAGCGGTG  
GTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTTTCCGAAGGTAAGTGGCTTCAGCAGAGCGCAGATACCAAATA  
CTGTTCTTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACTCTGTAGCACCGCTACATACCTCGCTCTGCTA  
ATCCTGTTACCAAGTGGCTGCTGCCAGTGGCGATAAGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTTACCGG  
ATAAGGCGCAGCGTCTGGGCTGAACGGGGGGTTCGTGCACACAGCCCAGCTTGAGCGAACGACCTACACCGAA  
CTGAGATACCTACAGCGTGAGCTATGAGAAAGCGCCACGCTTCCGAAGGGAGAAAGGCGGACAGGTATCCGGT



AAGCGGCAGGGTCGGAACAGGAGAGCGCACGAGGGAGCTTCAGGGGGAAACGCCTGGTATCTTTATAGTCCTG  
TCGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCAGGGGGGCGGAGCCTATGGAAaaccg  
agcaacgcgcccttttacggctcctggccttttgctggccttttgctcacatGCGATGataGGTCTCaTACgtgttacaaccaattaaccaattc  
tgattagaaaaactcatcgagcatcaaatgaaactgcaatttattcatatcaggattatcaataccatattttgaaaaagccgtttctgtaatgaagga  
gaaaactcaccgaggcagttccataggatggcaagatcctggatcggtctgcatccgactcgtccaacatcaatacaacctattaatttccctcgt  
caaaaataaggttatcaagtgagaaatcaccatgagtgcgactgaatccggtgagaatggcaaaagccttatgcatttcttccagacttgttcaaca  
ggccagccattacgctcgtcatcaaaatcactcgcatacaaaaaccgttattcattcgtgattgctgagcaggcgaaatacgcgatcgtgtta  
aaaggacaattacaacaggaatcgaatgcaaccggcgaggaacactgccagcgcatacaaatatttcacctgaatcaggatattcttctaata  
cctggaatgctgttttccggggatcgcagtggtgagtaacatgcatcatcaggagtagcgataaaatgcttgatggcggaagaggcataaattcc  
gtcagccagtttagtctgacctctcatctgtaacatcattggcaacgctaccttggcatgttcagaaacaactctggcgcatcgggcttccatacaa  
tcgatagattgtcgcacctgattgcccagacattatcgcgagccattataacatataaatcagcatccatgttggaattaatcggcgctggagcaa  
gacgtttccggtgaatatggctcataacacccttgattactgttatgtaagcagacagtttattgttcatgatgatataattttatcttgtgcaatgta  
acatcagagattttgagacacaacgtggcttgtgaataaatcgaacttttgctgagttgaaggatcagGAGTggtgctaatgagtgaactaactT  
acattaattgctgtgcgctcactgcccgtttccagtcgggaaacctgtcgtgccagctgcattaatgaatcgccaaacgcgcggggagaggcggtttg  
cgtattggcgccagggtggttttttccaccagtgaAacgggcaacagctgattgcccttaccgcctggccctgagagagttgcagcaagcggtc  
cacgctggtttgcccagcaggcgaaaaatcctgtttgatggtggttaacggcgggatataacatgagctgtcttcggtatcgtcgtatcccactaccgag  
atGtccgcaccaacgcgcagcccgactcggaatggcgcgcatgtgcgccagcgccatctgatcgttggaaccagcatcgagtggaacgatgc  
cctcattcagcatttgcatggtttgtgaaaacgggacatggcactccagtcgccttcccgttccgctatcggctgaatttgattgcgagtgaatattat  
gccagccagccagacgcagacgcgcggagacagaacttaatgggcccgttaacagcgcgatttgctggtgacccaatgcgaccagatgtccacgc  
ccagtcgctgaccgttctatgggagaaaaataactgttgatgggtgctggtcagagacatcaagaaataacccggaacattagtgcaggcagct  
tccacagcaatggcatcctggtcatccagcggatagttaatgatcagccactgacgcttgcgcgagaagattgtgacccgccgtttacaggcttcg  
acgccgttctgttaccatcgacaccaccagctggcaccagttgatcggcgagatattaatcgccgcgacaatttgcgacggcgcggtgcagggc  
cagactggaggtggaacgccaatcagcaacgactgtttgcccgagttgtgtgccacgcggttgggaatgtaattcagctccgccatcgccgttc  
cactttttcccgcttttgcagaaacgtggctggcctggttcaccacgcgggaaacggtctgataagagacaccggcatactctgcgacatcgataa  
cgttactggtttcacattcaccacctgaattgactcttccggcgctatcatccataccgcgaaaggttttgcgccattcgatggtgtccgggatct  
cgacgctctcccttatgcgactcctgcattaggaaCAAgttacattgtcgatctgttcatggtgaacagcttgaatacacaaaaactcgtaaaagc  
tctgatgtatctatctttttacaccgttttcatctgtgcataatggacagttttcccttgatagtaacggtgaacagttgttctacttttgtttagtcttg  
atgcttcactgatagatacaagagccataagaacctcagatccttccgtatttagccagtagtcttctagtggttctgtttttgcgtgagccatga  
gaacgaaccattgagatcatacttactttgcatgtcactcaaaaatttgcctcaaaaactggtgagctgaattttgcagttaaagcatcgtgtagtgtt  
ttcttagtccgttatgtaggtaggaatctgatgtaatggtgttggatatttgcaccattcattttatctggttgttctcaagttcggttacgagatccatt  
gtctatctagttcaacttgaaaaataacgtatcagtcggcgccctcgcttatcaaccaccaatttcatattgctgtaagtgtttaaacttttactattg  
gtttcaaaaccattggttaagccttttaactcatggtagttattttcaagcattaacatgaactaaattcatcaaggctaattcttatattgacctgtg  
agttttctttgtgttagttcttttaataaccactcataaatcctcatagagtatttgtttcaaaagacttaacatgttccagattatattttatgaattttt  
taactggaaaagataaggcaatatcttctactaaaaactaattctaatttttgccttgagaacttgcatagtttgtccactggaaaatctcaaagcct  
ttaaccaaaggatttctgatttccacagttctcgtcatcagctctcgtgtttagctaatacaccataagcattttccctactgatgttcatcatctgag  
cgtattggttataagtgaacgataccgtccgttcttctttaggggtttcaatcgtgggggtgagtagtgccacacagcataaaattagcttggttcat  
gtccgttaagtcatagcgactaatcgtagttcatttgccttgaaaacaactaattcagacatacatctcaattggtctaggtgattttaaactatac  
caattgagatgggctagtcattgataattactagtccttttcccttgagttgtgggtatctgtaaatctgctagaccttgcgtgaaaacttgtaaatct  
gctagacctctgtaaatccgctagaccttgtgtgtttttttgtttatattcaagtgggtataatttatagaataaagaaagaataaaaaaagataaa  
aagaatagatcccagccctgtgtataactactacttttagtcagttccgcagattacaaaaggatgtcgaaacgctgtttgctcctctacaaaacag  
acctaaaaccctaaaggcttaagtagcacctcgcaagctcgggcaaactcgtgaatattcctttgtctccgacctcaggcacctgagtcgctgtct  
tttctgtgacattcagttcgtcgcctcacggctcggcagtgatgggggtaaatggcactacaggcgcttttatggattcatgcaaggaaactacc  
ataatacaagaaaagcccgtcacgggcttctcagggcgttttatggcggtctgctatgtgtgctatctgacttttgcgttcagcagttcctgcctct



gattttccagtctgGccacttcggattatcccgtgacaggtcattcagactggctaatgcacccagtaaggcagcggtatcatcaacaggcttaccggt  
cttactgtcACGG

**pSPB875 PL.lacO1-B0034-mCherry2-tVoigtN1 KanR-lacI-p15A (casS2.1)**

ACGGAaaaaaaaaaccccgcccctgacagggcgggggttttttccaattattgaaggccgctaacgcgccttttttgttctggtctgccttaataca  
tgactaagaattcgccggccgttctagagCGTCTCaCTTCggatccgctgcaggCTTcaattgtgagcggataacaattgacattgtgagcggat  
aacaagatactgagcacaCGACctagtgaagaggagaaatactaAATGgtgagtaaaggagaagaaaacaacttagctatcattaagagtt  
catgcgcttcaaagttcacatggagggttctgttaacggtcacgagttcgagatcgaaggcgaaggcgaggccgtccgtatgaaggcaccagacc  
gccaaactgaaagtgactaaaggcgcccgtgccttttgcgtgggacatcctgagcccgcaatttatgtacggttctaaagcgtatgttaaaccacca  
gcggatatcccgactatctgaagctgtctttccggaaggtttcaactgggaacgcgtaataatttgaagatgggtggtcgtgaccgtcactcagg  
actcctccctTCaggatggcgagttcatctataaagttaaactgcgtgggtactaattttcatctgatggcccggtgatgcagtgtaggacgatgggttg  
ggaggcgtctaccgaacgcatgtatccggaagatgggtgcgtgaaaggcgaaattaaacagcgcctgaaactgaaagatggcgccattatgacgc  
tgaagtgaaccacgtacaagccaagaaacctgtgcagctgcctggcgctacaatgtggatattaaactggacatcttatctcataatgaagatt  
atacgcgtgtagcaatatgagcgcgcggagggtcgtcattctaccggtggcatggatgaactatacaataaTGGCttcagccaaaaacttaa  
gaccgccggtcttctccactaccttgagtaatgcggtggacaggatcgcggttttcttctctctcaaGCTGCGTTtGAGACGtactagtagc  
ggcgtgcagttaatcactgattaactcggtagcaaaatccagaaaagaggcctcccgaaagggggcctttttcgttttggctcttttgttatcaata  
aaaaaggggagcgggttcccgctccccttattgttcgtCTACgtgttacaaccaattaaccaattctgattagaaaaactcatcgagcatcaaatga  
aactgcaatttattcatatcaggattatcaataccatattttgaaaaagccgtttctgtaataaggagaaaaactcaccgaggcagttccataggatg  
gcaagatcctggtatcggctgcgattccgactcgtccaacatcaatacaacctattaatttcccctcgtcaaaaataaggttatcaagtgagaaatca  
ccatgagtgcgactgaatccggtgagaatggcaaaagcttatgcatttcttccagacttgttcaacaggccagccattacgctcgtcatcaaatca  
ctcgcatacaaaaacggttattcattcgtgattgcgcctgagcgaggcgaaatacgcgatcgtgttaaaaggacaattacaacagggaatcgaatg  
caaccggcgaggaacactgccagcgcatcaacaatatttccctgaatcaggatattcttctaatacctggaatgctgttttccggggatcgagc  
ggtgagtaacatgcacatcaggagtaggataaaatgcttgatggctgggaaggcgataaattccgtcagccagtttagtctgacctctcatctgt  
aacatcattggcaacgctacctttgccatgttccagaacaactctggcgcatcgggcttccatacaatcgatagattgtcgacactgattgccgaca  
ttatcgagcccatttatacccatataaatcagcatccatgttgaatttaacgcggcctggagcaagacgtttccggtgaatatggctcataacac  
ccctgtattactgtttatgtaagcagacagttttattgttcatgatgatatttttatcttgtgcaatgtaacatcagagattttgagacacaacgtggct  
ttgtgaaataatcgaaacttttgcgtgagttgaaggatcagGAGTggtgcctaatagtgagtaactTacttaattgcgttcgctcactgccgctt  
tccagtcgggaaacctgtcgtgccagctgcattaatgaatcgccaacgcgcggggagaggcggtttgctattggcgccagggtggttttcttttc  
accagtgaAacgggcaacagctgattgcccttaccgcctggccctgagagagttgcagcaagcgggtccacgctggtttgcccagcaggcgaaaat  
cctgtttgatggtggttaacggcgggatataacatgagctgtcttcggatcgtcgtatcccactaccgagatGtccgcaccaacgcgcagcccggact  
cggtaatggcgcgattgcgcccagcgccatctgatcgttggcaaccagcatcgcagtgggaacgatgccctcattcagcatttgatggtttgtgaa  
aaccggacatggcactccagtcgcttccggttcgctatcggtgaatttgattgcgagtgagatattatgccagccagccagacgcagacgcgcg  
agacagaacttaatgggcccgttaacagcgcgatttgcgtgtgaccaatgcgaccagatgtccacgcccagtcgctaccgtcttcatgggagaaa  
ataatactgttgatgggtgtcgtgagacatcaagaaataacccggaacattagtgcaggcagcttccacagcaatggcatcctggtcatccag  
cggatagttaatgatcagccactgcgcgttgcgcgagaagattgtgcaccgcccgtttacaggcttcgacgcccgttcttctacatcgacaccac  
cacgctggcaccagttgatcggcgagatttaacgcccgcgacaatttgcgacggcgctgcagggccagactggaggtggcaacgcaatcagc  
aacgactgtttgcccgcagttgttgcacgcggttgggaatgtaattcagctccgcatcgcgcttccacttttcccggttttcgcagaaacgtg  
gctggcctggttaccacgcgggaaacggtctgataagagacaccggcatactctgcacatcgtataacgttactggtttcacattcaccacctgaa  
ttgactcttccggcgctatcatgccataaccgcgaaaggttttgcgcattcgatgggttcgggatctcgacgctccttctatgcgactctgcatta  
ggaaCCAAtagcggagtgatactggcttactatgttggcactgatgagggtgcagtgaagtgttcattgtggcaggagaaaaagggtgcaccgg  
tgcgtcagcagaatatgtgatacaggatataatccgcttctcgtcactgactcgtacgctcggtcgttcgactcgggcgagcggaatggcttacg  
aacggggcgagatttctggaagatgccaggaagataacttaacagggaagtgcagggcgcggaagccgtttttcataggctccgccccct  
gacaagcatcacgaaatctgacgctcaaatcagtggtggcgaaacccgacaggactataaagataccaggcgtttcccctggcggtccctcgtgc  
gctctcgttctcgttccgtttaccggtgtcattccgctgttatggccggtttgtctcattccacgctgacactcagttccgggtaggcagttcgt  
ccaagctggactgtatgcacgaacccccgttcagtcggaccgctgcgccttatccggtaatatcgtcttgagtccaacccggaagacatgcaaaa



gcaccactggcagcagccactggaattgatttagaggagttagcttgaagtcagcgccggtaaggctaaactgaaaggacaagtttggtagct  
gcgctcctcaagccagttacctcggttcaaagagttggtagctcagagaacctcgaaaaaccgacctgaaggcgggttttctgtttcagagcaag  
agattacgcgcagacaaaacgatctcaagaagatcatcttattaa

**pSPB877 P.llacO1-B0034-mCherry2-tVoigtN1 KanR-lacI-pSC101 (casS2.1)**

ACGGAaaaaaaaaaccccgcccctgacagggcgggggttttttccaattattgaaggccgctaacgggccttttttctgtctgccttaatcaa  
tgactaagaattcgcgccgcttctagagCGTCTCaCTTCggatccgctgcaggCTTcaattgtgagcggataacaattgacattgtgagcggat  
aacaagatactgagcacaCGACctagtgaagaggagaaatactaAATGgtgagtaaaggagaagaaaacaacttagctatcattaaagagtt  
catgcgcttcaaagttcacatggagggttctgttaacgggtcacgagttcgagatcgaaggcgaaggcaggggccgtccgtatgaaggcaccagacc  
gcaaactgaaagtactaaaggcgcccgctgcttttgcgtgggacatcctgagcccgcaatttatgtacggttctaaagcgtatgttaaaccacca  
gcggatatcccgactatctgaagctgtctttccggaaggtttcaactgggaacgcgtaataatgaatttgaagatggtggtgctgtagccgtcactcagg  
actcctccctTcaggatggcgagttcatctataaagttaaactgcgtggtactaattttccatctgtagggccggtgatgcagtgtaggacgatgggttg  
ggaggcgtctaccgaacgatgatccggaagatggtgcgtgaaaggcgaaattaaacagcgctgaaactgaaagatggcgccattatgacgc  
tgaagtgaaaaccagctacaaagccaagaaacctgtgcagctgcctggcgctacaatgtggatattaaactggacatcttatctcataatgaagatt  
atacgatcgtagagcaatatgagcgcgagggtcgctattctaccggtggcatggatgaactatacaataaTGGCttcagccaaaaaacttaa  
gaccgccggtcttgtccactaccttgcaataatgcggtggacaggatcgcggttttctttctctctcaaGCTGCGTTTgAGACGtactagtagc  
ggcgtgctgagttaatcactgattaactcggtaccaaattccagaaaagaggcctcccgaagggggcctttttctgtttggtcctttgttatcaata  
aaaaaggggagcggtttccgctccccttattgttcgtTACAggttacaaccaattaaccaattctgattagaaaaactcatcgagcatcaaatga  
aactgcaatttattcatatcaggattatcaataccatattttgaaaaagccgtttctgtaataaggagaaaaactcaccgaggcagttccataggatg  
gcaagatcctggtatcggtctgcgattccgactcgtccaacatcaatacaacctattaatttcccctcgtcaaaaaataaggttatcaagtgagaaatca  
ccatgagtgcgactgaatccggtgagaatggcaaaagcttatgcatttcttccagacttgttcaacaggccagccattacgctcgtcatcaaaatca  
ctcgcatacaaaaaccgttattcattcgtgattgcgctgagcgaggcgaaatacgcgatcgtgttaaaaggacaattacaacaggaatcgaatg  
caaccggcgaggaacactgccagcgcatcaacaatatttccactgaatcaggatattcttctaatacctggaatgctgttttccggggatcgcagt  
ggtgagtaacatgcatcatcaggagtagcgataaaatgcttgatggtcggaaggagcataaattccgtcagccagtttagtctgacctctcatctgt  
aacatcattggcaacgctacctttgcatgtttcagaacaactctggcgcatcgggctcccatacaatcgatagattgtcgacactgattgcccgaca  
ttatcgcgagccatttatacccatataaatcagcatccatgttggaattaatcgcggcctggagcaagacgtttccgttgaatatggctcataacac  
ccctgttattactgtttatgaagcagacagttttattgttcagatgatataattttatcttgcaatgaacatcagagattttgagacacaactggct  
ttgtgaataaatcgaacttttctgagttgaaggatcagGAGTggtgcctaatagtgagtaactTactaattgctgtcgcctcactgccgctt  
tccagtcgggaacactgtcgtgccagctgcattaatgaatcggccaaacgcgaggagaggcggtttgctattggcgccagggtggttttcttttc  
accagtgaAacgggcaacagctgattgcccttcaccgcctggccctgagagagttgcagcaagcggctccacgctggtttgccccagcaggcgaaaaat  
cctgtttgatggtggttaacggcgggataatacatgagctgtcttcggtatcgtcgtatccactaccagatGtccgcaccaacgcgcagccggact  
cggtaatggcgcgcatgcccagcgccatctgatcgttggaaccagcatcgcagtggaacgatgccctcattcagcatttgatggtttgtgaa  
aaccggacatggcactccagtcgcttcccgttcgctatcggtgaatttgattgcgagtgagatattatgccagccagccagacgcagacgcgccc  
agacagaacttaattggcccgcctaacagcgcatgttgcgtgtgaccaatgcgaccagatgctccacgcccagtcgctaccgtcttcatgggagaaa  
ataatactgttgatgggtgtcgtgagacatcaagaaataacgccggaacattagtgcaggcagcttcacagcaatggcatcctggtcatccag  
cggatagttaatgatcagccactgacgcgttgcgcgagaagattgtgcaccgcccgtttacaggcttcgacgcccgttcttaccatcgacaccac  
cacgctggcaccagttgatcgcgcgagatttaacgccgcgacaatttgcgacggcgctgcagggccagactggagggtggcaacgccaatcagc  
aacgactgtttgcccgcagttgtgtgccacgcggttggaatgtaattcagctccgcatcgcgcttccacttttcccgcgttttcgcagaaacgtg  
gctggcctggttcaccacgcgggaaacggtctgataagagacaccggcatactctgcgacatcgtataacgttactggtttcacattcaccacctgaa  
ttgactcttccgggctcatcatgccataccgcgaaaggttttgcgcattcgatggtgtccgggatctcgacgcttcccttatgcgactcctgcatta  
ggaaCCAAGttacattgtgatctgttcaggtgaacagctttgaatacaccaaaaactcgtaaaagctctgatgtatctatctttttacaccgttttc  
atctgtcatatggacagttttcccttgatgttaacggtgaacagttgttctacttttgttttagtcttgatgcttactgatagatacaagaccata  
agaacctcagatccttccgtatttagccagtatgttcttagtggttcgttgttttgcgtgagccatgagaacgaaccattgagatcatacttactttg  
catgtcactcaaaaattttgcctcaaaactggtgagctgaattttgcagttaaagcatcgtgtagtgttttcttagtcggttatgtaggtaggaatctga  
tgaatggtgttggtattttgtcaccattcattttatctggttctcaagttcggttacgagatccatttgtctatctagttaacttgaaaaatcaacg



tatcagtcgggcgccctcgcttatcaaccaccaatttcatattgctgtaagtgtttaaattttacttattgggttcaaaacccattgggtaagccttttaa  
ctcatggtagttattttcaagcattaacatgaacttaaattcatcaaggctaattcttatatttgccttgtaggtttcttttggttagttctttaataacc  
actcataaatcctcatagagtattgttttcaaaagacttaacatgttccagattatattttatgaattttttaactggaaaagataaggcaatatctctt  
cactaaaaactaattctaattttcgcttgagaacttggcatagtttgcactggaaaatctcaaagcctttaaccaaaggattcctgatttccacagtt  
ctcgtcatcagctctctgggtgcttagctaatacaccataagcattttccctactgatgttcatcatctgagcgtattgggtataagtgaacgataccgtc  
cgttctttccttgtaggggtttcaatcgtggggttgagtagtgccacacagcataaaaattagcttgggttcatgctccgttaagtcatagcgactaatcgct  
agttcatttgctttgaaaacaactaattcagacatacatctcaattgggtctaggtgattttaatcactataccaattgagatgggctagtcaatgataatt  
actagtccttttccttgagttgtgggtatctgtaaattctgctagaccttggctggaaaactgttaaattctgctagacctctgtaaattccgctagacct  
ttgtgtgtttttttgtttatattcaagtgggtataatttatagaataaagaaagaataaaaaaagataaaaagaatagatcccagccctgtgtataact  
cactacttttagtcagttccgcagattacaaaaggatgtcgaaacgctgttgcctctacaaaacagaccttaaacctaaaggcttaagtagca  
ccctcgcaagctcgggcaaatcgctgaatattcctttgtctccgaccatcaggcacctgagtcgctgtcttttcgtgacattcagttcgctgcgctcacg  
gctctggcagtgaaatgggggtaaatggcactacaggcgcttttatggattcatgcaaggaaactaccataatacaagaaaagcccgtcacgggctt  
ctcagggcgttttatggcgggtctgctatgtgtgctatctgacttttgcgttcagcagttcctgccctctgattttcagtcctgGccacttcggattatc  
ccgtgacaggtcattcagactggctaatgcaccagtaaggcagcggtatcatcaacaggcttaccgtcttactgtc