

517416 Sequence Listing
SEQUENCE LISTING

<110> Nuseed Pty Ltd
Grain Research and Development Corporation
Commonwealth Scientific and Industrial Research
Organisation

<120> LIPID COMPRISING DOCOSAPENTAENOIC ACID

<130> 517416

<150> AU 2014902471

<151> 2014-06-27

<150> US 14/575,756

<151> 2014-12-18

<150> AR 20140104761

<151> 2014-12-18

<150> PCT/AU2014/050433

<151> 2014-12-18

<160> 58

<170> PatentIn version 3.5

<210> 1

<211> 21527

<212> DNA

<213> Artificial Sequence

<220>

<223> pJP3416-GA7 nucleotide sequence.

<400> 1

tcctgtggtt ggcattgcaca tacaaatgga cgaacggata aaccttttca cgccctttta	60
aatatccgat tattctaata aacgctcttt tctcttaggt ttacccgccca atatatcctg	120
tcaaacactg atagttttaa ctgaaggcgg gaaacgacaa tctgctagt gatctcccag	180
tcacgacgtt gtaaaacggg cgccccgcgg aaagcttgcg gccgcccgat ctagtaacat	240
agatgacacc gcgcgcgata atttatccta gtttgcgcg tatattttgt tttctatcgc	300
gtattaaatg tataattgcy ggactctaata cataaaaacc catctcataa ataacgtcat	360
gcattacatg ttaattatta cgtgcttaac gtaattcaac agaaattata tgataatcat	420
cgcaagaccg gcaacaggat tcaatcttaa gaaactttat tgccaaatgt ttgaacgatc	480
ggcgcgcctc attagttagc cttctcagcc tttccgttaa cgtagtagtg ctgtcccacc	540
ttatcaaggt tagagaaagt agccttccaa gcaccgtagt aagagagcac cttgtagttg	600
agtccccact tcttagcgaa aggaacgaat cttctgctaa cctcaggctg tctgaattga	660
ggcatatcag ggaagagggt gtggataacc tgacagttaa ggtatcccat aagccagttc	720
acgtatcctc tagaaggatc gatatcaacg gtgtgatcaa cagcgtagtt aaccaagaa	780
aggtgcttat cagatggaac aacagggagg tgagtatgag aagtagagaa gtgagcgaaa	840
aggtacatgt aagcgatcca gtttccgaaa gtgaaccacc agtaagcaac aggccaaag	900
tatccagtag caagcttgat aacagcgggt ctaacaacat gagaaacgag catccaagaa	960

517416 Sequence Listing

gcctcttcgt agttcttctt acggagaact tgtctagggt ggagaacgta gatccagaaa	1020
gcttgaacaa gaagtccaga ggtaacagga acgaaagtcc aagcttgaag tctagcccaa	1080
gctctagaga atcctctagg tctgttatcc tcaacagcag tgttgaagaa agccacagca	1140
ggagtgggtat caagatccat atcgtgtcta accttttgag gggtagcatg gtgcttggtta	1200
tgcattctggt tccacatctc accagaagta gaaagtccga atccacaagt catagcctga	1260
agtctcttgt ccacgtaaac agatccggta agagagttat gtccaccctc atgttgaacc	1320
catccacatc tagctccgaa gaaagcaccg taaacaacag aagcaatgat aggggtatcca	1380
gcgtacataa gagcagttcc aagagcgaat gtagcaagaa gctcgagaag tctgtaagcc	1440
acatgggtga tagaaggctt gaagaatcca tctctctcaa gctcagcacg ccatctagcg	1500
aaatcctcaa gcataggagc atcctcagac tcagatctct tgatctcagc aggtctagaa	1560
ggcaaagctc taagcatctt ccaagccttg agagaacgca tgtggaattc tttgaaagcc	1620
tcagtagcat cagcaccagt gttagcaagc atgtagaaga tcacagatcc accagggtgc	1680
ttgaagttag tcacatcgta ctcaacgtcc tcaactctaa cccatctagt ctcgaaagta	1740
gcagcaagct catgaggctc aagagtctta agatcaacag gagcagtaga agcatcctta	1800
gcatcaagag cctcagcaga agatttagac ctggtaagtg gagatctagg agaagatctt	1860
ccatcagtct taggagggca catggtatgg taattgtaaa tgtaattgta atgttgtttg	1920
ttgtttgttg ttgttggtta ttgttgtaaa agatcctcgt gtatgttttt aatcttgttt	1980
gtatcgatga gttttggttt gagtaaagag tgaagcggat gagttaattt ataggctata	2040
aaggagattt gcatggcgat cacgtgtaat aatgcatgca cgcattgtgat tgtatgtgtg	2100
tgctgtgaga gagaagctct taggtgtttg aaggaggatga caagtggcga agaaaaacaa	2160
ttctccgcgg ctgcatgcta tgtgtaacgt gtagctaatag ttctggcatg gcatcttatg	2220
aacgattctt tttaaaaaca aggtaaaaac ttaacttcat aaaattaaaa aaaaaaacgt	2280
ttactaagtt ggtttaaaag gggatgagac tagtagattg gttggttggt ttccatgtac	2340
cagaaggctt accctattag ttgaaagttg aaactttgtt ccctactcaa ttcctagttg	2400
tgtaaattgta tgtatatgta atgtgtataa aacgtagtac ttaaattgact aggagtgggt	2460
cttgagaccg atgagagatg ggagcagaac taaagatgat gacataatta agaacgaatt	2520
tgaaaggctc ttaggtttga atcctattcg agaattgttt tgtcaaagat agtggcgatt	2580
ttgaaccaa gaaaacattt aaaaaatcag tatccgggta cgttcatgca aatagaaagt	2640
gggtctaggat ctgattgtaa ttttagactt aaagagtctc ttaagattca atcctggctg	2700
tgtacaaaac tacaaataat atattttaga ctatttggcc ttaactaaac ttccactcat	2760
tatttactga ggtagagaa tagacttgcg aataaacaca ttcccagaaa atactcatga	2820
tcccataatt agtcagaggg tatgccaatc agatctaaga acacacattc cctcaaattt	2880
taatgcacat gtaatcatag tttagcacia ttcaaaaata atgtagtatt aaagacagaa	2940
attttagtagac ttttttttgg cgttaaaaga agactaagtt tatacgtaca ttttatttta	3000

517416 Sequence Listing

agtggaac	cgaaattttc	catcgaaata	tatgaattta	gtatatatat	ttctgcaatg	3060
tactattttg	ctattttggc	aactttcagt	ggactactac	tttattacaa	tgtgtatgga	3120
tgcattgagtt	tgagtataca	catgtctaaa	tgcattgcttt	gtaaaacgta	acggaccaca	3180
aaagaggatc	catacaaata	catctcatag	cttcctccat	tattttccga	cacaaacaga	3240
gcattttaca	acaattacca	acaacaacaa	acaacaacaa	acattacaat	tacatttaca	3300
attaccatac	catggaattc	gcccagcctc	ttgttgctat	ggctcaagag	caatacgctg	3360
ctatcgatgc	tggttggtgct	cctgctatct	tctctgctac	tgattctatc	ggatggggac	3420
ttaagcctat	ctcttctgct	actaaggact	tgccctctgt	tgagtctcct	acacctctca	3480
tcctttcttt	gcttgcttac	ttcgtctatcg	ttggatctgg	actcgtttac	agaaagggtt	3540
tccttagaac	cgtgaaggga	caagatccat	tccttttgaa	ggctcttatg	cttgctcaca	3600
acgtgttcct	tatcggactt	tctctttaca	tgtgcctcaa	gcttggtgtac	gaggcttacg	3660
ttaacaagta	ctctttctg	ggaaacgctt	acaaccctgc	tcaaactgag	atggctaagg	3720
ttatctggat	cttctacgtg	agcaagatct	acgagttcat	ggataccttc	atcatgctcc	3780
tcaagggaaa	tgtaaccag	gtagcttcc	ttcacgttta	ccatcacgga	tctatctctg	3840
gaatctggtg	gatgattact	tacgctgctc	ctgggtggtga	tgcttacttc	tctgctgctc	3900
ttaactcttg	ggttcacgtg	tgtatgtaca	cctactat	tatggctgcc	gtgcttccta	3960
aggacgagaa	aactaagaga	aagtacctct	ggtggggaag	ataccttact	caaatgcaga	4020
tgttccagtt	cttcatgaac	cttctccagg	ctgtttacct	tctctactct	tcattctcct	4080
accctaagtt	tatcgtcag	ctcctcggtg	tgtacatggt	tactcttctc	atgcttttcg	4140
gaaacttcta	ctacatgaag	caccacgcta	gcaagtgatg	aggcgcgccg	ggccgccgcc	4200
atgtgacaga	tcgaaggaag	aaagtgtaat	aagacgactc	tcactactcg	atcgctagt	4260
attgtcattg	ttatatataa	taatgttatc	tttcacaact	tatcgtaatg	catgtgaaac	4320
tataacacat	taatctact	tgtcatatga	taacactctc	cccatttaaa	actcttgtca	4380
atttaagat	ataagattct	ttaaagtatt	aaaaaaaaata	tattataaat	tcaatcactc	4440
ctactaataa	attattaatt	attatttatt	gattaaaaaa	atacttatac	taatttagtc	4500
tgaatagaat	aattagattc	tagtctcatc	cccttttaaa	ccaacttagt	aaacgttttt	4560
ttttttaatt	ttatgaagtt	aagtttttac	cttgttttta	aaaagaatcg	ttcataagat	4620
gccatgccag	aacattagct	acacgttaca	catagcatgc	agccgcggag	aattgttttt	4680
cttcgccact	tgtcactccc	ttcaaaccac	taagagcttc	tctctcacag	cacacacata	4740
caatcacatg	cgtgcatgca	ttattacacg	tgatcgccat	gcaaactctc	tttatagcct	4800
ataaattaac	tcattccgctt	cactctttac	tcaaaccaaa	actcatcgat	acaaacaaga	4860
ttaaaaacat	acacgaggat	cttttacaac	aattaccaac	aacaacaaac	aacaacaac	4920
attacaatta	catttacaat	taccatacca	tgccctccaag	ggactcttac	tcttatgctg	4980
ctcctccttc	tgctcaactt	cacgaagttg	atactcctca	agagcacgac	aagaaagagc	5040

517416 Sequence Listing

ttgttatcgg agatagggct tacgatgtta ccaacttcgt taagagacac cctggtggaa	5100
agatcattgc ttaccaagtt ggaactgatg ctaccgatgc ttacaagcag ttccatgtta	5160
gatctgctaa ggctgacaag atgcttaagt ctcttccttc tcgtcctggt cacaagggat	5220
actctccaag aagggtgat cttatcgctg atttccaaga gttcaccaag caacttgagg	5280
ctgagggaaat gttcgagcct tctcttcctc atgttgctta cagacttgct gaggttatcg	5340
ctatgcatgt tgctggtgct gctcttatct ggcatggata cactttcgct ggaatcgcta	5400
tgcttgaggt tgttcagggg agatgtggat ggcttatgca tgaggggtgga cattactctc	5460
tacttgaaaa cattgctttc gacagagcta tccaagttgc ttgttacgga cttggatgtg	5520
gaatgtctgg tgcttggtgg cgtaaccagc ataacaagca ccatgctact cctcaaaagc	5580
ttcagcacga tgttgatctt gatacccttc ctctcgttgc tttccatgag agaatcgctg	5640
ctaagggttaa gtctcctgct atgaaggctt ggctttctat gcaagctaag cttttcgctc	5700
ctgttaccac tcttcttggt gctcttggtt ggtagcttta ccttcacctt agacacatgc	5760
tcaggactaa gcactacgat gagcttgcta tgctcggaat cagatacgga cttgttggtt	5820
accttgctgc taactacggt gctggatacg ttctcgcttg ttaccttctt tacgttcagc	5880
ttggagctat gtacatcttc tgcaacttcg ctgtttctca tactcacctc cctgttggtg	5940
agcctaacga gcatgctact tgggttgagt acgctgctaa ccacactact aactgttctc	6000
catcttggtg gtgtgattgg tggatgtctt accttaacta ccagatcgag caccacctt	6060
accttcttat gcctcaattc agacacccta agatcgctcc tagagttaag cagcttttcg	6120
agaagcacgg acttcactac gatgttagag gatacttcga ggctatggct gatactttcg	6180
ctaaccttga taacgttgcc catgctcctg agaagaaaaat gcagtaatga gatcgttcaa	6240
acatttgga ataaagtttc ttaagattga atcctgttgc cggctcttgcg atgattatca	6300
tataatttct gttgaattac gttaagcacg taataattaa catgtaatgc atgacgttat	6360
ttatgagatg ggtttttatg attagagtcc cgcaattata catttaatac gcgatagaaa	6420
acaaaatata gcgcgcaaac taggataaat tatcgcgcgcg ggtgtcatct atgttactag	6480
atcggtcgat taaaaatccc aattatatat ggtctaattt agtttggtat tgagtaaaac	6540
aaattcgaac caaaccaaaa tataaatata tagtttttat atatatgcct ttaagacttt	6600
ttatagaatt ttctttaaaa aatatctaga aatatttgcg actcttctgg catgtaatat	6660
ttcgttaaat atgaagtgct ccatttttat taactttaaa taattgggtg tacgatcact	6720
ttcttatcaa gtgttactaa aatgcgtcaa tctctttggt cttccatatt catatgtcaa	6780
aatctatcaa aattcttata tatctttttc gaatttgaag tgaaatttcg ataatttaaa	6840
attaaataga acatatcatt atttaggtat catattgatt ttatactta attactaaat	6900
ttggttaact ttgaaagtgt acatcaacga aaaattagtc aaacgactaa aataaataaa	6960
tatcatgtgt tattaagaaa attctcctat aagaatatat taatagatca tatgtttgta	7020
aaaaaaatta atttttacta acacatatat ttacttatca aaaatttgac aaagtaagat	7080

517416 Sequence Listing

taaaataata	ttcatctaac	aaaaaaaaaa	ccagaaaatg	ctgaaaaacc	ggcaaaaccg	7140
aaccaatcca	aaccgatata	gttggttttg	tttgattttg	atataaaccg	aaccaactcg	7200
gtccatttgc	accctaatac	ataatagctt	taatatattca	agatattatt	aagttaacgt	7260
tgtcaatatc	ctggaaatth	tgcaaaatga	atcaagccta	tatggctgta	atatgaatth	7320
aaaagcagct	cgatgtggtg	gtaatatgta	atttacttga	ttctaaaaaa	atatcccaag	7380
tattaataat	ttctgctagg	aagaagggtta	gctacgattt	acagcaaagc	cagaatacaa	7440
agaaccataa	agtgattgaa	gctcgaaata	tacgaaggaa	caaataatth	taaaaaaata	7500
cgcaatgact	tggaacaaaa	gaaagtgata	tattttttgt	tcttaaaaaa	gcatccccct	7560
taaagaatgg	cagtttttct	ttgcatgtaa	ctattatgct	cccttcgtta	caaaaaatth	7620
ggactactat	tggaacttct	ttctgaaaat	agtgatagaa	cccacacgag	catgtgctth	7680
ccatttaatt	ttaaaaacca	agaacataac	atacataaca	ttccatcagc	ctctctctct	7740
ttttattacg	gttaatgact	taaaacacat	cttattatcc	catccttaac	acctagcagt	7800
gtctttatac	gatctcatcg	atcaccactt	caaaaccatg	cagactgctg	ctgccccctg	7860
agctggcatc	ggctaggctg	ggtgccgcac	tgtcccggaa	ggtccctagc	gacttgttta	7920
gattgatggg	accacctctc	aacttcctgc	tgctgtccct	gctgctggat	gtcctgcctc	7980
atctggccga	ttgcacgctc	cagtcccctg	catgtgcact	cgctcctcaa	ttgcttaaga	8040
tcatcgcagc	agctatcgaa	gtgctggctc	tgttgccctc	ctccacggcc	ttggtttaga	8100
tagtagctgc	cgccgccctt	ctggactttt	tcccacagga	accgccgaat	aattcgatag	8160
aaccacacga	gcatgtgctt	tcattttatt	taaaaaccaa	gaaacataca	taacatttca	8220
tcagcctctc	tctctctctc	tctctctctc	tctctctctc	tctctctctc	tctctcttta	8280
ttacagctgt	tacactaact	taaaacacat	tcatctcatt	attattatta	ttatccatcc	8340
ttaacaccta	gcagtgtctt	tgtacgatct	cataatcgat	cacccttca	tcaggatatcc	8400
ttaggcttca	ctccaacgtt	gttgacgtta	cggaacatgt	acacaccatc	atggtttctca	8460
acgaactggc	aagatctcca	agttttccaa	aggctaacc	acatgttctc	atcgggtgtgt	8520
ctgtagtgct	ctcccataac	tttcttgatg	cactcggtag	cttctctagc	atggtagaat	8580
gggatccttg	aaacgtagtg	atggagcaca	tgagtctcga	tgatgtcatg	gaagatgatt	8640
ccgaggattc	cgaactctct	atcgatagta	gcagcagcac	ccttagcgaa	agtccactct	8700
tgagcatcgt	aatgaggcat	agaagaatcg	gtgtgctgaa	ggaaggtaac	gaaaacaagc	8760
cagtgggtta	caaggatcca	aggacagaac	catgtgatga	aagtaggcca	gaatccgaaa	8820
accttgtaag	cgggtgtaaac	agaagtgagg	gtagcaagga	ttccaagatc	agaaagaacg	8880
atgtaccagt	agtccttctt	atcgaaaaca	gggctagaag	gccagtagtg	agacttgaag	8940
aacttagaaa	caccagggta	aggttgtcca	gtagcgtag	tagcaaggta	aagagaaagt	9000
cctccaagct	gttggaacaa	gagagcgaaa	acagagtaga	taggagtttc	ctcagcgata	9060
tcgtgaaggc	tggttaacttg	gtgcttctct	ttgaattcct	cggcgggtga	aggaacgaaa	9120

517416 Sequence Listing

accatatctc	tgggtcatgtg	tccagtagcc	ttatgggtgct	tagcatgaga	gaacttccag	9180
ctgaagtaag	gaaccataac	aagagagtgg	agaacccatc	caacggtatc	gttaacccat	9240
ccgtagttag	agaaagcaga	atgtccacac	tcatgtccaa	ggatccagat	tccgaatccg	9300
aaacaagaga	tagagaacac	gtaagcagac	caagcagcga	atctaaggaa	ttcgttaggg	9360
agaagagggg	tgtaggtaag	tccaacgtaa	gcgatagcag	agatagccac	gatatctctc	9420
accacgtaag	acatagactt	cacgagagat	ctctcgtaac	agtgccttagg	gatagcgtca	9480
aggatatcct	tgatgggtgta	atctggcacc	ttgaaaacgt	ttccgaagggt	atcgatagcg	9540
gtcttttgct	gcttgaaaga	tgcaacgttt	ccagaacgcc	taacggtctt	agtagatccc	9600
tcaaggatct	cagatccaga	cacggtaacc	ttagacatgg	tatggtaatt	gtaaatgtaa	9660
ttgtaatgtt	gtttgttggt	tggtgttggt	ggtaattgtt	gtaaaatttt	tgggtggtgat	9720
tggttcttta	aggtgtgaga	gtgagttgtg	agttgtgtgg	tgggtttggt	gagattgggg	9780
atgggtgggtt	tatatagtgg	agactgagga	atgggggtcgt	gagtgttaac	tttgcatggg	9840
ctacacgtgg	gttcttttgg	gcttacacgt	agtattattc	atgcaaattgc	agccaataca	9900
tatacggtat	tttaataatg	tgtgggaata	caatatgccg	agtattttac	taattttggc	9960
aatgacaagt	gtacatttgg	attatcttac	ttggcctctc	ttgctttaat	ttggattatt	10020
tttattctct	taccttggcc	gttcatattc	acatccctaa	aggcaagaca	gaattgaatg	10080
gtggccaaaa	attaaaacga	tggatatgac	ctacatagtg	taggatcaat	taacgtcgaa	10140
ggaaaatact	gattctctca	agcatacgga	caagggtaaa	taacatagtc	accagaacat	10200
aataaacaaa	aagtcagaa	gcaagactaa	aaaaattagc	tatggacatt	caggttcata	10260
ttggaaacat	cattatccta	gtcttgtgac	catccttcct	cctgctctag	ttgagaggcc	10320
ttgggactaa	cgagagggtca	gttgggatat	cagatcctta	tcctggacta	gcctttctgg	10380
tgtttcagag	tcttcgtgcc	gccgtctaca	tctatctcca	ttagggtctga	agatgactct	10440
tcacaccaac	gacgtttaag	gtctctatcc	tactcctagc	ttgcaatacc	tggcttgcaa	10500
tacctggagc	atcgtgcacg	atgattggat	actgtggagg	aggagtgttt	gctgatttag	10560
agctcccgggt	tgggtgattt	gacttcgatt	tcagtttagg	cttggtgaaa	tttttcaggt	10620
tccattgtga	agcctttaga	gcttgagctt	ccttccatgt	taatgccttg	atcgaatact	10680
cctagagaaa	aggggaagtcg	atctctgagt	attgaaatcg	aagtgacacat	tttttttcaa	10740
cgtgtccaat	caatccacaa	acaaagcaga	agacaggtaa	tctttcatac	ttatactgac	10800
aagtaatagt	cttaccgtca	tgcataataa	cgtctcgttc	cttcaagagg	ggttttccga	10860
catccataac	gacccgaagc	ctcatgaaag	cattaggggaa	gaacttttgg	ttcttcttgt	10920
catggccttt	ataggtgtca	gccgagctcg	ccaattcccg	tccgactggc	tccgaaaaat	10980
attcgaacgg	caagttatgg	acttgcaacc	ataactccac	ggtattgagc	aggacctatt	11040
gtgaagactc	atctcatgga	gcttcagaat	gtgggtgtca	gcaaaccaat	gaccgaaatc	11100
catcacatga	cggacgtcca	gtgggtgagc	gaaacgaaac	aggaagcgcc	tatctttcag	11160

517416 Sequence Listing

agtcgtgagc	tccacaccgg	attccggcaa	ctacgtgttg	ggcaggcttc	gccgtattag	11220
agatatgttg	aggcagaccc	atctgtgcca	ctcgtacaat	tacgagagtt	gttttttttg	11280
tgattttcct	agtttctcgt	tgatggtgag	ctcatattct	acatcgtatg	gtctctcaac	11340
gtcgtttcct	gtcatctgat	atcccgtcat	ttgcatccac	gtgcgccgcc	tcccgtgcca	11400
agtcacctagg	tgtcatgcac	gccaaattgg	tgggtggtgcg	ggctgccctg	tgcttcttac	11460
cgatgggtgg	aggttgagtt	tgggggtctc	cgcggcgatg	gtagtggggt	gacggtttgg	11520
tgtgggttga	cggcattgat	caatttactt	cttgcttcaa	attctttggc	agaaaacaat	11580
tcattagatt	agaactggaa	accagagtga	tgagacggat	taagtcagat	tccaacagag	11640
ttacatctct	taagaaataa	tgtaacccct	ttagacttta	tataatttgca	attaaaaaaa	11700
taattttaact	tttagacttt	atatatagtt	ttaataacta	agtttaacca	ctctattatt	11760
tatatcgaaa	ctatttgtat	gtctcccctc	taaataaact	tggatttgtg	tttacagaac	11820
ctataatcaa	ataatcaata	ctcaactgaa	gtttgtgcag	ttaattgaag	ggattaacgg	11880
ccaaaatgca	ctagtattat	caaccgaata	gattcacact	agatggccat	ttccatcaat	11940
atcatcgccg	ttcttcttct	gtccacatat	cccccttgaa	acttgagaga	cacctgcact	12000
tcattgtcct	tattacgtgt	tacaaaatga	aaccatgca	tccatgcaaa	ctgaagaatg	12060
gcgcaagaac	ccttcccctc	catttcttat	gtggcgacca	tccatttcac	catctcccgc	12120
tataaaacac	ccccatcact	tcacctagaa	catcatcact	acttgcttat	ccatccaaaa	12180
gatacccact	tttacaacaa	ttaccaacaa	caacaaacaa	caaacaacat	tacaattaca	12240
tttacaatta	ccataccatg	ccacctagcg	ctgctaagca	aatgggagct	tctactggtg	12300
ttcatgctgg	tgttactgac	tcttctgctt	tcaccagaaa	ggatgttgct	gatagacctg	12360
atctcaccat	cgttggagat	tctgttttacg	atgctaaggc	tttcagatct	gagcatcctg	12420
gtggtgctca	tttcgtttct	ttgttcggag	gaagagatgc	tactgaggct	ttcatggaat	12480
accatagaag	ggcttggcct	aagtctagaa	tgtctagatt	ccacgttgga	tctcttgctt	12540
ctactgagga	acctgttgct	gctgatgagg	gataccttca	actttgtgct	aggatcgcta	12600
agatggtgcc	ttctgtttct	tctggattcg	ctcctgcttc	ttactggggt	aaggctggac	12660
ttatccttgg	atctgctatc	gctcttgagg	cttacatgct	ttacgctgga	aagagacttc	12720
tcccttctat	cgttcttgga	tggcttttctg	ctcttatcgg	tcttaacatc	cagcatgatg	12780
ctaaccatgg	tgctttgtct	aagtctgctt	ctgttaacct	tgctcttgga	ctttgtcagg	12840
attggatcgg	aggatctatg	atcctttggc	ttcaagagca	tgttgttatg	caccacctcc	12900
acactaacga	tgttgataag	gatcctgatc	aaaaggctca	cggtgctctt	agactcaagc	12960
ctactgatgc	ttggtcacct	atgcattggc	ttcagcatct	ttaccttttg	cctggtgaga	13020
ctatgtacgc	tttcaagctt	ttgttcctcg	acatctctga	gcttgttatg	tggcgttggg	13080
agggtgagcc	tatctctaag	cttgctggat	acctctttat	gccttctttg	cttctcaagc	13140
ttaccttctg	ggctagattc	gttgctttgc	ctctttacct	tgctccttct	gttcatactg	13200

517416 Sequence Listing

ctgtgtgtat	cgctgctact	gttatgactg	gatctttcta	cctcgctttc	ttcttcttca	13260
tctcccacaa	cttcgagggg	gttgcttctg	ttggacctga	tggatctatc	acttctatga	13320
ctagaggtgc	tagcttcctt	aagagacaag	ctgagacttc	ttctaacggt	ggaggacctc	13380
ttcttgctac	tcttaacggg	ggactcaact	accaaattga	gcatcacttg	ttccctagag	13440
ttcaccatgg	attctaccct	agacttgctc	ctcttggtta	ggctgagctt	gaggctagag	13500
gaatcgagta	caagcactac	cctactatct	ggtctaacct	tgcttctacc	ctcagacata	13560
tgtacgctct	tggaagaagg	cctagatcta	aggctgagta	atgacaagct	tatgtgacgt	13620
gaaataataa	cggtaaaata	tatgtaataa	taataataat	aaagccacaa	agtgagaatg	13680
aggggaaggg	gaaatgtgta	atgagccagt	agccggtggg	gctaattttg	tatcgtattg	13740
tcaataaatc	atgaattttg	tggtttttat	gtgttttttt	aaatcatgaa	ttttaaat	13800
tataaaataa	tctccaatcg	gaagaacaac	attccatatc	catgcatgga	tgtttcttta	13860
cccaaataa	gttcttgaga	ggatgaagca	tcaccgaaca	gttctgcaac	tatccctcaa	13920
aagcttttaa	atgaacaaca	aggaacagag	caacgttcca	aagatcccaa	acgaaacata	13980
ttatctatac	taataactata	ttattaatta	ctactgcccc	gaatcacaat	ccctgaatga	14040
ttcctattaa	ctacaagcct	tggtggcggc	ggagaagtga	tcggcgcggc	gagaagcagc	14100
ggactcggag	acgaggcctt	ggaagatctg	agtcgaacgg	gcagaatcag	tattttcctt	14160
cgacgttaat	tgatcctaca	ctatgtaggt	catatccatc	gttttaattt	ttggccacca	14220
ttcaattctg	tcttgccctt	agggatgtga	atatgaacgg	ccaaggtaag	agaataaaaa	14280
taatccaaat	taaagcaaga	gaggccaagt	aagataatcc	aaatgtacac	ttgtcattgc	14340
caaaattagt	aaaataactg	gcataattgta	ttcccacaca	ttattaaaaat	accgtatatg	14400
tattggctgc	atttgcatga	ataataactac	gtgtaagccc	aaaagaaccc	acgtgtagcc	14460
catgcaaagt	taacactcac	gaccccatc	ctcagtctcc	actatataaa	cccaccatcc	14520
ccaatctcac	caaaccacc	acacaactca	caactcactc	tcacacctta	aagaaccaat	14580
caccaccaa	aattttacaa	caattaccaa	caacaacaaa	caacaacaa	cattacaatt	14640
acatttaca	ttaccatacc	atgagcgctg	ttaccgttac	tggatctgat	cctaagaaca	14700
gaggatcttc	tagcaacacc	gagcaagagg	ttccaaaagt	tgctatcgat	accaacggaa	14760
acgtgttctc	tgttcctgat	ttcaccatca	aggacatcct	tggagctatc	cctcatgagt	14820
gttacgagag	aagattggct	acctctctct	actacgtgtt	cagagatatc	ttctgcatgc	14880
ttaccaccgg	ataccttacc	cataagatcc	tttaccctct	cctcatctct	tacacctcta	14940
acagcatcat	caagttcact	ttctgggccc	tttactactta	cgttcaagga	cttttcggaa	15000
ccggaatctg	ggttctcgct	catgagtgtg	gacatcaagc	tttctctgat	tacggaatcg	15060
tgaacgattt	cgttggatgg	acccttcact	cttaccttat	ggttccttac	ttcagctgga	15120
agtactctca	tggaagcac	cataaggcta	ctggacacat	gaccagagat	atggttttcg	15180
ttcctgccac	caaagaggaa	ttcaagaagt	ctaggaactt	cttcggtaac	ctcgctgagt	15240

517416 Sequence Listing

actctgagga	ttctccactt	agaacccttt	acgagcttct	tgttcaacaa	cttggaggat	15300
ggatcgctta	cctcttcggt	aacgttacag	gacaacctta	ccctgatggt	ccttcttgga	15360
aatggaacca	cttctggcct	acctctccac	ttttcgagca	aagagatgct	ctctacatct	15420
tcctttctga	tcttggaatc	ctcaccacag	gaatcggtct	tactctttgg	tacaagaaat	15480
tcggaggatg	gtcccttttc	atcaactggt	tcgttcctta	catctgggtt	aaccactggc	15540
tcgttttcat	cacattcctt	cagcacactg	atcctactat	gcctcattac	aacgctgagg	15600
aatggacttt	cgctaagggt	gctgctgcta	ctatcgatag	aaagttcgga	ttcatcggac	15660
ctcacatctt	ccatgatata	atcgagactc	atgtgcttca	ccactactgt	tctaggatcc	15720
cattctacaa	cgctagacct	gcttctgagg	ctatcaagaa	agttatggga	aagcactaca	15780
ggctctagcga	cgagaacatg	tggaagtcac	tttggaagtc	tttcagggtct	tgccaatacg	15840
ttgacggtga	taacggtggt	ctcatgttcc	gtaacatcaa	caactgcgga	gttgaggctg	15900
ctgagaagta	atgaaggggt	gatcgattat	gagatcgtag	aaagacactg	ctagggtgta	15960
aggatggata	ataataataa	taatgagatg	aatgtgtttt	aagttagtgt	aacagctgta	16020
ataaagagag	agagagagag	agagagagag	agagagagag	agagagagag	agagaggctg	16080
atgaaatggt	atgtatgttt	cttgggtttt	aaaataaatg	aaagcacatg	ctcgtgtggt	16140
tctatcgaat	tattcggcgg	ttcctgtggg	aaaaagtcca	gaagggccgc	cgcagctact	16200
actacaacca	aggccgtgga	ggagggcaac	agagccagca	cttcgatagc	tgctgcgatg	16260
atcttaagca	attgaggagc	gagtgcacat	gcaggggact	ggagcgtgca	atcggccaga	16320
tgaggcagga	catccagcag	cagggacagc	agcaggaagt	tgagagggtg	tcccatcaat	16380
ctaaacaagt	cgctagggac	cttccgggac	agtgcggcac	ccagcctagc	cgatgccagc	16440
tccaggggca	gcagcagtct	gcatgggttt	gaagtgggtga	tcgatgagat	cgtataaaga	16500
cactgctagg	tgtaaggat	gggataataa	gatgtgtttt	aagtcattaa	ccgtaataaa	16560
aagagagaga	ggctgatgga	atgttatgta	tgtatgtttc	ttgggttttta	aaattaaatg	16620
gaaagcacat	gctcgtgtgg	gttctatctc	gattaaaaat	cccaattata	tttgggtctaa	16680
tttagtttgg	tattgagtaa	aacaaattcg	aaccaaacca	aaatataaat	atatagtttt	16740
tatatatatg	cctttaagac	tttttataga	attttcttta	aaaaatatct	agaaatattt	16800
gcgactcttc	tggcatgtaa	tatttcgtta	aatatgaagt	gctccatttt	tattaacttt	16860
aaataattgg	ttgtacgata	actttcttat	caagtgttac	taaaatgcgt	caatctcttt	16920
gttctttccat	attcatatgt	caaaatctat	caaaattctt	atatatcttt	ttcgaatttg	16980
aagtgaattt	tcgataattt	aaaattaaat	agaacatatc	attatttagg	tatcatattg	17040
atttttatac	ttaattacta	aatttggtta	actttgaaag	tgtacatcaa	cgaaaaatta	17100
gtcaaacgac	taaaataaat	aaatatcatg	tgttattaag	aaaattctcc	tataagaata	17160
ttttaataga	tcatatgttt	gtaaaaaaaa	ttaattttta	ctaacacata	tatttactta	17220
tcaaaaattt	gacaaagtaa	gattaaaata	atattcatct	aacaaaaaaaa	aaaccagaaa	17280

517416 Sequence Listing

atgctgaaaa	cccggcaaaa	ccgaaccaat	ccaaaccgat	atagttgggt	tggtttgatt	17340
ttgatataaa	ccgaaccaac	tcggtccatt	tgcaccccta	atcataatag	ctttaatatt	17400
tcaagatatt	attaagttaa	cgttgtcaat	atcctggaaa	ttttgcaaaa	tgaatcaagc	17460
ctatatggct	gtaatatgaa	tttaaaagca	gctcgatgtg	gtggtaatat	gtaatttact	17520
tgattctaaa	aaaatatccc	aagtattaat	aatttctgct	aggaagaagg	ttagctacga	17580
tttacagcaa	agccagaata	caaagaacca	taaagtgatt	gaagctcgaa	atatacgaag	17640
gaacaaatat	ttttaaaaaa	atacgcaatg	acttggaaaca	aaagaaaagt	atataatttt	17700
tgttcttaaa	caagcatccc	ctctaaagaa	tggcagtttt	cctttgcatg	taactattat	17760
gctcccttcg	ttacaaaaat	tttggtactac	tattgggaac	ttcttctgaa	aatagtcctg	17820
caggctagta	gattgggttg	ttggtttcca	tgtaccagaa	ggcttaccct	attagttgaa	17880
agttgaaact	ttgttcccta	ctcaattcct	agttgtgtaa	atgtatgtat	atgtaatgtg	17940
tataaaacgt	agtacttaaa	tgactaggag	tggttcttga	gaccgatgag	agatgggagc	18000
agaactaaag	atgatgacat	aattaagaac	gaatttgaaa	ggctcttagg	tttgaatcct	18060
attcgagaat	gtttttgtca	aagatagtgg	cgattttgaa	ccaaagaaaa	catttaaaaa	18120
atcagtatcc	ggttacgttc	atgcaaatag	aaagtgggtct	aggatctgat	tgtaatttta	18180
gacttaaaga	gtctcttaag	attcaatcct	ggctgtgtac	aaaactacaa	ataatatatt	18240
ttagactatt	tggccttaac	taaacttcca	ctcattattt	actgagggtta	gagaatagac	18300
ttgcgaataa	acacattccc	gagaaatact	catgatccca	taattagtca	gagggtatgc	18360
caatcagatc	taagaacaca	cattccctca	aattttaatg	cacatgtaat	catagtttag	18420
cacaattcaa	aaataatgta	gtattaaaga	cagaaatttg	tagacttttt	tttggcgtta	18480
aaagaagact	aagttttatac	gtacatttta	ttttaagtgg	aaaaccgaaa	ttttccatcg	18540
aaatatatga	atttagtata	tatatttctg	caatgtacta	ttttgctatt	ttggcaactt	18600
tcagtggact	actactttat	tacaatgtgt	atggatgcat	gagtttgagt	atacacatgt	18660
ctaaatgcat	gctttgtaaa	acgtaacgga	ccacaaaaga	ggatccatac	aaatacatct	18720
catagcttcc	tccattattt	tccgacacaa	acagagcatt	ttacaacaat	taccaacaac	18780
aacaaacaac	aaacaacatt	acaattacat	ttacaattac	cataccatgg	cctctatcgc	18840
tatccctgct	gctcttgctg	gaactcttgg	atacgttacc	tacaatgtgg	ctaaccctga	18900
tatcccagct	tctgagaaaag	ttcctgctta	cttcatgcag	gttgagtact	ggggacctac	18960
tatcggaact	attggatacc	tcctcttcat	ctacttcgga	aagcgtatca	tgcagaacag	19020
atctcaacct	ttcggactca	agaacgctat	gctcgtttac	aacttctacc	agaccttctt	19080
caacagctac	tgcattctacc	ttttcgttac	ttctcatagg	gctcagggac	ttaaggtttg	19140
gggaaacatc	cctgatatga	ctgctaactc	ttgggggaatc	tctcagggtta	tctggcttca	19200
ctacaacaac	aagtacgttg	agcttctcga	caccttcttc	atggtgatga	ggaagaagtt	19260
cgaccagctt	tctttccttc	acatctacca	ccacactctt	ctcatctggt	catggttcgt	19320

517416 Sequence Listing

tgttatgaag cttgagcctg ttggagattg ctacttcgga tcttctgtta acaccttcgt	19380
gcacgtgatac atgtactctt actacggact tgctgctctt ggagttaact gtttctggaa	19440
gaagtacatc acccagatcc agatgcttca gttctgtatc tgtgcttctc actctatcta	19500
caccgcttac gttcagaata ccgctttctg gcttccttac cttcaactct gggttatggg	19560
gaacatgttc gtttctcttcg ccaacttcta ccgtaagagg tacaagtcta aggggtgctaa	19620
gaagcagtga taagggccgc cgccatgtga cagatcgaag gaagaaagtg taataagacg	19680
actctcacta ctcgatcgct agtgattgtc attgttatat ataataatgt tatctttcac	19740
aacttatcgt aatgcatgtg aaactataac acattaatcc tacttgtcat atgataacac	19800
tctccccatt taaaactctt gtcaatttaa agatataaga ttctttaaat gattaaaaaa	19860
aatatattat aaattcaatc actcctacta ataaattatt aattattatt tattgattaa	19920
aaaaatactt atactaattt agtctgaata gaataattag attctagcct gcagggcggc	19980
cgcggatccc atggagtcaa agattcaaat agaggaccta acagaactcg ccgtaaagac	20040
tggcgaacag ttcatacaga gtctcttacg actcaatgac aagaagaaaa tcttcgtcaa	20100
catggtggag cacgacacac ttgtctactc caaaaatatc aaagatacag tctcagaaga	20160
caaaggggca attgagactt ttcaacaaag ggtaatatcc ggaaacctcc tcggattcca	20220
ttgcccagct atctgtcact ttattgtgaa gatagtggaa aaggaagggtg gctcctacaa	20280
atgccatcat tgcgataaag gaaaggccat cgttgaagat gcctctgccg acagtgggtcc	20340
caaagatgga ccccccacca cgaggagcat cgtggaaaaa gaagacgttc caaccacgtc	20400
ttcaaagcaa gtggattgat gtgatatctc cactgacgta agggatgacg cacaatccca	20460
ctatccttcg caagaccctt cctctatata aggaagttca tttcatttgg agagaacacg	20520
ggggactgaa ttaaatatga gccctgagag gcgtcctgtt gaaatcagac ctgctactgc	20580
tgctgatatg gctgctgttt gtgatatcgt gaaccactac atcgagactt ctaccgttaa	20640
cttcagaact gagcctcaaa ctctcaaga gtggatcgat gatcttgaga gactccaaga	20700
tagataccct tggcttggtg ctgaggttga ggggtgtgtt gctggaatcg cttacgctgg	20760
accttggaag gctagaaacg cttacgattg gactgttgag tctaccgttt acgtttcaca	20820
cagacatcag agacttggac ttggatctac cctttacact caccttctca agtctatgga	20880
agctcagggg ttcaagtctg ttgttgctgt tatcggactc cctaacgata cttctgttag	20940
acttcatgag gctcttggat aactgctag aggaactctt agagctgctg gatacaagca	21000
cgggtggatgg catgatgttg gattctggca aagagatttc gagcttcctg ctctccttag	21060
acctgttaga ccagttactc agatctgaat ttgcgtgata gttcaaacaat ttggcaataa	21120
agtttcttaa gattgaatcc tgttgccggt cttgcgatga ttatcatata atttctgttg	21180
aattacgtta agcatgtaat aattaacatg taatgcatga cgttatttat gagatggggtt	21240
tttatgatta gagtcccgcg attatacatt taatacgcga tagaaaacaa aatatagcgc	21300
gcaaactagg ataaattatc gcgcgcggtg tcatctatgt tactagatca ctagtgatgt	21360

517416 Sequence Listing

acggttaaaa	ccaccccagt	acattaaaaa	cgctccgcaat	gtgttattaa	gttgtctaag	21420
cgtcaatttg	tttacaccac	aatatatacct	gccaccagcc	agccaacagc	tccccgaccg	21480
gcagctcggc	acaaaatcac	cactcgatac	aggcagccca	tcagtcc		21527

<210> 2
 <211> 23512
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> pGA7- mod_B nucleotide sequence

<400> 2	
tcctgtggtt	ggcatgcaca
tacaaatgga	cgaacggata
aaccttttca	cgccctttta
60	
aatatccgat	tattctaata
aacgctcttt	tctcttaggt
ttacccgcca	atatatacctg
120	
tcaaacactg	atagttttaa
ctgaaggcgg	gaaacgacaa
tctgctagt	gatctccag
180	
tcacgacgtt	gtaaaacggg
cgccccgcgg	aaagcttgcg
gccgcggtac	cgcccggttcg
240	
actcagatct	tccaaggcct
cgtctccgag	tccgctgctt
ctcgccgcgc	cgatcacttc
300	
tccgccgcca	acaaggcttg
tagttaatag	gaatcattca
gggattgtga	ttccgggcag
360	
tagtaattaa	taatatagta
ttagtataga	taatatgttt
cgtttgggat	ctttggaacg
420	
ttgctctgtt	ccttggtgtt
cattttaaag	cttttgaggg
atagttgcag	aactgttcgg
480	
tgatgcttca	tcctctcaag
aactagattt	gggtaaagaa
acatccatgc	atggatatgg
540	
aatgttggtc	ttccgattgg
agattatttt	ataaaattta
aaattcatga	tttaaaaaaa
600	
cacataaaaa	ccacaaaatt
catgatttat	tgacaatacg
atacaaaatt	agcaccaccg
660	
gctactggct	cattacacat
ttcccccttc	cctcattctc
actttgtggc	tttattatta
720	
ttattattac	atatatttta
ccgttattat	ttcacgtcac
ataagcttgt	taattaatca
780	
ttagttagcc	ttctcagcct
ttccgttaac	gtagtagtgc
tgtcccacct	tatcaagggt
840	
agagaaagta	gccttccaag
caccgtagta	agagagcacc
ttgtagttga	gtccccactt
900	
cttagcgaaa	ggaacgaatc
ttctgctaac	ctcaggctgt
ctgaattgag	gcatatcagg
960	
gaagagggtg	tggataacct
gacagttaag	gtatcccata
agccagttca	cgatcctct
1020	
agaaggatcg	atatcaacgg
tgtgatcaac	agcgtagtta
acccaagaaa	ggtgcttatc
1080	
agatggaaca	acagggaggt
gagtatgaga	agtagagaag
tgagcgaaaa	ggtacatgta
1140	
agcgatccag	tttccgaaag
tgaaccacca	gtaagcaaca
ggccaagagt	atccagtagc
1200	
aagcttgata	acagcggttc
taacaacatg	agaaacgagc
atccaagaag	cctcttcgta
1260	
gttcttctta	cggagaactt
gtctaggggtg	gagaacgtag
atccagaaaag	cttgaacaag
1320	
aagtccagag	gtaacaggaa
cgaaagtcca	agcttgaagt
ctagcccaag	ctctagagaa
1380	
tcctctaggt	ctgttatcct
caacagcagt	gttgaagaaa
gccacagcag	gagtgggtatc
1440	
aagatccata	tcgtgtctaa
ccttttgagg	ggtagcatgg
tgcttggttat	gcatctgggt
1500	
ccacatctca	ccagaagtag
aaagtccgaa	tccacaagtc
atagcctgaa	gtctcttgtc
1560	

517416 Sequence Listing

cacgtaaaca gatccggtaa gagagttatg tccaccctca tgttgaaccc atccacatct	1620
agctccgaag aaagcaccgt aaacaacaga agcaatgata gggatatccag cgtacataag	1680
agcagttcca agagcgaatg tagcaagaag ctcgagaagt ctgtaagcca catgggtgat	1740
agaaggcttg aagaatccat ctctctcaag ctcagcacgc catctagcga aatcctcaag	1800
cataggagca tcctcagact cagatctctt gatctcagca ggtctagaag gcaaagctct	1860
aagcatcttc caagccttga gagaacgcat gtggaattct ttgaaagcct cagtagcatc	1920
agcaccagtg ttagcaagca tgtagaagat cacagatcca ccagggtgct tgaagttagt	1980
cacatcgtac tcaacgtcct caactctaac ccatctagtc tcgaaagtag cagcaagctc	2040
atgaggctca agagtcttaa gatcaacagg agcagtagaa gcataccttag catcaagagc	2100
ctcagcagaa gatttagacc tggttaagtgg agatctagga gaagatcttc catcagtctt	2160
aggagggcac atggtatggt aattgtaaat gtaattgtaa tgttgtttgt tgtttgttgt	2220
tgttggtaat tgttgtaaaa ttaattaagt gggatatctt ttgatggata agcaagtagt	2280
gatgatgttc taggtgaagt gatgggggtg ttttatagcg ggagatggtg aaatggatgg	2340
tcgccacata agaaatggag ggggaagggtt cttgcgccat tcttcagttt gcatggatgc	2400
atgggtttca ttttgtaaca cgtaataagg acaatgaagt gcagggtgtct ctcaagtttc	2460
agaggggata tgtggacaga agaagaacgg cgatgatatt gatggaaatg gccatctagt	2520
gtgaatctat tcggttgata atactagtg attttgccg ttaatccctt caattaactg	2580
cacaaacttc agttgagtat tgattatttg attatagggt ctgtaaacac aataccaagt	2640
ttatttagag gggagacata caaatagttt cgatataaat aatagagtgg ttaaacttag	2700
ttattaaaac tatatataaa gtctaaaagt taaattatct ttttaattgc aaatatataa	2760
agtctaaagg ggttacatta tttcttaaga gatgtaactc tgttggaatc tgacttaatc	2820
cgtctcatca ctctggtttc cagttcta ataatgaatt gttttctgcc aaagaatttg	2880
aagcaagaag taaattgatc aatgccgtca acccacacca aaccgtcaac ccactaccat	2940
cgccgcggag acccccaaac tcaacctcca cccatcggta agaagcacag ggcagccgc	3000
accaccacca atttggcgtg catgacacct agggacttgg cacgggaggc ggcgcacgtg	3060
gatgcaaag acgggatatc agatgacagg aaacgacgtt gagagaccat acgatgtaga	3120
atatgagctc accatcaacg agaaactagg aaaatcaca aaaaaacaac tctcgtaatt	3180
gtacgagtgg cacagatggg tctgcctcaa catatctcta atacggcgaa gcctgccaa	3240
cacgtagttg ccggaatccg gtgtggagct cacgactctg aaagataggc gcttcctggt	3300
tcgtttcgct caccactg acgtccgtca tgtgatggat ttcggtcatt ggtttgctga	3360
caaccacatt ctgaagctcc atgagatgag tcttcacaat aggtcctgct caataccgtg	3420
gagttatggg tgcaagtcca taacttgccg ttcgaatatt ttgcggagcc agtcggacgg	3480
gaattggcga gctcggctga cacctataaa ggccatgaca agaagaacca aaagtcttc	3540
cctaattgctt tcatgaggct tcgggtcggt atggatgtcg gaaaaccct cttgaaggaa	3600

517416 Sequence Listing

cgagacgtta	ttatgcatga	cggttaagact	attacttgct	agtataagta	tgaaagatta	3660
cctgtcttct	gctttgtttg	tggattgatt	ggacacgttg	aaaaaaaaatg	tgcacttcga	3720
tttcaatact	cagagatcga	cttccctttt	ctctaggagt	attcgatcaa	ggcattaaca	3780
tggaaggaag	ctcaagctct	aaaggcttca	caatggaacc	tgaaaaattt	caacaagcct	3840
aaactgaaat	cgaagtcaaa	tcaccaacc	gggagctcta	aatcagcaaa	cactcctcct	3900
ccacagtatc	caatcatcgt	gcacgatgct	ccaggatttg	caagccaggt	attgcaagct	3960
aggagtagga	tagagacctt	aaacgtcgtt	ggtgtgaaga	gtcatcttca	gacctaattg	4020
agatagatgt	agacggcggc	acgaagactc	tgaaacacca	gaaaggctag	tccaggataa	4080
ggatctgcta	tcccaactga	cctctcgtta	gtcccaaggc	ctctcaacta	gagcaggagg	4140
aaggatgggtc	acaagactag	gataatgatg	tttccaatat	gaacctgaat	gtccatagct	4200
aattttttta	gtcttgcttc	tgcacttttt	gtttattatg	ttctggtgac	tatgttattt	4260
acccttgctc	gtatgcttga	gggtacccta	gtagattggg	tggttggttt	ccatgtacca	4320
gaaggcttac	cctattagtt	gaaagttgaa	actttgttcc	ctactcaatt	cctagttgtg	4380
taaatgtatg	tatatgtaat	gtgtataaaa	cgtagtactt	aaatgactag	gagtggttct	4440
tgagaccgat	gagagatggg	agcagaacta	aagatgatga	cataattaag	aacgaatttg	4500
aaaggctctt	aggtttgaat	cctattcgag	aatgtttttg	tcaaagatag	tggcgatttt	4560
gaaccaaaga	aaacatttaa	aaaatcagta	tccggttacg	ttcatgcaaa	tagaaagtgg	4620
tctaggatct	gattgtaatt	ttagacttaa	agagtctctt	aagattcaat	cctggctgtg	4680
tacaaaacta	caaataatat	atttttagact	atttggcctt	aactaaactt	ccactcatta	4740
tttactgagg	ttagagaata	gacttgcgaa	taaacacatt	cccgagaaat	actcatgatc	4800
ccataattag	tcagagggta	tgccaatcag	atctaagaac	acacattccc	tcaaatttta	4860
atgcacatgt	aatcatagtt	tagcacaatt	caaaaataat	gtagtattaa	agacagaaat	4920
ttgtagactt	ttttttggcg	ttaaaagaag	actaagttta	tacgtacatt	ttattttaag	4980
tggaaaaccg	aaattttcca	tcgaaatata	tgaatttagt	atatatat	ctgcaatgta	5040
ctattttgct	attttggcaa	ctttcagtgg	actactactt	tattacaatg	tgtatggatg	5100
catgagtttg	agtatacaca	tgtctaaatg	catgctttgt	aaaacgtaac	ggaccacaaa	5160
agaggatcca	tacaaataca	tctcatagct	tcctccatta	ttttccgaca	caaacagagc	5220
attttacaac	aattaccaac	aacaacaaac	aacaaacaac	attacaatta	catttacaat	5280
taccatacca	tggcctctat	cgctatccct	gctgctcttg	ctggaaactct	tggatacggt	5340
acctacaatg	tggctaaccc	tgatatccca	gcttctgaga	aagttcctgc	ttacttcatg	5400
caggttgagt	actggggacc	tactatcgga	actattggat	acctcctctt	catctacttc	5460
ggaaagcgta	tcatgcagaa	cagatctcaa	cctttcggac	tcaagaacgc	tatgctcggt	5520
tacaacttct	accagacctt	cttcaacagc	tactgcatct	accttttcgt	tacttctcat	5580
agggctcagg	gacttaaggt	ttggggaaac	atccctgata	tgactgctaa	ctcttgggga	5640

517416 Sequence Listing

atctctcagg ttatctggct tcaactacaac aacaagtacg ttgagcttct cgacaccttc	5700
ttcatggtga tgaggaagaa gttagcaccag ctttctttcc ttcacatcta ccaccacact	5760
cttctcatct ggtcatggtt cgttggttatg aagcttgagc ctggttgaga ttgctacttc	5820
ggatcttctg ttaacacctt cgtgcacgtg atcatgtact cttactacgg acttgctgct	5880
cttgaggtta actgtttctg gaagaagtac atcaccaga tccagatgct tcagttctgt	5940
atctgtgctt ctactctat ctacaccgct tacgttcaga ataccgcttt ctggcttcct	6000
taccttcaac tctgggttat ggtgaacatg ttcgttctct tcgccaaactt ctaccgtaag	6060
aggatcaagt ctaagggtgc taagaagcag tgataaggcg cgcggcgcg cgggccgccg	6120
ccatgtgaca gatcgaagga agaaagtgtg ataagacgac tctcactact cgatcgctag	6180
tgattgtcat tgttatatat aataatgtta tctttcacaa cttatcgtaa tgcattgtga	6240
actataacac attaatccta cttgtcatat gataacactc tccccattta aaactcttgt	6300
caatttaaag atataagatt ctttaaatga ttaaaaaaaaa tatattataa attcaatcac	6360
tcctactaat aaattattaa ttattattta ttgattaaaa aaatacttat actaatttag	6420
tctgaataga ataattagat tctagtctca tcccctttta aaccaactta gtaaactgtt	6480
ttttttttta ttttatgaag ttaagttttt accttgtttt taaaaagaat cgttcataag	6540
atgccatgcc agaacattag ctacacgtta cacatagcat gcagccgcgg agaattgttt	6600
ttcttcgcca cttgtcactc ctttcaaaca cctaagagct tctctctcac agcacacaca	6660
tacaatcaca tgcgtgcatg cattattaca cgtgatcgcc atgcaaactt cttttatagc	6720
ctataaatta actcatccgc ttcactcttt actcaaacca aaactcatcg atacaaacaa	6780
gattaaaaac atacacgagg atctttttaca acaattacca acaacaacaa acaacaacaa	6840
acattacaat tacatttaca attaccatac catgcctcca agggactctt actcttatgc	6900
tgctcctcct tctgctcaac ttcacgaagt tgatactcct caagagcacg acaagaaaga	6960
gcttggttat ggagataggg cttacgatgt taccaacttc gttaagagac accctggtgg	7020
aaagatcatt gcttaccaag ttggaactga tgctaccgat gcttacaagc agttccatgt	7080
tagatctgct aaggctgaca agatgcttaa gtctcttcct tctcgtcctg ttcacaaggg	7140
atactctcca agaagggtg atcttatcgc tgattttcaa gagttacca agcaacttga	7200
ggctgagggg atgttcgagc cttctcttcc tcatgttgct tacagacttg ctgaggttat	7260
cgctatgcat gttgctggtg ctgctcttat ctggcatgga tacactttcg ctggaatcgc	7320
tatgcttgga gttgttcagg gaagatgtgg atggcttatg catgaggggtg gacattactc	7380
tctcactgga aacattgctt tcgacagagc tatccaagtt gcttggttac gacttggtatg	7440
tggaatgtct ggtgcttggt ggcgtaacca gcataacaag caccatgcta ctcctcaaaa	7500
gcttcagcac gatgttgatc ttgataacct tcctctcggt gctttccatg agagaatcgc	7560
tgctaagggt aagtctcctg ctatgaaggc ttggctttct atgcaagcta agcttttcgc	7620
tcctgttacc actcttcttg ttgctcttgg atggcagctt taccttcac ctagacacat	7680

517416 Sequence Listing

gctcaggact aagcactacg atgagcttgc tatgctcgga atcagatacg gacttgttgg	7740
ataccttgct gctaactacg gtgctggata cgttctcgct tgttaccttc tttacgttca	7800
gcttggagct atgtacatct tctgcaactt cgctgtttct catactcacc tccctgttgt	7860
tgagcctaac gagcatgcta cttgggttga gtacgctgct aaccacacta ctaactgttc	7920
tccatcttgg tgggtgtgatt ggtggatgtc ttaccttaac taccagatcg agcaccacct	7980
ttacccttct atgcctcaat tcagacaccc taagatcgct cctagagtta agcagctttt	8040
cgagaagcac ggacttcact acgatgttag aggatacttc gaggctatgg ctgatacttt	8100
cgctaaccctt gataacgttg cccatgctcc tgagaagaaa atgcagtaat gagatcgttc	8160
aaacatttgg caataaagtt tcttaagatt gaatcctgtt gccggtcttg cgatgattat	8220
catataattt ctgttgaatt acgttaagca cgtaataatt aacatgtaat gcatgacgtt	8280
atztatgaga tgggttttta tgattagagt cccgcaatta tacatttaat acgcataga	8340
aaacaaaata tagcgcgcaa actaggataa attatcgcgc gcggtgtcat ctatgttact	8400
agatcggtcg attaaaaatc ccaattatat ttggtctaatt ttagtttggg attgagtaaa	8460
acaaattcga accaaaccaa aatataaata tatagttttt atatatatgc ctttaagact	8520
ttttatagaa ttttctttaa aaaatatcta gaaatatatt cgactcttct ggcatgtaat	8580
atctcgttaa atatgaagtg ctccattttt attaacttta aataattggg tgtacgatca	8640
ctttcttatac aagtgttact aaaatgcgtc aatctctttg ttcttccata ttcatatgtc	8700
aaaatctatc aaaattctta tatatctttt tcgaatttga agtgaaattt cgataattta	8760
aaattaaata gaacatatca ttatttaggt atcatattga tttttatact taattactaa	8820
atcttggttaa ctttgaaagt gtacatcaac gaaaaattag tcaaacgact aaaataaata	8880
aatatcatgt gttattaaga aaattctcct ataagaatat tttaatagat catatgtttg	8940
taaaaaaaaat taatttttac taacacatat atttacttat caaaaatttg acaaagtaag	9000
attaaaataa tattcatcta acaaaaaaaaa aaccagaaaa tgctgaaaac ccggcaaac	9060
cgaaccaatc caaaccgata tagttggttt ggtttgattt tgatataaac cgaaccaact	9120
cggtccattt gcaccctaa tcataatagc tttaatatat caagatatta ttaagttaac	9180
gttgtcaata tcctggaaat ttgcaaaat gaatcaagcc tatatggctg taatatgaat	9240
ttaaaagcag ctcatgtgtg tggtaatatg taatttactt gattctaaaa aaatatccca	9300
agtattaata atttctgcta ggaagaagg tagctacgat ttacagcaaa gccagaatac	9360
aaagaaccat aaagtgattg aagctcgaaa tatacgaagg aacaaatatt tttaaaaaaa	9420
tacgcaatga cttggaacaa aagaaagtga tatatttttt gttcttaaac aagcatcccc	9480
tctaaagaat ggcagttttc ctttgcatgt aactattatg ctcccttcgt taaaaaatt	9540
ttggactact attgggaact tcttctgaaa atagtgatag aaccacacg agcatgtgct	9600
ttccatttaa ttttaaaaac caagaaacat acatacataa cattccatca gcctctctct	9660
ctttttatta cggttaatga cttaaaacac atcttattat cccatcctta acacctagca	9720

517416 Sequence Listing

gtgtctttat	acgatctcat	cgatcaccac	ttcaaaacca	tgagactgc	tgctgcccct	9780
ggagctggca	tcggctaggc	tgggtgccgc	actgtcccgg	aaggctcccta	gcgacttggt	9840
tagattgatg	ggaccacctc	tcaacttcct	gctgctgtcc	ctgctgctgg	atgtcctgcc	9900
tcatctggcc	gattgcacgc	tccagtcccc	tgcatgtgca	ctcgctcctc	aattgcttaa	9960
gatcatcgca	gcagctatcg	aagtgtggc	tctgttgccc	tcctccacgg	ccttggttgt	10020
agtagtagct	gccgccgccc	ttctggactt	tttcccacag	gaaccgccga	ataattcgat	10080
agaaccacac	gagcatgtgc	tttcatttat	tttaaaaacc	aagaaacata	cataacattt	10140
catcagcctc	tctctctctc	tctctctctc	tctctctctc	tctctctctc	tctctctctt	10200
tattacagct	gttacactaa	cttaaaacac	attcatctca	ttattattat	tattatccat	10260
ccttaacacc	tagcagtgtc	tttgtacgat	ctcataatcg	atcaccctt	catcaggtat	10320
ccttaggctt	cactccaacg	ttgttgacgt	tacggaacat	gtacacacca	tcatggttct	10380
caacgaactg	gcaagatctc	caagttttcc	aaaggctaac	ccacatgttc	tcatcggtgt	10440
gtctgtagt	ctctcccata	actttcttga	tgcaactcgt	agcttctcta	gcatggtaga	10500
atgggatcct	tgaaacgtag	tgatggagca	catgagtctc	gatgatgtca	tggaagatga	10560
ttccgaggat	tccgaactct	ctatcgatag	tagcagcagc	acccttagcg	aaagtccact	10620
cttgagcatc	gtaatgaggc	atagaagaat	cgggtgtgctg	aaggaaggta	acgaaaacaa	10680
gccagtgggt	aacaaggatc	caaggacaga	accatgtgat	gaaagtaggc	cagaatccga	10740
aaaccttgta	agcgggtgta	acagaagtga	gggtagcaag	gattccaaga	tcagaaagaa	10800
cgatgtacca	gtagtccttc	ttatcgaaaa	cagggctaga	aggccagtag	tgagacttga	10860
agaacttaga	aacaccaggg	taaggttgtc	cagtagcgtt	agtagcaagg	taaagagaaa	10920
gtcctccaag	ctgttggaac	aagagagcga	aaacagagta	gataggagtt	tcctcagcga	10980
tatcgtgaag	gctggtaact	tggtgcttct	ctttgaattc	ctcggcgggtg	taaggaacga	11040
aaaccatata	tctgggtcatg	tgtccagtag	ccttatgggtg	ccttagcatga	gagaacttcc	11100
agctgaagta	aggaaccata	acaagagagt	ggagaaccca	tccaacggta	tcgttaaccc	11160
atccgtagtt	agagaaagca	gaatgtccac	actcatgtcc	aaggatccag	attccgaatc	11220
cgaacaaga	gatagagaac	acgtaagcag	accaagcagc	gaatctaagg	aattcggttag	11280
ggagaagagg	gatgtaggta	agtccaacgt	aagcgatagc	agagatagcc	acgatatctc	11340
tcaccacgta	agacatagac	ttcacgagag	atctctcgta	acagtgccta	gggatagcgt	11400
caaggatatc	cttgatgggtg	taatctggca	ccttgaaaac	gtttccgaag	gtatcgatag	11460
cggctctttt	ctgcttgaaa	gatgcaacgt	ttccagaacg	cctaacgggtc	ttagtagatc	11520
cctcaaggat	ctcagatcca	gacacggtaa	ccttagacat	ggtatggtaa	ttgtaaatgt	11580
aattgtaatg	ttgtttgttg	ttgtttgttg	ttggtaattg	ttgtaaaatt	tttggtgggtg	11640
attggttctt	taagggtgtga	gagtgtgttg	tgagtgtgtg	ggtgggtttg	gtgagattgg	11700
ggatgggtggg	tttatatagt	ggagactgag	gaatgggggtc	gtgagtgtta	actttgcatg	11760

517416 Sequence Listing

ggctacacgt	gggttctttt	gggcttacac	gtagtattat	tcatgcaa	gcagccaata	11820
catatacgg	attttaataa	tgtgtgggaa	tacaatatgc	cgagtatttt	actaattttg	11880
gcaatgacaa	gtgtacattt	ggattatctt	acttggcctc	tcttgcttta	atttggatta	11940
tttttattct	cttaccttgg	ccgttcatat	tcacatccct	aaaggcaaga	cagaattgaa	12000
tggtggccaa	aaattaaaac	gatggatatg	acctacatag	tgtaggatca	attaacgtcg	12060
aaggaaaata	ctgattctct	caagcatacg	gacaagggta	aataacatag	tcaccagaac	12120
ataataaaca	aaaagtgcag	aagcaagact	aaaaaaatta	gctatggaca	ttcaggttca	12180
tatttgaaac	atcattatcc	tagtcttgtg	accatccttc	ctcctgctct	agttgagagg	12240
ccttgggact	aacgagaggt	cagttgggat	agcagatcct	tatcctggac	tagcctttct	12300
gggtgtttcag	agtcttcgtg	ccgccgtcta	catctatctc	cattaggtct	gaagatgact	12360
cttcacacca	acgacgttta	aggtctctat	cctactccta	gcttgcaata	cctggcttgc	12420
aatacctgga	gcatcgtgca	cgatgattgg	atactgtgga	ggaggagtgt	ttgctgattt	12480
agagctcccg	gttgggtgat	ttgacttcga	tttcagttta	ggcttgttga	aatttttcag	12540
gttccattgt	gaagccttta	gagcttgagc	ttccttccat	gttaatgcct	tgatcgaata	12600
ctcctagaga	aaagggaggt	cgatctctga	gtattgaaat	cgaagtgcac	atTTTTTTTc	12660
aacgtgtcca	atcaatccac	aaacaaagca	gaagacaggt	aatctttcat	acttatactg	12720
acaagtaata	gtcttaccgt	catgcataat	aacgtctcgt	tccttcaaga	gggtttttcc	12780
gacatccata	acgacccgaa	gcctcatgaa	agcattaggg	aagaactttt	ggttcttctt	12840
gtcatggcct	ttataggtgt	cagccgagct	cgccaattcc	cgtccgactg	gctccgcaaa	12900
atattcgaac	ggcaagttat	ggacttgcaa	ccataactcc	acggtattga	gcaggaccta	12960
ttgtgaagac	tcatctcatg	gagcttcaga	atgtgggtgt	cagcaaacca	atgaccgaaa	13020
tccatcacat	gacggacgtc	cagtgggtga	gcgaaacgaa	acaggaagcg	cctatctttc	13080
agagtcgtga	gctccacacc	ggattccggc	aactacgtgt	tgggcaggct	tcgccgtatt	13140
agagatatgt	tgaggcagac	ccatctgtgc	cactcgtaca	attacgagag	ttgttttttt	13200
tgtgattttc	ctagtctctc	gttgatgggtg	agctcatatt	ctacatcgta	tggctctctca	13260
acgtcgtttc	ctgtcatctg	atatcccgtc	atTTTgcattc	acgtgcgccg	cctcccgtgc	13320
caagtcctta	ggtgtcatgc	acgccaaatt	ggtgggtgggtg	cgggctgccc	tgtgcttctt	13380
accgatgggt	ggaggttgag	tttgggggtc	tccgcggcga	tggtagtggg	ttgacggttt	13440
ggtgtgggtt	gacggcattg	atcaattttac	ttcttgcttc	aaattctttg	gcagaaaaca	13500
attcattaga	ttagaactgg	aaaccagagt	gatgagacgg	attaagtcag	attccaacag	13560
agttacatct	cttaagaaat	aatgtaaccc	ctttagactt	tatatatttg	caattaaaaa	13620
aataatttaa	cttttagact	ttatatatag	ttttaataac	taagttaa	cactctatta	13680
tttataatcga	aactatttgt	atgtctcccc	tctaaataaa	cttgggtattg	tgtttacaga	13740
acctataatc	aaataatcaa	tactcaactg	aagtttgtgc	agttaattga	agggattaac	13800

517416 Sequence Listing

ggccaaaatg	cactagtagt	atcaaccgaa	tagattcaca	ctagatggcc	atttccatca	13860
atatcatcgc	cgttcttctt	ctgtccacat	atccccctctg	aaacttgaga	gacacctgca	13920
cttcattgtc	cttattacgt	gttacaaaat	gaaacccatg	catccatgca	aactgaagaa	13980
tggcgcaaga	acccttcccc	tccatttctt	atgtggcgac	catccatttc	accatctccc	14040
gctataaaac	acccccatca	cttcacctag	aacatcatca	ctacttgctt	atccatccaa	14100
aagataccca	cttttacaac	aattaccaac	aacaacaaac	aacaaacaac	attacaatta	14160
catttacaat	taccatacca	tgccacctag	cgctgctaag	caaatgggag	cttctactgg	14220
tgttcatgct	gggtgttactg	actcttctgc	tttcaccaga	aaggatgttg	ctgatagacc	14280
tgatctcacc	atcgttggag	attctgttta	cgatgctaag	gctttcagat	ctgagcatcc	14340
tggtggtgct	catttcgttt	ctttgttcgg	aggaagagat	gctactgagg	ctttcatgga	14400
ataccataga	agggcttggc	ctaagtctag	aatgtctaga	ttccacgttg	gatctcttgc	14460
ttctactgag	gaacctgttg	ctgctgatga	gggatacctt	caactttgtg	ctaggatcgc	14520
taagatgggtg	ccttctgttt	cttctggatt	cgctcctgct	tcttactggg	ttaaggctgg	14580
acttatcctt	ggatctgcta	tcgctcttga	ggcttacatg	ctttacgctg	gaaagagact	14640
tctcccttct	atcgttcttg	gatggctttt	cgctcttatac	ggctctaaca	tccagcatga	14700
tgctaaccat	ggtgctttgt	ctaagtctgc	ttctgttaac	cttgctcttg	gactttgtca	14760
ggattggatc	ggaggatcta	tgatcctttg	gcttcaagag	catgttggtta	tgcaccacct	14820
ccacactaac	gatgttgata	aggatcctga	tcaaaaggct	cacggtgctc	ttagactcaa	14880
gcctactgat	gcttggtcac	ctatgcattg	gcttcagcat	ctttaccttt	tgcttggtga	14940
gactatgtac	gctttcaagc	ttttgttcct	cgacatctct	gagcttggtta	tgtggcggtg	15000
ggaggggtgag	cctatctcta	agcttgctgg	atacctcttt	atgccttctt	tgcttctcaa	15060
gcttaccttc	tgggctagat	tcgttgcttt	gcctctttac	cttgctcctt	ctgttcatac	15120
tgctgtgtgt	atcgctgcta	ctgttatgac	tggatctttc	tacctcgctt	tcttcttctt	15180
catctccac	aacttcgagg	gtgttgcttc	tgttggaacct	gatggatcta	tcacttctat	15240
gactagaggt	gctagcttcc	ttaagagaca	agctgagact	tcttctaacg	ttggaggacc	15300
tcttcttgct	actcttaacg	gtggactcaa	ctaccaaaatt	gagcatcact	tgttccctag	15360
agttcaccat	ggattctacc	ctagacttgc	tcctcttggt	aaggctgagc	ttgaggctag	15420
aggaatcgag	tacaagcact	accctactat	ctggtctaac	cttgcttcta	ccctcagaca	15480
tatgtacgct	cttgggaagaa	ggcctagatc	taaggctgag	taatgacaag	cttatgtgac	15540
gtgaaataat	aacggtaaaa	tatatgtaat	aataataata	ataaagccac	aaagtgagaa	15600
tgaggggaag	gggaaatgtg	taatgagcca	gtagccggtg	gtgctaattt	tgtatcgtat	15660
tgtcaataaa	tcatgaattt	tgtggttttt	atgtgttttt	ttaaatacatg	aattttaaat	15720
tttataaaat	aatctccaat	cggaagaaca	acattccata	tccatgcatg	gatgtttctt	15780
tacccaaatc	tagttcttga	gaggatgaag	catcaccgaa	cagttctgca	actatccctc	15840

517416 Sequence Listing

aaaagcttta	aatgaacaa	caaggaacag	agcaacgttc	caaagatccc	aaacgaaaca	15900
tattatctat	actaatacta	tattattaat	tactactgcc	cggaatcaca	atccctgaat	15960
gattcctatt	aactacaagc	cttggtggcg	gcggaagaagt	gatcggcgcg	gcgagaagca	16020
gcggaactcg	agacgaggcc	ttggaagatc	tgagtcgaac	gggcagaatc	agtattttcc	16080
ttcgacgtta	attgatccta	cactatgtag	gtcatatcca	tcgttttaat	ttttggccac	16140
cattcaattc	tgtcttgcc	ttagggatgt	gaatatgaac	ggccaaggta	agagaataaa	16200
aataatccaa	attaaagcaa	gagaggccaa	gtaagataat	ccaaatgtac	acttgtcatt	16260
gccaaaatta	gtaaaatact	cggcataattg	tattcccaca	cattattaaa	ataccgtata	16320
tgtattggct	gcatttgcat	gaataatact	acgtgtaagc	ccaaaagaac	ccacgtgtag	16380
cccatgcaaa	gttaacactc	acgaccccat	tcctcagtct	ccactatata	aaccaccat	16440
ccccaatctc	accaaacc	ccacacaact	cacaactcac	tctcacacct	taaagaacca	16500
atcaccacca	aaaattttac	aacaattacc	aacaacaaca	aacaacaaac	aacattacaa	16560
ttacatttac	aattaccata	ccatgagcgc	tgttaccgtt	actggatctg	atcctaagaa	16620
cagaggatct	tctagcaaca	ccgagcaaga	ggttccaaaa	gttgctatcg	ataccaacgg	16680
aaacgtgttc	tctgttcctg	atttcacat	caaggacatc	cttggagcta	tccctcatga	16740
gtgttacgag	agaagattgg	ctacctctct	ctactacgtg	ttcagagata	tcttctgcat	16800
gcttaccacc	ggataacctta	cccataagat	cctttaccct	ctcctcatct	cttacacctc	16860
taacagcatc	atcaagttca	ctttctgggc	cctttacact	tacgttcaag	gacttttcgg	16920
aaccggaatc	tgggttctcg	ctcatgagtg	tggacatcaa	gctttctctg	attacggaat	16980
cgtgaacgat	ttcgttggat	ggacccttca	ctcttacctt	atgggttcctt	acttcagctg	17040
gaagtactct	catggaaagc	accataaggc	tactggacac	atgaccagag	atatggtttt	17100
cgttcctgcc	accaaagagg	aattcaagaa	gtctaggaac	ttcttcggta	acctcgctga	17160
gtactctgag	gattctccac	ttagaaccct	ttacgagctt	cttgttcaac	aacttggagg	17220
atggatcgct	tacctcttcg	ttaacgttac	aggacaacct	tacctgatg	ttccttcttg	17280
gaaatggaac	cacttctggc	ttacctctcc	acttttcgag	caaagagatg	ctctctacat	17340
cttcctttct	gatcttggaa	tcctcaccca	gggaatcggt	cttactcttt	ggtacaagaa	17400
attcggaaga	tggtcccttt	tcatcaactg	gttcgttcct	tacatctggg	ttaaccactg	17460
gctcgttttc	atcacattcc	ttcagcacac	tgatcctact	atgcctcatt	acaacgctga	17520
ggaatggact	ttcgctaagg	gtgctgctgc	tactatcgat	agaaagtctg	gattcatcgg	17580
acctcacatc	ttccatgata	tcatcgagac	tcatgtgctt	caccactact	gttctaggat	17640
cccattctac	aacgctagac	ctgcttctga	ggctatcaag	aaagttatgg	gaaagcacta	17700
caggtctagc	gacgagaaca	tgtggaagtc	actttggaag	tctttcaggt	cttgccaata	17760
cgttgacggt	gataacggtg	ttctcatggt	ccgtaacatc	aacaactgcg	gagttggagc	17820
tgctgagaag	taatgaagg	gtgatcgatt	atgagatcgt	acaaagacac	tgctaggtgt	17880

517416 Sequence Listing

taaggatgga	taataataat	aataatgaga	tgaatgtggt	taaagttagt	gtaacagctg	17940
taataaagag	agagagagag	agagagagag	agagagagag	agagagagag	agagagaggc	18000
tgatgaaatg	ttatgtatgt	ttcttggttt	ttaaaataaa	tgaaagcaca	tgctcgtgtg	18060
gttctatcga	attattcggc	ggttcctgtg	ggaaaaagtc	cagaagggcc	gccgcagcta	18120
ctactacaac	caaggccgtg	gaggagggca	acagagccag	cacttcgata	gctgctgcga	18180
tgatcttaag	caattgagga	gcgagtgcac	atgcagggga	ctggagcgtg	caatcggcca	18240
gatgaggcag	gacatccagc	agcagggaca	gcagcaggaa	gttgagaggt	ggccccatca	18300
atctaaacaa	gtcgctaggg	accttccggg	acagtgcggc	accagccta	gccgatgccca	18360
gctccagggg	cagcagcagt	ctgcatgggt	ttgaagtggg	gatcgatgag	atcgataaaa	18420
gacactgcta	ggtggttaagg	atgggataat	aagatgtggt	taaagtcatt	aaccgtaata	18480
aaaagagaga	gaggctgatg	gaatgttatg	tatgtatggt	tcttggtttt	taaaattaaa	18540
tggaagcac	atgctcgtgt	gggttctatc	tcgattaaaa	atcccaatta	tatttggtct	18600
aatttagttt	ggtattgagt	aaaacaaatt	cgaaccaaac	caaaatataa	atatatagtt	18660
tttatatata	tgcccttaag	actttttata	gaattttctt	taaaaaatat	ctagaaatat	18720
ttgcgactct	tctggcatgt	aatatttcgt	taaatatgaa	gtgctccatt	tttattaact	18780
ttaaataatt	ggttgtagca	tcactttctt	atcaagtgtt	actaaaatgc	gtcaatctct	18840
ttgttcttcc	atattcatat	gtcaaaatct	atcaaaattc	ttatatatct	ttttcgaatt	18900
tgaagtgaag	tttcgataat	ttaaaattaa	atagaacata	tcattattta	ggatcatat	18960
tgatttttat	acttaattac	taaatttggg	taactttgaa	agtgtacatc	aacgaaaaat	19020
tagtcaaacg	actaaaataa	ataaatatca	tgtgttatta	agaaaattct	cctataagaa	19080
tattttaata	gatcatatgt	ttgtaaaaaa	aattaatttt	tactaacaca	tatatttact	19140
tatcaaaaat	ttgacaaagt	aagattaaaa	taatattcat	ctaacaaaaa	aaaaaccaga	19200
aaatgctgaa	aaccgcggca	aaccgaacca	atccaaaccg	atatagttgg	tttggtttga	19260
ttttgatata	aaccgaacca	actcgggtcca	tttgcacccc	taatcataat	agctttaata	19320
tttcaagata	ttattaagtt	aacgttgtca	atatcctgga	aattttgcaa	aatgaatcaa	19380
gcctatatgg	ctgtaatatg	aattttaaag	cagctcgtatg	tggtggtaat	atgtaattta	19440
cttgattcta	aaaaaatatc	ccaagtatta	ataatttctg	ctaggaagaa	ggtagctac	19500
gatttacagc	aaagccagaa	tacaaagaac	cataaagtga	ttgaagctcg	aaatatacga	19560
aggaacaaat	atttttaaaa	aaatacgcaa	tgacttgga	caaaagaaag	tgatatattt	19620
tttggttcta	aacaagcatc	ccctctaaag	aatggcagtt	ttcctttgca	tgtaactatt	19680
atgctccctt	cgttacaaaa	attttggtact	actattggga	acttcttctg	aaaatagtcc	19740
tgcaggctag	tagattgggt	ggttgggtttc	catgtaccag	aaggcttacc	ctattagttg	19800
aaagttgaaa	ctttgttccc	tactcaattc	ctagttgtgt	aaatgtatgt	atatgtaatg	19860
tgtataaaac	gtagtactta	aatgactagg	agtggttctt	gagaccgatg	agagatggga	19920

517416 Sequence Listing

gcagaactaa	agatgatgac	ataattaaga	acgaatttga	aaggctctta	ggtttgaatc	19980
ctattcgaga	atgtttttgt	caaagatagt	ggcgattttg	aaccaaagaa	aacattttaa	20040
aaatcagtat	ccggttacgt	tcatgcaaat	agaaagtggg	ctaggatctg	attgtaattt	20100
tagacttaaa	gagtctctta	agattcaatc	ctggctgtgt	acaaaactac	aaataatata	20160
ttttagacta	tttggcctta	actaaacttc	cactcattat	ttactgaggt	tagagaatag	20220
acttgcgaa	aaacacattc	ccgagaaata	ctcatgatcc	cataattagt	cagagggtat	20280
gccaatcaga	tctaagaaca	cacattccct	caaattttta	tgcacatgta	atcatagttt	20340
agcacaaatc	aaaaataatg	tagtattaaa	gacagaaatt	tgtagacttt	tttttggcgt	20400
taaaagaaga	ctaagtttat	acgtacattt	tatttttaagt	ggaaaaccga	aattttccat	20460
cgaatatata	gaatttagta	tatatatttc	tgcaatgtac	tattttgcta	ttttggcaac	20520
tttcagtgga	ctactacttt	attacaatgt	gtatggatgc	atgagtttga	gtatacacat	20580
gtctaaatgc	atgctttgta	aaacgtaacg	gaccacaaaa	gaggatccat	acaaatacat	20640
ctcatagctt	cctccattat	tttccgacac	aaacagagca	ttttacaaca	attaccaaca	20700
acaacaaaca	acaacaca	ttacaattac	atttacaatt	accataccat	ggaatttgct	20760
caacctctcg	ttgctatggc	tcaagagcag	tacgctgcta	tcgatgctgt	tgttgctcct	20820
gctatcttct	ctgctaccga	ctctattgga	tggggactca	agcctatctc	ttctgctact	20880
aaggatctcc	ctctcgttga	atctcctacc	cctcttatcc	tttctctcct	cgcttacttc	20940
gctatcgttg	gttctggact	cgtttaccgt	aaagtgttcc	ctagaaccgt	taagggacag	21000
gatcctttcc	ttctcaaggc	tcttatgctc	gctcacaacg	ttttccttat	cggactcagc	21060
ctttacatgt	gcctcaagct	cgttttacgag	gcttacgtga	acaagtactc	cttctgggga	21120
aacgcttaca	accctgctca	aaccgagatg	gctaagggtga	tctggatctt	ctacgtgtcc	21180
aagatctacg	agttcatgga	caccttcac	atgcttctca	agggaaacgt	taaccagggt	21240
tccttctctc	atgtttacca	ccacggatct	atctctggaa	tctggtggat	gatcacttat	21300
gctgctccag	gtggagatgc	ttacttctct	gctgctctca	actcttgggt	tcatgtgtgc	21360
atgtacacct	actacttcat	ggctgctggt	cttcctaagg	acgaaaagac	caagagaaag	21420
tacctttggg	ggggaagata	ccttaccag	atgcaaagt	tccagttctt	catgaacctt	21480
ctccaggctg	tttacctcct	ctactcttct	tctccttacc	ctaagttcat	tgctcaactc	21540
ctcgttggtt	acatggttac	cctcctcatg	cttttcggaa	acttctacta	catgaagcac	21600
cacgcttcta	agtgataagg	gccgccgcca	tgtgacagat	cgaaggaaga	aagtgtata	21660
agacgactct	cactactcga	tcgctagtga	ttgtcattgt	tatatataat	aatgttatct	21720
ttcacaactt	atcgtaatgc	atgtgaaact	ataacacatt	aatcctactt	gtcatatgat	21780
aacactctcc	ccatttataa	ctcttgctca	tttaaagata	taagattctt	taaagtatta	21840
aaaaaaatat	attataaatt	caatcactcc	tactaataaa	ttattaatta	ttattttattg	21900
attaaaaaaa	tacttatact	aatttagtct	gaatagaata	attagattct	agcctgcagg	21960

517416 Sequence Listing

gcggccgcgg atcccatgga gtcaaagatt caaatagagg acctaacaga actcgccgta	22020
aagactggcg aacagttcat acagagtctc ttacgactca atgacaagaa gaaaatcttc	22080
gtcaacatgg tggagcacga cacacttgtc tactccaaaa atatcaaaga tacagtctca	22140
gaagaccaaa gggcaattga gacttttcaa caaagggtaa tatccggaaa cctcctcgga	22200
ttccattgcc cagctatctg tcactttatt gtgaagatag tggaaaagga aggtggctcc	22260
tacaaatgcc atcattgcga taaaggaaag gccatcgttg aagatgcctc tgccgacagt	22320
gggtcccaaag atggaccccc acccacgagg agcatcgtgg aaaaagaaga cgttccaacc	22380
acgtcttcaa agcaagtgga ttgatgtgat atctccactg acgtaaggga tgacgcacaa	22440
tcccactatc cttcgcaaga ccttcctct atataaggaa gttcatttca tttggagaga	22500
acacggggga ctgaattaaa tatgagccct gagaggcgtc ctgttgaaat cagacctgct	22560
actgctgctg atatggctgc tgtttgatgat atcgtgaacc actacatcga gacttctacc	22620
gttaacttca gaactgagcc tcaaaactct caagagtgga tcgatgatct tgagagactc	22680
caagatagat acccttggtc tgttgctgag gttgagggtg ttgttgctgg aatcgcttac	22740
gctggacctt ggaaggctag aaacgcttac gattggactg ttgagtctac cgtttacgtt	22800
tcacacagac atcagagact tggacttgga tctacccttt aactcacct tctcaagtct	22860
atggaagctc agggattcaa gtctgttggt gctgttatcg gactccctaa cgatccttct	22920
gttagacttc atgaggctct tggatacact gctagaggaa ctcttagagc tgctggatac	22980
aagcacggtg gatggcatga tggtggattc tggcaaagag atttcgagct tcctgctcct	23040
cctagacctg ttagaccagt tactcagatc tgaatttgcg tgatcgttca aacatttggc	23100
aataaagttt cttgaatttg aatcctgttg ccggtcctgc gatgattatc atataatttc	23160
tgttgaatta cgtaagcat gtaataatta acatgtaatg catgacgtta tttatgagat	23220
gggtttttat gattagagtc ccgcaattat acatttaata cgcgatagaa aacaaaatat	23280
agcgcgcaaa ctaggataaa ttatcgcgcg cgggtgtcatc tatgttacta gatcactagt	23340
gatgtacggt taaaaccacc ccagtacatt aaaaacgtcc gcaatgtgtt attaagttgt	23400
ctaagcgtca atttgtttac accacaatat atcctgccac cagccagcca acagctcccc	23460
gaccggcagc tcggcacaaa atcaccactc gatacaggca gcccatcagt cc	23512

<210> 3

<211> 1254

<212> DNA

<213> Artificial Sequence

<220>

<223> Codon-optimized open reading frame for expression of Lachancea kluyveri 12 desaturase in plants

<400> 3

atgagcgctg ttaccgttac tggatctgat cctaagaaca gaggatcttc tagcaacacc	60
---	----

gagcaagagg ttccaaaagt tgctatcgat accaacggaa acgtgttctc tgttcctgat	120
---	-----

ttcaccatca aggacatcct tggagctatc cctcatgagt gttacgagag aagattggct	180
---	-----

517416 Sequence Listing

```

acctctctct actacgtggt cagagatatc ttctgcatgc ttaccaccgg ataccttacc      240
cataagatcc ttaccctct cctcatctct tacacctcta acagcatcat caagttcact      300
ttctgggccc ttacactta cggtcaagga cttttcggaa ccggaatctg ggttctcgct      360
catgagtgtg gacatcaagc tttctctgat tacggaatcg tgaacgattt cgttggatgg      420
acccttcact cttaccttat gggttccttac ttcagctgga agtactctca tggaaagcac      480
cataaggcta ctggacacat gaccagagat atgggttttcg ttcctgccac caaagaggaa      540
ttcaagaagt ctaggaactt cttcggtaac ctcgctgagt actctgagga ttctccactt      600
agaacccttt acgagcttct tggtcaacaa cttggaggat ggatcgctta cctcttcggt      660
aacgttacag gacaacctta ccctgatggt ccttcttgga aatggaacca cttctggcct      720
acctctccac ttttcgagca aagagatgct ctctacatct tcctttctga tcttggaatc      780
ctcaccaggg gaatcgttct tactctttgg tacaagaaat tcggaggatg gtcccttttc      840
atcaactggg tcgttcctta catctggggt aaccactggc tcgttttcat cacattcctt      900
cagcactctg atcctactat gcctcattac aacgctgagg aatggacttt cgctaagggt      960
gctgctgcta ctatcgatag aaagttcgga ttcatcggac ctcacatctt ccatgatatc     1020
atcgagactc atgtgcttca ccactactgt tctaggatcc cattctacaa cgctagacct     1080
gcttctgagg ctatcaagaa agttatggga aagcactaca ggtctagcga cgagaacatg     1140
tggaagtcac tttggaagtc tttcaggtct tgccaatacg ttgacggtga taacggtggt     1200
ctcatgttcc gtaacatcaa caactgcgga gttggagctg ctgagaagta atga           1254

```

```

<210> 4
<211> 416
<212> PRT
<213> Lachancea kluyveri

```

```

<400> 4

```

```

Met Ser Ala Val Thr Val Thr Gly Ser Asp Pro Lys Asn Arg Gly Ser
1          5          10          15

```

```

Ser Ser Asn Thr Glu Gln Glu Val Pro Lys Val Ala Ile Asp Thr Asn
20          25          30

```

```

Gly Asn Val Phe Ser Val Pro Asp Phe Thr Ile Lys Asp Ile Leu Gly
35          40          45

```

```

Ala Ile Pro His Glu Cys Tyr Glu Arg Arg Leu Ala Thr Ser Leu Tyr
50          55          60

```

```

Tyr Val Phe Arg Asp Ile Phe Cys Met Leu Thr Thr Gly Tyr Leu Thr
65          70          75          80

```

```

His Lys Ile Leu Tyr Pro Leu Leu Ile Ser Tyr Thr Ser Asn Ser Ile
85          90          95

```

517416 Sequence Listing

Ile Lys Phe Thr Phe Trp Ala Leu Tyr Thr Tyr Val Gln Gly Leu Phe
100 105 110

Gly Thr Gly Ile Trp Val Leu Ala His Glu Cys Gly His Gln Ala Phe
115 120 125

Ser Asp Tyr Gly Ile Val Asn Asp Phe Val Gly Trp Thr Leu His Ser
130 135 140

Tyr Leu Met Val Pro Tyr Phe Ser Trp Lys Tyr Ser His Gly Lys His
145 150 155 160

His Lys Ala Thr Gly His Met Thr Arg Asp Met Val Phe Val Pro Ala
165 170 175

Thr Lys Glu Glu Phe Lys Lys Ser Arg Asn Phe Phe Gly Asn Leu Ala
180 185 190

Glu Tyr Ser Glu Asp Ser Pro Leu Arg Thr Leu Tyr Glu Leu Leu Val
195 200 205

Gln Gln Leu Gly Gly Trp Ile Ala Tyr Leu Phe Val Asn Val Thr Gly
210 215 220

Gln Pro Tyr Pro Asp Val Pro Ser Trp Lys Trp Asn His Phe Trp Leu
225 230 235 240

Thr Ser Pro Leu Phe Glu Gln Arg Asp Ala Leu Tyr Ile Phe Leu Ser
245 250 255

Asp Leu Gly Ile Leu Thr Gln Gly Ile Val Leu Thr Leu Trp Tyr Lys
260 265 270

Lys Phe Gly Gly Trp Ser Leu Phe Ile Asn Trp Phe Val Pro Tyr Ile
275 280 285

Trp Val Asn His Trp Leu Val Phe Ile Thr Phe Leu Gln His Thr Asp
290 295 300

Pro Thr Met Pro His Tyr Asn Ala Glu Glu Trp Thr Phe Ala Lys Gly
305 310 315 320

Ala Ala Ala Thr Ile Asp Arg Lys Phe Gly Phe Ile Gly Pro His Ile
325 330 335

Phe His Asp Ile Ile Glu Thr His Val Leu His His Tyr Cys Ser Arg
340 345 350

Ile Pro Phe Tyr Asn Ala Arg Pro Ala Ser Glu Ala Ile Lys Lys Val
355 360 365

517416 Sequence Listing

Met Gly Lys His Tyr Arg Ser Ser Asp Glu Asn Met Trp Lys Ser Leu
370 375 380

Trp Lys Ser Phe Arg Ser Cys Gln Tyr Val Asp Gly Asp Asn Gly Val
385 390 395 400

Leu Met Phe Arg Asn Ile Asn Asn Cys Gly Val Gly Ala Ala Glu Lys
405 410 415

<210> 5
<211> 1251
<212> DNA
<213> *Pichia pastoris*

<400> 5
atgtctaagg ttaccgtgtc tggatctgag atccttgagg gatctactaa gaccgtagg 60
cgttctggaa acgttgcatac tttcaagcag caaaagaccg ctatcgatac cttcggaac 120
gttttcaagg tgccagatta caccatcaag gatataccttg acgctatccc taagcactgt 180
tacgagagat ctctcgtgaa gtctatgtct tacgtggtga gagatatcgt ggctatctct 240
gctatcgctt acgttggact tacctacatc cctcttctcc ctaacgaatt ccttagattc 300
gctgcttggt ctgcttacgt gttctctatc tcttgtttcg gattcggaaat ctggatcctt 360
ggacatgagt gtggacattc tgctttctct aactacggat gggttaacga taccgttggg 420
tggtttctcc actctcttgt tatggttcct tacttcagct ggaagttctc tcatgctaag 480
caccataagg ctactggaca catgaccaga gatatggttt tcgttcctta caccgccgag 540
gaattcaaag agaagcacca agttaccagc cttcacgata tcgctgagga aactcctatc 600
tactctgttt tcgctctctt gttccaacag cttggaggac tttctcttta ccttgctact 660
aacgctactg gacaacctta ccctggtggt tctaagttct tcaagtctca ctactggcct 720
tctagccctg ttttcgataa gaaggactac tggtagatcg ttctttctga tcttggaaatc 780
cttgctaccc tcacttctgt ttacaccgct tacaagggtt tcggattctg gcctactttc 840
atcacatggt tctgtccttg gatccttggt aaccactggc ttgttttcgt taccttcctt 900
cagcacaccg attcttctat gcctcattac gatgctcaag agtggacttt cgctaagggt 960
gctgctgcta ctatcgatag agagttcggg atcctcggaa tcatcttcca tgacatcatc 1020
gagactcatg tgctccatca ctacgtttca aggatcccat tctaccatgc tagagaagct 1080
accgagtga tcaagaaagt tatgggagag cactacagac acaccgatga gaacatgtgg 1140
gttagccttt ggaaaacttg gagatcttgc cagttcgttg agaaccatga tgggtgtgtac 1200
atgttccgta actgcaacaa cgttggagtg aagcctaagg atacctgatg a 1251

<210> 6
<211> 415
<212> PRT
<213> *Pichia pastoris*

<400> 6

517416 Sequence Listing

Met Ser Lys Val Thr Val Ser Gly Ser Glu Ile Leu Glu Gly Ser Thr
1 5 10 15

Lys Thr Val Arg Arg Ser Gly Asn Val Ala Ser Phe Lys Gln Gln Lys
20 25 30

Thr Ala Ile Asp Thr Phe Gly Asn Val Phe Lys Val Pro Asp Tyr Thr
35 40 45

Ile Lys Asp Ile Leu Asp Ala Ile Pro Lys His Cys Tyr Glu Arg Ser
50 55 60

Leu Val Lys Ser Met Ser Tyr Val Val Arg Asp Ile Val Ala Ile Ser
65 70 75 80

Ala Ile Ala Tyr Val Gly Leu Thr Tyr Ile Pro Leu Leu Pro Asn Glu
85 90 95

Phe Leu Arg Phe Ala Ala Trp Ser Ala Tyr Val Phe Ser Ile Ser Cys
100 105 110

Phe Gly Phe Gly Ile Trp Ile Leu Gly His Glu Cys Gly His Ser Ala
115 120 125

Phe Ser Asn Tyr Gly Trp Val Asn Asp Thr Val Gly Trp Val Leu His
130 135 140

Ser Leu Val Met Val Pro Tyr Phe Ser Trp Lys Phe Ser His Ala Lys
145 150 155 160

His His Lys Ala Thr Gly His Met Thr Arg Asp Met Val Phe Val Pro
165 170 175

Tyr Thr Ala Glu Glu Phe Lys Glu Lys His Gln Val Thr Ser Leu His
180 185 190

Asp Ile Ala Glu Glu Thr Pro Ile Tyr Ser Val Phe Ala Leu Leu Phe
195 200 205

Gln Gln Leu Gly Gly Leu Ser Leu Tyr Leu Ala Thr Asn Ala Thr Gly
210 215 220

Gln Pro Tyr Pro Gly Val Ser Lys Phe Phe Lys Ser His Tyr Trp Pro
225 230 235 240

Ser Ser Pro Val Phe Asp Lys Lys Asp Tyr Trp Tyr Ile Val Leu Ser
245 250 255

Asp Leu Gly Ile Leu Ala Thr Leu Thr Ser Val Tyr Thr Ala Tyr Lys
260 265 270

517416 Sequence Listing

Val Phe Gly Phe Trp Pro Thr Phe Ile Thr Trp Phe Cys Pro Trp Ile
275 280 285

Leu Val Asn His Trp Leu Val Phe Val Thr Phe Leu Gln His Thr Asp
290 295 300

Ser Ser Met Pro His Tyr Asp Ala Gln Glu Trp Thr Phe Ala Lys Gly
305 310 315 320

Ala Ala Ala Thr Ile Asp Arg Glu Phe Gly Ile Leu Gly Ile Ile Phe
325 330 335

His Asp Ile Ile Glu Thr His Val Leu His His Tyr Val Ser Arg Ile
340 345 350

Pro Phe Tyr His Ala Arg Glu Ala Thr Glu Cys Ile Lys Lys Val Met
355 360 365

Gly Glu His Tyr Arg His Thr Asp Glu Asn Met Trp Val Ser Leu Trp
370 375 380

Lys Thr Trp Arg Ser Cys Gln Phe Val Glu Asn His Asp Gly Val Tyr
385 390 395 400

Met Phe Arg Asn Cys Asn Asn Val Gly Val Lys Pro Lys Asp Thr
405 410 415

<210> 7
<211> 1392
<212> DNA
<213> Micromonas pusilla

<400> 7
atgtgcccgc cgaagacgga cggccgatcg tccccgcgat cgccgctgac gcgcagcaaa 60
tcctccgcgg aggcgctcga cgccaaggac gcgtcgaccg cgcccgtcga tctcaaaacg 120
ctcgagccgc acgagctcgc ggcgacgttc gagacgcgat ggggtgcgct ggaggacgtc 180
gagtacgacg tcacaaactt caaacacccg ggaggcagcg tgatattcta catgctcgcg 240
aacacgggcg cggacgccac ggaggcggtc aaggagttcc acatgcgatc gcttaaggcg 300
tggaagatgc tcagagcgct gccgtcgcgc cccgcggaga tcaaacgcag cgagagcgag 360
gacgcgccga tgttggagga tttcgcgcgg tggcgcgcgg agctcgaacg cgacgggttc 420
tttaagccct cgataacgca cgtcgcgtat cggttactcg agtcctcgc gaccttcgcc 480
ctcggcaccg ccctcatgta cgccgggtac ccgatcatcg cgtccgtcgt gtacggcgcg 540
ttcttcggcg ctcggtgcgg ttgggtccag cacgagggcg ggcacaactc gtcacgggg 600
tccgtctacg tcgacaagcg cctccaagcg atgacgtgcg gggtcgggct gtccacgagc 660
ggggagatgt ggaaccagat gcacaataag caccacgcga cgccgcagaa agtgaggcac 720
gacatggacc tggacacgac ccccgcggtg gcgtttttta acaccgccgt ggaggacaac 780

517416 Sequence Listing

cggccgaggg	ggttctcccg	cgcggtgggct	cggcttcagg	cgtggacgtt	cgtccccggtg	840
acctccgggc	tgctcgtcca	ggcgttcttg	atctacgtcc	tgaccccgcg	gcaggtgttg	900
cgaagaaga	actacgagga	ggcgctcgtg	atgctcgtct	ctcacgtcgt	caggaccgcg	960
gtgattaaac	tcgcgacggg	gtactcgtgg	cccgtcgcgt	actggtgggt	caccttcggc	1020
aactggatcg	cgtacatgta	cctcttcgcg	cacttctcca	cgagccacac	gcacctcccg	1080
gtcgtgccct	cggataagca	cctgagctgg	gtgaactacg	cggtcgatca	caccgtggac	1140
atcgaccctg	cgcgcgggta	cgtgaactgg	ttgatgggat	atctgaactg	ccaggtcatt	1200
catcacctgt	tcccggacat	gccgcagttt	cgccagccgg	aggtgagccg	gcggttcgtc	1260
ccgttcgcga	agaagtgggg	gctgaactac	aagggtgctgt	cctattacgg	cgcttggaa	1320
gcgacgttct	cgaacttggg	taaggtcggg	cagcactact	acgtcaacgg	caaggcggag	1380
aaggcgact	ga					1392

<210> 8
 <211> 1395
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Codon-optimized open reading frame for expression of Micromonas
 pusilla 6 desaturase in plants (version 1)

<400> 8						
atgtgccctc	ctaagactga	tggaagatct	tctcctagat	ctccacttac	caggtctaaa	60
tcttctgctg	aggctcttga	tgctaaggat	gcttctactg	ctcctgttga	tcttaagact	120
cttgagcctc	atgagcttgc	tgctactttc	gagactagat	gggttagagt	tgaggacgtt	180
gagtacgatg	tgactaactt	caagcaccct	ggtggatctg	tgatcttcta	catgcttgct	240
aacactgggtg	ctgatgctac	tgaggctttc	aaagaattcc	acatgcgttc	tctcaaggct	300
tggaagatgc	ttagagcttt	gccttctaga	cctgctgaga	tcaagagatc	tgagtctgag	360
gatgctccta	tgcttgagga	tttcgctaga	tggtgctgctg	agcttgagag	agatggattc	420
ttcaagcctt	ctatcaccca	tgtggcttac	agacttctcg	agcttcttgc	tacattcgct	480
cttggaaactg	ctcttatgta	cgctggatac	cctatcattg	cttctgttgt	ttacgggtgct	540
ttcttcggag	ctagatgtgg	atgggttcaa	catgaggggtg	gacataactc	tcttaccgga	600
tctgttttacg	tggacaagag	acttcaggct	atgacttggtg	gattcggact	ttctacttct	660
ggtgagatgt	ggaaccagat	gcataacaag	caccatgcta	cccctcaaaa	ggtagacac	720
gatatggatc	ttgataccac	tcctgctgtg	gctttcttca	acactgctgt	tgaggataac	780
agacctagag	gattctctag	agcttgggct	agacttcaag	cttggacttt	cgttcctgtt	840
acctctggac	ttcttggtca	agctttctgg	atctacgttc	tccaccctag	acaagttctc	900
cgtaagaaga	actacgaaga	ggcttcttgg	atgctcgttt	ctcatgttgt	tagaaccgct	960
gttatcaagc	ttgctactgg	atactcttgg	cctgttgctt	actggtgggt	cactttcgga	1020

517416 Sequence Listing

aactggatcg cttacatgta ccttttcgct cacttctcta cttctcatac tcacctccct 1080
gttgttccat ctgataagca cctttcttgg gttaactacg ctgttgatca caccgttgat 1140
atcgatcctt ctagaggata cgtgaactgg cttatgggat accttaactg tcaggttatc 1200
caccacctct tccctgatat gcctcaattc agacagcctg aggttagcag aagattcgtt 1260
cctttcgcta agaagtgggg actcaactac aagggtgctct cttactacgg tgcttgaag 1320
gctactttct ctaaccttga taagggtggga cagcactact acgttaacgg aaaggctgag 1380
aaggctcact aatga 1395

<210> 9
<211> 463
<212> PRT
<213> Micromonas pusilla

<400> 9

Met Cys Pro Pro Lys Thr Asp Gly Arg Ser Ser Pro Arg Ser Pro Leu
1 5 10 15

Thr Arg Ser Lys Ser Ser Ala Glu Ala Leu Asp Ala Lys Asp Ala Ser
20 25 30

Thr Ala Pro Val Asp Leu Lys Thr Leu Glu Pro His Glu Leu Ala Ala
35 40 45

Thr Phe Glu Thr Arg Trp Val Arg Val Glu Asp Val Glu Tyr Asp Val
50 55 60

Thr Asn Phe Lys His Pro Gly Gly Ser Val Ile Phe Tyr Met Leu Ala
65 70 75 80

Asn Thr Gly Ala Asp Ala Thr Glu Ala Phe Lys Glu Phe His Met Arg
85 90 95

Ser Leu Lys Ala Trp Lys Met Leu Arg Ala Leu Pro Ser Arg Pro Ala
100 105 110

Glu Ile Lys Arg Ser Glu Ser Glu Asp Ala Pro Met Leu Glu Asp Phe
115 120 125

Ala Arg Trp Arg Ala Glu Leu Glu Arg Asp Gly Phe Phe Lys Pro Ser
130 135 140

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

Leu Gly Thr Ala Leu Met Tyr Ala Gly Tyr Pro Ile Ile Ala Ser Val
165 170 175

Val Tyr Gly Ala Phe Phe Gly Ala Arg Cys Gly Trp Val Gln His Glu
180 185 190

517416 Sequence Listing

Gly Gly His Asn Ser Leu Thr Gly Ser Val Tyr Val Asp Lys Arg Leu
 195 200 205
 Gln Ala Met Thr Cys Gly Phe Gly Leu Ser Thr Ser Gly Glu Met Trp
 210 215 220
 Asn Gln Met His Asn Lys His His Ala Thr Pro Gln Lys Val Arg His
 225 230 235 240
 Asp Met Asp Leu Asp Thr Thr Pro Ala Val Ala Phe Phe Asn Thr Ala
 245 250 255
 Val Glu Asp Asn Arg Pro Arg Gly Phe Ser Arg Ala Trp Ala Arg Leu
 260 265 270
 Gln Ala Trp Thr Phe Val Pro Val Thr Ser Gly Leu Leu Val Gln Ala
 275 280 285
 Phe Trp Ile Tyr Val Leu His Pro Arg Gln Val Leu Arg Lys Lys Asn
 290 295 300
 Tyr Glu Glu Ala Ser Trp Met Leu Val Ser His Val Val Arg Thr Ala
 305 310 315 320
 Val Ile Lys Leu Ala Thr Gly Tyr Ser Trp Pro Val Ala Tyr Trp Trp
 325 330 335
 Phe Thr Phe Gly Asn Trp Ile Ala Tyr Met Tyr Leu Phe Ala His Phe
 340 345 350
 Ser Thr Ser His Thr His Leu Pro Val Val Pro Ser Asp Lys His Leu
 355 360 365
 Ser Trp Val Asn Tyr Ala Val Asp His Thr Val Asp Ile Asp Pro Ser
 370 375 380
 Arg Gly Tyr Val Asn Trp Leu Met Gly Tyr Leu Asn Cys Gln Val Ile
 385 390 395 400
 His His Leu Phe Pro Asp Met Pro Gln Phe Arg Gln Pro Glu Val Ser
 405 410 415
 Arg Arg Phe Val Pro Phe Ala Lys Lys Trp Gly Leu Asn Tyr Lys Val
 420 425 430
 Leu Ser Tyr Tyr Gly Ala Trp Lys Ala Thr Phe Ser Asn Leu Asp Lys
 435 440 445
 Val Gly Gln His Tyr Tyr Val Asn Gly Lys Ala Glu Lys Ala His
 450 455 460

517416 Sequence Listing

<210> 10
 <211> 1449
 <212> DNA
 <213> *Ostreococcus lucimarinus*

<400> 10
 atgtgctgctg aaacgaccga aggcacatcg cgaacgatgg cgaacgaacg cacgagctcg 60
 tcgtcgtcgc tgagcgaagg cggaacgccg acggtgacgg tcgggatggg aagcgaagac 120
 gcggggaaga agactcgaaa cgcgagcgtc acggcgtgga cgaaagagtt ggagccgcac 180
 gcgatcgca agacgttcga acggcgggtac gtgacgatcg aaggcgtgga atacgatgtg 240
 acggatttta agcatcccgg aggatcgggtt atttattaca tgctgtcgaa cacggggagcg 300
 gacgcgacgg aggtttttaa agagtttcat tatcggtcga aaaaggcgcg caaggcgttg 360
 gcggcgttgc cgcataagcc agtggacgcg gcgacgcggg aaccgatcga agatgaggcg 420
 atgctgaagg atttcgcgca gtggcgcaag gaattggagc gtgagggatt ttttaagccc 480
 tcgccggcgc acgtggcgta tcgattcgcc gagctcgcgg cgatgttcgc gctcggcacg 540
 gcgttgatgc acgcgcgttg gcacgtcgct tccgtgatcg tgtactcgtg tttcttcggc 600
 gcgcgatgcg gttgggtgca gcacgagggg gggcacaatt cgttgactgg aaacatttgg 660
 tgggacaagc gaatccaagc cttcgccgcg gggttcggct tggcgtcgag tggcgacatg 720
 tggaacaaca tgcacaaca gcacacgcg acgccccaaa aggtgcgaca cgatatggat 780
 ctgcacacca ctccacggg ggcgttcttc aactccgcgg ttgaagaaaa tcgcccgcg 840
 ggattcagta agttgtggtt gcgccttcaa gcgtggacct tcgtgcccgt gacgtccggt 900
 atggttttgt tcttctggat gttcgtcttg caccgcgta acgcgctgcg acgcaaaagc 960
 ttcgaagaag cggcttggat gttttccgcg cacgtcattc gcacggcggg tatcaaagcc 1020
 gtcaccggct actcctggat cgcctcgta ggcttggtcg cggcgacgat gtgggcgagc 1080
 ggatgttact tgttcgca cttttccacg tctcacacgc acttggatgt cgtgccgagc 1140
 gataaacacc tctcgtgggt gcgatacgcc gtcgatcaca cgatcgacat caatccgaac 1200
 aacagcgtcg tcaactggtt gatgggctac ttgaactgcc aagtcacca tcacctgttc 1260
 ccggatatgc ctcagttccg ccaacccgaa gtctcccgcc gattcgtccc gtttgcaag 1320
 aagtggaact taaactacaa ggtcttgacg tattatgggg cctggaaggc gacgttcggc 1380
 aacttgaacg acgtcgggaa gcactattac gtgcacggat ctacgcgct caaatcaaag 1440
 tcggcgtga 1449

<210> 11
 <211> 1449
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Codon-optimized open reading frame for expression of *Ostreococcus lucimarinus* 6-desaturase in plants

517416 Sequence Listing

```

<400> 11
atgtgtgttg agactactga ggaacacctt agaactatgg ctaacgagag gacctcttct 60
tcttctttcac tctctgaggg tggaactcct actgttactg tgggaatggg atctgaggat 120
gctggaaaga aaaccagaaa cgcttctgtt actgcttggg ccaaagagct tgagcctcac 180
gctatcgcta agaccttcga gagaagatac gttaccatcg aggggtgttg gtacgatgtg 240
accgatttca aacaccctgg tggatctgtg atctactaca tgctctctaa cactggtgct 300
gatgctactg aggccttcaa agagttccac taccgttcta agaaggctag aaaggctctt 360
gctgctcttc ctcacaagcc tgttgatgct gctactagag agcctattga ggacgaggct 420
atgcttaagg atttcgctca gtggagaaaa gagttggaga gagagggatt cttcaagcct 480
tctcctgctc atgttgctta ccgtttcgct gaactcgctg ctatgttcgc tcttgaacc 540
gctcttatgc atgctagatg gcacgttgct agcgttatcg tgtactcctg tttcttcgga 600
gctagatgtg gatgggttca acatgagggt ggacacaact ctcttaccgg aaacatctgg 660
tggaataaga gaatccaagc tttcgctgct ggattcggac ttgcttcttc tggtgacatg 720
tggaacaaca tgcacaacaa gcaccatgct actcctcaga aagtgagaca cgatatggat 780
cttgatacca cccctaccgt tgctttcttc aactctgctg tggaggaaaa cagacctagg 840
ggattctcta agctttggct cagacttcaa gcttggacct tcgttctgtt tacctctgga 900
atggtgctct tcttctggat gttcgttctc catcctagaa acgctctccg tcgtaagtct 960
ttcgaagagg ctgcttggat gttctctgct cacgttatca gaaccgctgt tatcaaggct 1020
gttaccggat actcttggat cgctagctac ggacttttctg ctgctactat gtgggcttct 1080
ggatgctacc ttttcgctca cttctctact tctcacaccc acctcgatgt tgttccatct 1140
gataagcacc ttagctgggt taggtacgct gttgatcaca ccatcgacat caaccctaac 1200
aactctgttg tgaactggct tatgggatac cttaactgcc aggttatcca ccatctcttc 1260
cctgatatgc ctcaattcag acagcctgag gtgtcaagaa gattcgtccc tttcgctaag 1320
aagtgaacc tcaactacaa ggtgctcact tactacggtg cttggaaggc tactttcgga 1380
aacctcaacg atgttggaag gcactactac gttcacggat ctcagagagt gaagagcaag 1440
agcgcttga 1449

```

```

<210> 12
<211> 482
<212> PRT
<213> Ostreococcus lucimarinus

```

<400> 12

Met Cys Val Glu Thr Thr Glu Gly Thr Ser Arg Thr Met Ala Asn Glu
1 5 10 15

Arg Thr Ser Ser Ser Ser Ser Leu Ser Glu Gly Gly Thr Pro Thr Val
20 25 30

Thr Val Gly Met Gly Ser Glu Asp Ala Gly Lys Lys Thr Arg Asn Ala
Page 33

517416 Sequence Listing

35

40

45

Ser Val Thr Ala Trp Thr Lys Glu Leu Glu Pro His Ala Ile Ala Lys
50 55 60

Thr Phe Glu Arg Arg Tyr Val Thr Ile Glu Gly Val Glu Tyr Asp Val
65 70 75 80

Thr Asp Phe Lys His Pro Gly Gly Ser Val Ile Tyr Tyr Met Leu Ser
85 90 95

Asn Thr Gly Ala Asp Ala Thr Glu Ala Phe Lys Glu Phe His Tyr Arg
100 105 110

Ser Lys Lys Ala Arg Lys Ala Leu Ala Ala Leu Pro His Lys Pro Val
115 120 125

Asp Ala Ala Thr Arg Glu Pro Ile Glu Asp Glu Ala Met Leu Lys Asp
130 135 140

Phe Ala Gln Trp Arg Lys Glu Leu Glu Arg Glu Gly Phe Phe Lys Pro
145 150 155 160

Ser Pro Ala His Val Ala Tyr Arg Phe Ala Glu Leu Ala Ala Met Phe
165 170 175

Ala Leu Gly Thr Ala Leu Met His Ala Arg Trp His Val Ala Ser Val
180 185 190

Ile Val Tyr Ser Cys Phe Phe Gly Ala Arg Cys Gly Trp Val Gln His
195 200 205

Glu Gly Gly His Asn Ser Leu Thr Gly Asn Ile Trp Trp Asp Lys Arg
210 215 220

Ile Gln Ala Phe Ala Ala Gly Phe Gly Leu Ala Ser Ser Gly Asp Met
225 230 235 240

Trp Asn Asn Met His Asn Lys His His Ala Thr Pro Gln Lys Val Arg
245 250 255

His Asp Met Asp Leu Asp Thr Thr Pro Thr Val Ala Phe Phe Asn Ser
260 265 270

Ala Val Glu Glu Asn Arg Pro Arg Gly Phe Ser Lys Leu Trp Leu Arg
275 280 285

Leu Gln Ala Trp Thr Phe Val Pro Val Thr Ser Gly Met Val Leu Phe
290 295 300

Phe Trp Met Phe Val Leu His Pro Arg Asn Ala Leu Arg Arg Lys Ser
Page 34

517416 Sequence Listing

305 310 315 320

Phe Glu Glu Ala Ala Trp Met Phe Ser Ala His Val Ile Arg Thr Ala
325 330 335

Val Ile Lys Ala Val Thr Gly Tyr Ser Trp Ile Ala Ser Tyr Gly Leu
340 345 350

Phe Ala Ala Thr Met Trp Ala Ser Gly Cys Tyr Leu Phe Ala His Phe
355 360 365

Ser Thr Ser His Thr His Leu Asp Val Val Pro Ser Asp Lys His Leu
370 375 380

Ser Trp Val Arg Tyr Ala Val Asp His Thr Ile Asp Ile Asn Pro Asn
385 390 395 400

Asn Ser Val Val Asn Trp Leu Met Gly Tyr Leu Asn Cys Gln Val Ile
405 410 415

His His Leu Phe Pro Asp Met Pro Gln Phe Arg Gln Pro Glu Val Ser
420 425 430

Arg Arg Phe Val Pro Phe Ala Lys Lys Trp Asn Leu Asn Tyr Lys Val
435 440 445

Leu Thr Tyr Tyr Gly Ala Trp Lys Ala Thr Phe Gly Asn Leu Asn Asp
450 455 460

Val Gly Lys His Tyr Tyr Val His Gly Ser Gln Arg Val Lys Ser Lys
465 470 475 480

Ser Ala

<210> 13
<211> 456
<212> PRT
<213> *Ostreococcus tauri*

<400> 13

Met Cys Val Glu Thr Glu Asn Asn Asp Gly Ile Pro Thr Val Glu Ile
1 5 10 15

Ala Phe Asp Gly Glu Arg Glu Arg Ala Glu Ala Asn Val Lys Leu Ser
20 25 30

Ala Glu Lys Met Glu Pro Ala Ala Leu Ala Lys Thr Phe Ala Arg Arg
35 40 45

Tyr Val Val Ile Glu Gly Val Glu Tyr Asp Val Thr Asp Phe Lys His
50 55 60

517416 Sequence Listing

Pro Gly Gly Thr Val Ile Phe Tyr Ala Leu Ser Asn Thr Gly Ala Asp
 65 70 75 80
 Ala Thr Glu Ala Phe Lys Glu Phe His His Arg Ser Arg Lys Ala Arg
 85 90 95
 Lys Ala Leu Ala Ala Leu Pro Ser Arg Pro Ala Lys Thr Ala Lys Val
 100 105 110
 Asp Asp Ala Glu Met Leu Gln Asp Phe Ala Lys Trp Arg Lys Glu Leu
 115 120 125
 Glu Arg Asp Gly Phe Phe Lys Pro Ser Pro Ala His Val Ala Tyr Arg
 130 135 140
 Phe Ala Glu Leu Ala Ala Met Tyr Ala Leu Gly Thr Tyr Leu Met Tyr
 145 150 155 160
 Ala Arg Tyr Val Val Ser Ser Val Leu Val Tyr Ala Cys Phe Phe Gly
 165 170 175
 Ala Arg Cys Gly Trp Val Gln His Glu Gly Gly His Ser Ser Leu Thr
 180 185 190
 Gly Asn Ile Trp Trp Asp Lys Arg Ile Gln Ala Phe Thr Ala Gly Phe
 195 200 205
 Gly Leu Ala Gly Ser Gly Asp Met Trp Asn Ser Met His Asn Lys His
 210 215 220
 His Ala Thr Pro Gln Lys Val Arg His Asp Met Asp Leu Asp Thr Thr
 225 230 235 240
 Pro Ala Val Ala Phe Phe Asn Thr Ala Val Glu Asp Asn Arg Pro Arg
 245 250 255
 Gly Phe Ser Lys Tyr Trp Leu Arg Leu Gln Ala Trp Thr Phe Ile Pro
 260 265 270
 Val Thr Ser Gly Leu Val Leu Leu Phe Trp Met Phe Phe Leu His Pro
 275 280 285
 Ser Lys Ala Leu Lys Gly Gly Lys Tyr Glu Glu Leu Val Trp Met Leu
 290 295 300
 Ala Ala His Val Ile Arg Thr Trp Thr Ile Lys Ala Val Thr Gly Phe
 305 310 315 320
 Thr Ala Met Gln Ser Tyr Gly Leu Phe Leu Ala Thr Ser Trp Val Ser
 325 330 335

517416 Sequence Listing

Gly Cys Tyr Leu Phe Ala His Phe Ser Thr Ser His Thr His Leu Asp
340 345 350

Val Val Pro Ala Asp Glu His Leu Ser Trp Val Arg Tyr Ala Val Asp
355 360 365

His Thr Ile Asp Ile Asp Pro Ser Gln Gly Trp Val Asn Trp Leu Met
370 375 380

Gly Tyr Leu Asn Cys Gln Val Ile His His Leu Phe Pro Ser Met Pro
385 390 395 400

Gln Phe Arg Gln Pro Glu Val Ser Arg Arg Phe Val Ala Phe Ala Lys
405 410 415

Lys Trp Asn Leu Asn Tyr Lys Val Met Thr Tyr Ala Gly Ala Trp Lys
420 425 430

Ala Thr Leu Gly Asn Leu Asp Asn Val Gly Lys His Tyr Tyr Val His
435 440 445

Gly Gln His Ser Gly Lys Thr Ala
450 455

<210> 14
<211> 894
<212> DNA
<213> Pyramimonas cordata

<400> 14	
atggagttcg ctcagcctct tgtggctatg gcacaggagc agtatgccgc aattgacgcg	60
gtggtagccc ctgcaatttt ctcagctacc gacagcatcg gttggggctct taagcccatt	120
agcagcgcca caaaggatct tcctctcggt gagagtccga cgccgctcat actgagcctg	180
ttggcctatt ttgcgatcgt cggctctggg ctggtgtacc gcaaagtatt ccctcgaca	240
gtaaaggggc aagacccctt cctgctgaag gcgctcatgc ttgcgcaaa cgtgttcctc	300
attggcctca gtctatacat gtgcttgaag cttgtctacg aggcttacgt caacaagtac	360
tccttctggg gaaacgccta caaccccgca cagaccgaga tggcgaaggc catctggatt	420
ttctacgtct ccaagatcta tgagttcatg gacacgttca tcatgctctt gaagggaac	480
gtcaaccagg tctctttcct gcatgtgtac catcatggct ccatctctgg tatctggtgg	540
atgatcacct acgctgcccc tggcgggtgac gcgtacttct cggcggcgct caactcgtgg	600
gtgcacgtgt gcatgtacac gtactacttc atggcggcgg tgctgcccaa ggacgagaag	660
accaagcgca agtacctctg gtggggccgc tacctgaccc agatgcagat gttccagttc	720
ttcatgaacc tgctccaggc ggtctacctc ctctactcct ctagccccta cccaagttc	780
atcgcccagc tgctggtggg gtacatgggc acgctgctga tgctcttcgg caacttctac	840

517416 Sequence Listing

tacatgaagc accacgcgag caagaagcag aagctggcca gcaagaagca gtag 894

<210> 15
 <211> 870
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Codon-optimized open reading frame for expression of *Pyramimonas cordata* 6 elongase in plants (truncated at 3' end and encoding functional elongase) (version 1)

<400> 15
 atggaattcg cccagcctct tggtgctatg gctcaagagc aatacgctgc tatcgatgct 60
 gttgttgctc ctgctatctt ctctgctact gattctatcg gatggggact taagcctatc 120
 tctttctgcta ctaaggactt gcctcttggt gagtctccta cacctctcat cctttctttg 180
 cttgcttact tcgctatcgt tggatctgga ctcgtttaca gaaagggttt ccctagaacc 240
 gtgaagggac aagatccatt ctttttgaag gctcttatgc ttgctcaciaa cgtgttcctt 300
 atcggacttt ctctttacat gtgcctcaag cttgtgtacg aggcttacgt taacaagtac 360
 tctttctggg gaaacgctta caaccctgct caaactgaga tggctaagggt tatctggatc 420
 ttctacgtga gcaagatcta cgagttcatg gataccttca tcatgctcct caagggaaat 480
 gttaaccagg ttagcttcct tcacgtttac catcacggat ctatctctgg aatctggtgg 540
 atgattactt acgctgctcc tgggtggtgat gcttacttct ctgctgctct taactcttgg 600
 gttcacgtgt gtatgtacac ctactatctt atggctgccg tgcttcctaa ggacgagaaa 660
 actaagagaa agtacctctg gtggggaaga taccttactc aaatgcagat gttccagttc 720
 ttcatgaacc ttctccaggc tgtttacctt ctctactctt catctcctta ccctaagttt 780
 atcgtctcagc tcctcggtgt gtacatgggt actcttctca tgcttttcgg aaacttctac 840
 tacatgaagc accacgctag caagtgatga 870

<210> 16
 <211> 297
 <212> PRT
 <213> *Pyramimonas cordata*

<400> 16
 Met Glu Phe Ala Gln Pro Leu Val Ala Met Ala Gln Glu Gln Tyr Ala
 1 5 10 15
 Ala Ile Asp Ala Val Val Ala Pro Ala Ile Phe Ser Ala Thr Asp Ser
 20 25 30
 Ile Gly Trp Gly Leu Lys Pro Ile Ser Ser Ala Thr Lys Asp Leu Pro
 35 40 45
 Leu Val Glu Ser Pro Thr Pro Leu Ile Leu Ser Leu Leu Ala Tyr Phe
 50 55 60

517416 Sequence Listing

Ala Ile Val Gly Ser Gly Leu Val Tyr Arg Lys Val Phe Pro Arg Thr
65 70 75 80

Val Lys Gly Gln Asp Pro Phe Leu Leu Lys Ala Leu Met Leu Ala His
85 90 95

Asn Val Phe Leu Ile Gly Leu Ser Leu Tyr Met Cys Leu Lys Leu Val
100 105 110

Tyr Glu Ala Tyr Val Asn Lys Tyr Ser Phe Trp Gly Asn Ala Tyr Asn
115 120 125

Pro Ala Gln Thr Glu Met Ala Lys Val Ile Trp Ile Phe Tyr Val Ser
130 135 140

Lys Ile Tyr Glu Phe Met Asp Thr Phe Ile Met Leu Leu Lys Gly Asn
145 150 155 160

Val Asn Gln Val Ser Phe Leu His Val Tyr His His Gly Ser Ile Ser
165 170 175

Gly Ile Trp Trp Met Ile Thr Tyr Ala Ala Pro Gly Gly Asp Ala Tyr
180 185 190

Phe Ser Ala Ala Leu Asn Ser Trp Val His Val Cys Met Tyr Thr Tyr
195 200 205

Tyr Phe Met Ala Ala Val Leu Pro Lys Asp Glu Lys Thr Lys Arg Lys
210 215 220

Tyr Leu Trp Trp Gly Arg Tyr Leu Thr Gln Met Gln Met Phe Gln Phe
225 230 235 240

Phe Met Asn Leu Leu Gln Ala Val Tyr Leu Leu Tyr Ser Ser Ser Pro
245 250 255

Tyr Pro Lys Phe Ile Ala Gln Leu Leu Val Val Tyr Met Val Thr Leu
260 265 270

Leu Met Leu Phe Gly Asn Phe Tyr Tyr Met Lys His His Ala Ser Lys
275 280 285

Lys Gln Lys Leu Ala Ser Lys Lys Gln
290 295

<210> 17
<211> 288
<212> PRT
<213> Pyramimonas cordata

<400> 17

Met Glu Phe Ala Gln Pro Leu Val Ala Met Ala Gln Glu Gln Tyr Ala
Page 39

517416 Sequence Listing

1 5 10 15
 Ala Ile Asp Ala Val Val Ala Pro Ala Ile Phe Ser Ala Thr Asp Ser
 20 25 30
 Ile Gly Trp Gly Leu Lys Pro Ile Ser Ser Ala Thr Lys Asp Leu Pro
 35 40 45
 Leu Val Glu Ser Pro Thr Pro Leu Ile Leu Ser Leu Leu Ala Tyr Phe
 50 55 60
 Ala Ile Val Gly Ser Gly Leu Val Tyr Arg Lys Val Phe Pro Arg Thr
 65 70 75 80
 Val Lys Gly Gln Asp Pro Phe Leu Leu Lys Ala Leu Met Leu Ala His
 85 90 95
 Asn Val Phe Leu Ile Gly Leu Ser Leu Tyr Met Cys Leu Lys Leu Val
 100 105 110
 Tyr Glu Ala Tyr Val Asn Lys Tyr Ser Phe Trp Gly Asn Ala Tyr Asn
 115 120 125
 Pro Ala Gln Thr Glu Met Ala Lys Val Ile Trp Ile Phe Tyr Val Ser
 130 135 140
 Lys Ile Tyr Glu Phe Met Asp Thr Phe Ile Met Leu Leu Lys Gly Asn
 145 150 155 160
 Val Asn Gln Val Ser Phe Leu His Val Tyr His His Gly Ser Ile Ser
 165 170 175
 Gly Ile Trp Trp Met Ile Thr Tyr Ala Ala Pro Gly Gly Asp Ala Tyr
 180 185 190
 Phe Ser Ala Ala Leu Asn Ser Trp Val His Val Cys Met Tyr Thr Tyr
 195 200 205
 Tyr Phe Met Ala Ala Val Leu Pro Lys Asp Glu Lys Thr Lys Arg Lys
 210 215 220
 Tyr Leu Trp Trp Gly Arg Tyr Leu Thr Gln Met Gln Met Phe Gln Phe
 225 230 235 240
 Phe Met Asn Leu Leu Gln Ala Val Tyr Leu Leu Tyr Ser Ser Ser Pro
 245 250 255
 Tyr Pro Lys Phe Ile Ala Gln Leu Leu Val Val Tyr Met Val Thr Leu
 260 265 270
 Leu Met Leu Phe Gly Asn Phe Tyr Tyr Met Lys His His Ala Ser Lys
 Page 40

<210> 18
<211> 1278
<212> DNA
<213> Pavlova salina

<400> 18
atgccgccgc gcgatagcta ctcgtacgcc gccccgccgt cggcccagct gcacgaggtc 60
gataccccgc aggagcatga taagaaggag ctcgtcatcg gtgaccgcgc gtacgacgtg 120
accaactttg tgaagcgcca cccgggtggc aagatcatcg cataccaggt tggcacagat 180
gcgacggacg cgtacaagca gttccatgtg cggctctgcc aggcggaaca gatgctcaag 240
tcgctgcctt cgcgcccggg gcacaagggc tactcgcccc gccgcgctga cctcattgcc 300
gacttccagg agttcaccaa gcagctggag gcggagggca tgtttgagcc gtcgctgccg 360
cacgtggcat accgcctggc ggaggtgatc gcgatgcacg tggccggcgc cgcgctcatc 420
tggcacgggt acaccttcgc gggcattgcc atgctcggcg ttgtgcaggg ccgctgcggc 480
tggctcatgc acgagggcgg cactactcg ctcacgggca acattgcttt tgaccgtgcc 540
atccaagtcg cgtgctacgg ccttggctgc ggcatgtcgg gcgcgtgggt gcgcaaccag 600
cacaacaagc accacgcgac gccgcagaag ttgcagcacg acgtcgacct cgacaccctc 660
ccgctcgtcg ccttccacga gcggatagcc gccaaaggta agagccccgc gatgaaggcg 720
tggcttagta tgcaggcgaa gctcttcgcg ccagtgaaca cgctgctggg cgcgctgggc 780
tggcagctgt acctgcaccc gcgccatatg ctgcgcacca agcactacga cgagctcgcg 840
atgctcggca ttcgctacgg ccttgtcggc tacctcgcgg cgaactacgg cgcggggtac 900
gtgctcgcgt gctacctgct gtacgtgcag ctcggcgcca tgtacatctt ctgcaacttt 960
gccgtgtcgc acacacacct gccggttgtc gagcctaacg agcacgcaac gtgggtggag 1020
tacgccgcga accacacgac caactgctcg ccctcgtggg ggtgcgactg gtggatgtcg 1080
tacctcaact accagatcga gcaccacctc taccgtcca tgccgcagtt ccgccacccg 1140
aagattgcgc cgcgggtgaa gcagctcttc gagaagcacg gcctgcacta cgacgtgcgt 1200
ggctacttcg aggccatggc ggacacgttt gccaaccttg acaacgtcgc gcacgcgccg 1260
gagaagaaga tgcagtga 1278

<210> 19
<211> 1281
<212> DNA
<213> Artificial Sequence

<220>
<223> Codon-optimized open reading frame for expression of Pavlova salina 5 desaturase in plants (version 1)

<400> 19
atgcctccaa gggactctta ctcttatgct gtcctcctt ctgctcaact tcacgaagtt 60
gatactcctc aagagcacga caagaaagag cttgttatcg gagatagggc ttacgatgtt 120

517416 Sequence Listing

accaaacttcg ttaagagaca ccctggtgga aagatcattg cttaccaagt tggaactgat	180
gctaccgatg cttacaagca gttccatggt agatctgcta aggctgacaa gatgcttaag	240
tctcttcctt ctcgtcctgt tcacaaggga tactctccaa gaagggctga tcttatcgct	300
gatttccaag agttcaccaa gcaacttgag gctgagggaa tggtcgagcc ttctcttcct	360
catgttgctt acagacttgc tgaggttatc gctatgcatg ttgctggtgc tgctcttatt	420
tggcattgat acactttcgc tggaatcgct atgcttgagg ttgttcaggg aagatgtgga	480
tggtttatgc atgaggggtg acattactct ctactggaa acattgcttt cgacagagct	540
atccaagttg cttgttacgg acttggaagt ggaatgtctg gtgcttggtg gcgtaaccag	600
cataacaagc accatgctac tcctcaaaag cttcagcacg atgttgatct tgataccctt	660
cctctcgttg ctttccatga gagaatcgct gctaagggtta agtctcctgc tatgaaggct	720
tggttttcta tgcaagctaa gcttttcgct cctgttacca ctcttcttgt tgctcttgga	780
tggcagcttt accttcatcc tagacacatg cttaggacta agcactacga tgagcttgct	840
atgctcggaa tcagatacgg acttggtgga taccttgctg ctaactacgg tgctggatac	900
gttctcgctt gttaccttct ttacgttcag cttggagcta tgtacatctt ctgcaacttc	960
gctgtttctc atactcacct ccctgttggt gagcctaacg agcatgctac ttgggttgag	1020
tacgtgcta accacactac taactgttct ccatcttggt ggtgtgattg gtggatgtct	1080
taccttaact accagatcga gcaccacctt tacccttcta tgcctcaatt cagacacct	1140
aagatcgctc ctagagttaa gcagcttttc gagaagcacg gacttacta cgatgttaga	1200
ggatacttcg aggctatggc tgatactttc gctaaccttg ataacgttgc ccatgctcct	1260
gagaagaaaa tgcagtaatg a	1281

<210> 20
 <211> 425
 <212> PRT
 <213> Pavlova salina

<400> 20

Met	Pro	Pro	Arg	Asp	Ser	Tyr	Ser	Tyr	Ala	Ala	Pro	Pro	Ser	Ala	Gln
1				5					10					15	

Leu	His	Glu	Val	Asp	Thr	Pro	Gln	Glu	His	Asp	Lys	Lys	Glu	Leu	Val
			20					25					30		

Ile	Gly	Asp	Arg	Ala	Tyr	Asp	Val	Thr	Asn	Phe	Val	Lys	Arg	His	Pro
		35					40					45			

Gly	Gly	Lys	Ile	Ile	Ala	Tyr	Gln	Val	Gly	Thr	Asp	Ala	Thr	Asp	Ala
	50					55					60				

Tyr	Lys	Gln	Phe	His	Val	Arg	Ser	Ala	Lys	Ala	Asp	Lys	Met	Leu	Lys
65					70					75					80

517416 Sequence Listing

Ser Leu Pro Ser Arg Pro Val His Lys Gly Tyr Ser Pro Arg Arg Ala
85 90 95

Asp Leu Ile Ala Asp Phe Gln Glu Phe Thr Lys Gln Leu Glu Ala Glu
100 105 110

Gly Met Phe Glu Pro Ser Leu Pro His Val Ala Tyr Arg Leu Ala Glu
115 120 125

Val Ile Ala Met His Val Ala Gly Ala Ala Leu Ile Trp His Gly Tyr
130 135 140

Thr Phe Ala Gly Ile Ala Met Leu Gly Val Val Gln Gly Arg Cys Gly
145 150 155 160

Trp Leu Met His Glu Gly Gly His Tyr Ser Leu Thr Gly Asn Ile Ala
165 170 175

Phe Asp Arg Ala Ile Gln Val Ala Cys Tyr Gly Leu Gly Cys Gly Met
180 185 190

Ser Gly Ala Trp Trp Arg Asn Gln His Asn Lys His His Ala Thr Pro
195 200 205

Gln Lys Leu Gln His Asp Val Asp Leu Asp Thr Leu Pro Leu Val Ala
210 215 220

Phe His Glu Arg Ile Ala Ala Lys Val Lys Ser Pro Ala Met Lys Ala
225 230 235 240

Trp Leu Ser Met Gln Ala Lys Leu Phe Ala Pro Val Thr Thr Leu Leu
245 250 255

Val Ala Leu Gly Trp Gln Leu Tyr Leu His Pro Arg His Met Leu Arg
260 265 270

Thr Lys His Tyr Asp Glu Leu Ala Met Leu Gly Ile Arg Tyr Gly Leu
275 280 285

Val Gly Tyr Leu Ala Ala Asn Tyr Gly Ala Gly Tyr Val Leu Ala Cys
290 295 300

Tyr Leu Leu Tyr Val Gln Leu Gly Ala Met Tyr Ile Phe Cys Asn Phe
305 310 315 320

Ala Val Ser His Thr His Leu Pro Val Val Glu Pro Asn Glu His Ala
325 330 335

Thr Trp Val Glu Tyr Ala Ala Asn His Thr Thr Asn Cys Ser Pro Ser
340 345 350

517416 Sequence Listing
 Trp Trp Cys Asp Trp Trp Met Ser Tyr Leu Asn Tyr Gln Ile Glu His
 355 360 365

His Leu Tyr Pro Ser Met Pro Gln Phe Arg His Pro Lys Ile Ala Pro
 370 375 380

Arg Val Lys Gln Leu Phe Glu Lys His Gly Leu His Tyr Asp Val Arg
 385 390 395 400

Gly Tyr Phe Glu Ala Met Ala Asp Thr Phe Ala Asn Leu Asp Asn Val
 405 410 415

Ala His Ala Pro Glu Lys Lys Met Gln
 420 425

<210> 21
 <211> 1329
 <212> DNA
 <213> Pyramimonas cordata

<400> 21
 atgggaaagg gaggaatgc tagcgctcct actgcgaaga aggaggtggt gatcgagggg 60
 aagttttacg atgtcaccga cttcaggcac cccgggtggt cgatcatcaa gtttctctcg 120
 ggttctggtg ctgacgccac cgcttcctac cgcgagttcc acgtaggtc agcgaaggca 180
 gacaagttct tgaagacgct gccctcccg cgaagccactc cccaggagct gaagcaggcg 240
 gttgagttct ccaagctcaa cccgccctcc gcggagagtg cctctgctcc cctgaccgac 300
 cttgccaagg tggaagcgct gaacaaggac ttcgaggctt tccgtgagca gctcattcag 360
 gagggcttct ttaagcccaa tatcccgcat gtggtcaagc gcatcacgga agtcgtggcg 420
 atgatggccg tagcctcctg gatgatggtg cagaccaacg ctcttggtgt gaccctcgga 480
 gttctgatcc gcggcattgc acagggccgg tgcggttggc ttatgcacga gggcggccac 540
 tatagtctta ctgggaagat ctccattgat aggcgtctgc aggagtcaat ttacggattc 600
 ggctgtggaa tgtccggcgc ctggtggcgc aaccagcaca acaagcacca cgcaacccca 660
 cagaagctgc agcatgacgt cgacctggag acccttcctc tgatggcttt caacaacgct 720
 gttaccgata gacgcaagggt gaagcctggt agtctccagg ctctgtggct caagtaccag 780
 gccttcctct tcttccccgt gacctccctt ctggtcggcc tcggttggac caccgtcctc 840
 caccacaggc acagcttgcg caccaagcac tatttcgagc tgctctgcat ggctgctcgt 900
 tacgcgagtt tcgctgctct tttcgctccc aagtacggac ttgcaggagc tgccgggctc 960
 tacctcgcca ccttcgctgt cgggtgcaac tatatatttca tcaacttctc ggtctctcac 1020
 actcacctgc ccgtgagcgg tgcgagcgag tacctgcatt gggctgtgta ttcggccatc 1080
 cacaccacta acatcaaata cagcatgctg tgcgattggt ggatgtcatt cctcaacttc 1140
 cagatcgagc atcacctggt ccttcaatg cccagttcc gccacaagat tatctccccg 1200
 cgtgtaaagg ccttgtttga gaagcacggt cttgtgtatg atgtgcgccc ctattggggg 1260

517416 Sequence Listing

gccatggctg acaccttcaa gaacttgaat gacgttggca ctacgcatc tcaactccaag 1320
gcgcactag 1329

<210> 22
<211> 442
<212> PRT
<213> Pyramimonas cordata
<400> 22

Met Gly Lys Gly Gly Asn Ala Ser Ala Pro Thr Ala Lys Lys Glu Val
1 5 10 15

Leu Ile Glu Gly Lys Phe Tyr Asp Val Thr Asp Phe Arg His Pro Gly
20 25 30

Gly Ser Ile Ile Lys Phe Leu Ser Gly Ser Gly Ala Asp Ala Thr Ala
35 40 45

Ser Tyr Arg Glu Phe His Val Arg Ser Ala Lys Ala Asp Lys Phe Leu
50 55 60

Lys Thr Leu Pro Ser Arg Glu Ala Thr Pro Gln Glu Leu Lys Gln Ala
65 70 75 80

Val Glu Phe Ser Lys Leu Asn Pro Pro Ser Ala Glu Ser Ala Ser Ala
85 90 95

Pro Leu Thr Asp Leu Ala Lys Val Glu Ala Leu Asn Lys Asp Phe Glu
100 105 110

Ala Phe Arg Glu Gln Leu Ile Gln Glu Gly Phe Phe Lys Pro Asn Ile
115 120 125

Pro His Val Val Lys Arg Ile Thr Glu Val Val Ala Met Met Ala Val
130 135 140

Ala Ser Trp Met Met Val Gln Thr Asn Ala Leu Val Val Thr Leu Gly
145 150 155 160

Val Leu Ile Arg Gly Ile Ala Gln Gly Arg Cys Gly Trp Leu Met His
165 170 175

Glu Gly Gly His Tyr Ser Leu Thr Gly Lys Ile Ser Ile Asp Arg Arg
180 185 190

Leu Gln Glu Ser Ile Tyr Gly Phe Gly Cys Gly Met Ser Gly Ala Trp
195 200 205

Trp Arg Asn Gln His Asn Lys His His Ala Thr Pro Gln Lys Leu Gln
210 215 220

517416 Sequence Listing

His Asp Val Asp Leu Glu Thr Leu Pro Leu Met Ala Phe Asn Asn Ala
225 230 235 240

Val Thr Asp Arg Arg Lys Val Lys Pro Gly Ser Leu Gln Ala Leu Trp
245 250 255

Leu Lys Tyr Gln Ala Phe Leu Phe Phe Pro Val Thr Ser Leu Leu Val
260 265 270

Gly Leu Gly Trp Thr Thr Val Leu His Pro Arg His Ser Leu Arg Thr
275 280 285

Lys His Tyr Phe Glu Leu Leu Cys Met Ala Ala Arg Tyr Ala Ser Phe
290 295 300

Ala Ala Leu Phe Ala Pro Lys Tyr Gly Leu Ala Gly Ala Ala Gly Leu
305 310 315 320

Tyr Leu Ala Thr Phe Ala Val Gly Cys Asn Tyr Ile Phe Ile Asn Phe
325 330 335

Ser Val Ser His Thr His Leu Pro Val Ser Gly Ala Ser Glu Tyr Leu
340 345 350

His Trp Val Val Tyr Ser Ala Ile His Thr Thr Asn Ile Lys Ser Ser
355 360 365

Met Leu Cys Asp Trp Trp Met Ser Phe Leu Asn Phe Gln Ile Glu His
370 375 380

His Leu Phe Pro Ser Met Pro Gln Phe Arg His Lys Ile Ile Ser Pro
385 390 395 400

Arg Val Lys Ala Leu Phe Glu Lys His Gly Leu Val Tyr Asp Val Arg
405 410 415

Pro Tyr Trp Gly Ala Met Ala Asp Thr Phe Lys Asn Leu Asn Asp Val
420 425 430

Gly Thr His Ala Ser His Ser Lys Ala His
435 440

<210> 23
<211> 804
<212> DNA
<213> Pyramimonas cordata

<400> 23
atggcgtcta ttgcgattcc ggctgcgctg gcagggactc ttggttatgt gacgtacaat 60
gtcgcaaacc cagatattcc tgcattccgag aagggtgcctg cttactttat gcaggtcgag 120
tattggggggc caacgattgg gaccatcggg tatcttctgt tcattctactt tggtaaacgg 180

517416 Sequence Listing

attatgcaaa acaggagcca gccgtttggc ctgaagaacg ctatgctggg	gtacaacttc	240
tatcagactt tcttcaactc gtactgcata tacctttttg tcacgtcgca ccgcgctcag		300
gggctgaaag tttggggaaa catccccgat atgactgccca acagctgggg gatctcacag		360
gtgatctggc tgcactacaa caacaagtac gttgagctgc tggacacgtt cttcatggtc		420
atgcgcaaga agtttgacca gctttcgttc ctgcacattt accatcatac cctgttgatc		480
tggctcttggg tcgtgggtgat gaaattggag cccgttgggg actgctactt tggctctagc		540
gtcaacacgt ttgtgcacgt cattatgtac tcgtactatg gccttgccgc gctcgggggtg		600
aattgcttct ggaagaagta cattacgcag attcagatgc tgcagttctg tatctgcgct		660
tcgcactcga ttataaccgc ctatgtgcag aacaccgcgt tctgggtgcc ttacttgtag		720
ctgtgggtga tgggtgaacat gttcgtgttg ttcgccaaact tctatcgcaa gcgctacaag		780
agcaagggtg ccaagaagca gtaa		804

<210> 24
 <211> 807
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Codon-optimized open reading frame for expression of Pyramimonas cordata 5 elongase in plants (version 1)

<400> 24	
atggcctcta tcgctatccc tgctgctctt gctggaactc ttggatacgt tacctacaat	60
gtggctaacc ctgatatccc agcttctgag aaagttcctg cttacttcat gcaggttgag	120
tactggggac ctactatcgg aactattgga tacctcctct tcatctactt cggaaagcgt	180
atcatgcaga acagatctca acctttcggga ctcaagaacg ctatgctcgt ttacaacttc	240
taccagacct tcttcaacag ctactgcata tacctttttc ttactttctca tagggctcag	300
ggacttaagg tttggggaaa catccctgat atgactgcta actcttgggg aatctctcag	360
gttatctggc ttcactacaa caacaagtac gttgagcttc tcgacacctt cttcatgggtg	420
atgaggaaga agttcgacca gctttctttc cttcacatct accaccacac tcttctcatc	480
tggatcatggg tcgttggttat gaagcttgag cctgttgagg attgctactt cggatcttct	540
gttaacacct tcgtgcacgt gatcatgtac tcttactacg gacttgctgc tcttgaggtt	600
aactgtttct ggaagaagta catcaccag atccagatgc ttcagttctg tatctgtgct	660
tctcactcta tctacaccgc ttacgttcag aataccgctt tctggcttcc ttaccttcaa	720
ctctgggtta tgggtgaacat gttcgttctc ttcgccaaact tctaccgtaa gaggtacaag	780
tctaagggtg ctaagaagca gtgataa	807

<210> 25
 <211> 267
 <212> PRT
 <213> Pyramimonas cordata

<400> 25

517416 Sequence Listing

Met Ala Ser Ile Ala Ile Pro Ala Ala Leu Ala Gly Thr Leu Gly Tyr
 1 5 10 15
 Val Thr Tyr Asn Val Ala Asn Pro Asp Ile Pro Ala Ser Glu Lys Val
 20 25 30
 Pro Ala Tyr Phe Met Gln Val Glu Tyr Trp Gly Pro Thr Ile Gly Thr
 35 40 45
 Ile Gly Tyr Leu Leu Phe Ile Tyr Phe Gly Lys Arg Ile Met Gln Asn
 50 55 60
 Arg Ser Gln Pro Phe Gly Leu Lys Asn Ala Met Leu Val Tyr Asn Phe
 65 70 75 80
 Tyr Gln Thr Phe Phe Asn Ser Tyr Cys Ile Tyr Leu Phe Val Thr Ser
 85 90 95
 His Arg Ala Gln Gly Leu Lys Val Trp Gly Asn Ile Pro Asp Met Thr
 100 105 110
 Ala Asn Ser Trp Gly Ile Ser Gln Val Ile Trp Leu His Tyr Asn Asn
 115 120 125
 Lys Tyr Val Glu Leu Leu Asp Thr Phe Phe Met Val Met Arg Lys Lys
 130 135 140
 Phe Asp Gln Leu Ser Phe Leu His Ile Tyr His His Thr Leu Leu Ile
 145 150 155 160
 Trp Ser Trp Phe Val Val Met Lys Leu Glu Pro Val Gly Asp Cys Tyr
 165 170 175
 Phe Gly Ser Ser Val Asn Thr Phe Val His Val Ile Met Tyr Ser Tyr
 180 185 190
 Tyr Gly Leu Ala Ala Leu Gly Val Asn Cys Phe Trp Lys Lys Tyr Ile
 195 200 205
 Thr Gln Ile Gln Met Leu Gln Phe Cys Ile Cys Ala Ser His Ser Ile
 210 215 220
 Tyr Thr Ala Tyr Val Gln Asn Thr Ala Phe Trp Leu Pro Tyr Leu Gln
 225 230 235 240
 Leu Trp Val Met Val Asn Met Phe Val Leu Phe Ala Asn Phe Tyr Arg
 245 250 255
 Lys Arg Tyr Lys Ser Lys Gly Ala Lys Lys Gln
 260 265

517416 Sequence Listing

<210> 26
 <211> 1344
 <212> DNA
 <213> Pavlova salina

 <400> 26
 atgcctccga gcgcggcgaa gcagatgggc gcgagcacgg gcgtgcatgc gggcgtcaca 60
 gattcgtcgg ccttcacgcg caaggatgtc gccgacaggc cggacctcac gatcgtgggt 120
 gacagcgtgt acgatgcgaa ggcgttccgc tccgagcatc cgggtggcgc gcactttgtg 180
 tcgctgttcg gcgggcgca tgccacggag gcgttcattg agtaccaccg gcgcgcctgg 240
 cccaagtcgc gcatgtcgcg cttccacgtc ggctctctgg catcgaccga ggagcccgtc 300
 gccgccgatg agggctacct ccagctgtgc gctcgcacgc ccaagatggg gccgtcgggc 360
 agcagcgggt tcgcgccggc gtcgtactgg gtgaaggccg ggctgaccta cggctccgcg 420
 atcgcgctcg aggcgtacat gctgtacgcg ggcaagcgcc tgctcccgtc gatcgtgctc 480
 ggggtggctgt ttgcgtgat tggcctgaac atccagcacg atgccaacca cggcgcgctc 540
 tccaagtcgg cctcggtaaa cctggcgctc gggttgtgcc aggactggat cggcgggagc 600
 atgacctaata ggctgcagga gcacgttggt atgcaccact tgcacaccaa cgacgttgac 660
 aaggacccgg accagaaggc gcacggcgcc ctgcggctca agccgaccga cgcgtggagc 720
 ccgatgcact ggctgcagca cctctacctg ctgcctgggg agacgatgta cgccttcaag 780
 ctgctgtttc tcgacatcag cgagctgggt atgtggcggt gggagggcga gcccatcagc 840
 aagctggccg ggtacctctt catgccctcg ctgctcctca agctcacctt ctgggcgcgc 900
 tttgtcgcgc tgccgtgta cctcgcgcc agcgtgcaca cggcgggtgt catcgcggcg 960
 acggtaataa cggggagctt ctacctgcc ttcttcttct tcatctcgca caacttcgag 1020
 ggcgtggcga gcgtcggacc ggacggcagc atcaccagca tgacgcgcgg cgcattcttc 1080
 ctcaagcggc agcccgagac ctgcgtcaac gtgggcggcc cgctgctcgc cagctcaac 1140
 ggcggcctca actaccaaata cgagcaccac ctcttcccca ggggtgacca cggcttctac 1200
 cctcgcctcg cgccgttggt caaggcggag ctcgaggcgc gcggcattga gtacaagcac 1260
 taccacacca tatggagcaa cctggcatcc acgctgaggc acatgtacgc gctcggccgc 1320
 aggccgcgca gcaaggcgga gtga 1344

<210> 27
 <211> 1347
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Codon-optimized open reading frame for expression of Pavlova salina 4 desaturase in plants (version 1)

<400> 27
 atgccaccta gcgctgctaa gcaaatggga gcttctactg gtgttcatgc tgggtgttact 60
 gactcttctg ctttcaccag aaaggatggt gctgatagac ctgatctcac catcgttgga 120

517416 Sequence Listing

gattctgttt acgatgctaa ggctttcaga tctgagcatc ctggtggtgc tcatttcggt	180
tctttgttcg gaggaagaga tgctactgag gctttcatgg aataccatag aagggtcttg	240
cctaagtcta gaatgtctag attccacggt ggatctcttg cttctactga ggaacctggt	300
gctgctgatg agggatacct tcaactttgt gctaggatcg ctaagatggt gccttctggt	360
tcttctggat tcgctcctgc ttcttactgg gttaaggctg gacttatcct tggatctgct	420
atcgctcttg aggcctacat gctttacgct ggaaagagac ttctcccttc tatcgttctt	480
ggatggcttt tcgctcttat cggctttaac atccagcatg atgctaacca tggtgctttg	540
tctaagtctg cttctgttaa ccttgctctt ggactttgtc aggattggat cggaggatct	600
atgatccttt ggcttcaaga gcatgttggt atgcaccacc tccacactaa cgatgttgat	660
aaggatcctg atcaaaaggc tcacggtgct cttagactca agcctactga tgcttggcca	720
cctatgcatt ggcttcagca tctttacctt ttgcctgggt agactatgta cgctttcaag	780
cttttgttcc tcgacatctc tgagcttggt atgtggcggt gggaggggtga gcctatctct	840
aagcttgctg gatacctctt tatgccttct ttgcttctca agcttacctt ctgggctaga	900
ttcgttgctt tgccctctta ccttgctcct tctgttcata ctgctgtgtg tatcgctgct	960
actgttatga ctggatcttt ctacctgct ttcttcttct tcatctcca caacttcgag	1020
ggtgttgctt ctggtggacc tgatggatct atcacttcta tgactagagg tgctagcttc	1080
cttaagagac aagctgagac ttcttctaac gttggaggac ctcttcttgc tactcttaac	1140
ggtggactca actaccaaat tgagcatcac ttgttccta gagttcacca tggattctac	1200
cctagacttg ctctcttgt taaggctgag cttgaggcta gaggaatcga gtacaagcac	1260
tacctacta tctgggtctaa ccttgcttct accctcagac atatgtacgc tcttgggaaga	1320
aggcctagat ctaaggctga gtaatga	1347

<210> 28
 <211> 447
 <212> PRT
 <213> Pavlova salina
 <400> 28

Met	Pro	Pro	Ser	Ala	Ala	Lys	Gln	Met	Gly	Ala	Ser	Thr	Gly	Val	His
1				5					10					15	

Ala	Gly	Val	Thr	Asp	Ser	Ser	Ala	Phe	Thr	Arg	Lys	Asp	Val	Ala	Asp
			20					25					30		

Arg	Pro	Asp	Leu	Thr	Ile	Val	Gly	Asp	Ser	Val	Tyr	Asp	Ala	Lys	Ala
		35					40					45			

Phe	Arg	Ser	Glu	His	Pro	Gly	Gly	Ala	His	Phe	Val	Ser	Leu	Phe	Gly
	50					55					60				

Gly	Arg	Asp	Ala	Thr	Glu	Ala	Phe	Met	Glu	Tyr	His	Arg	Arg	Ala	Trp
65					70					75					80

517416 Sequence Listing

Pro Lys Ser Arg Met₈₅ Ser Arg Phe His Val₉₀ Gly Ser Leu Ala Ser₉₅ Thr
 Glu Glu Pro Val₁₀₀ Ala Ala Asp Glu Gly₁₀₅ Tyr Leu Gln Leu Cys₁₁₀ Ala Arg
 Ile Ala Lys₁₁₅ Met Val Pro Ser Val₁₂₀ Ser Ser Gly Phe Ala₁₂₅ Pro Ala Ser
 Tyr Trp Val₁₃₀ Lys Ala Gly Leu₁₃₅ Ile Leu Gly Ser Ala₁₄₀ Ile Ala Leu Glu
 Ala Tyr Met Leu Tyr Ala₁₅₀ Gly Lys Arg Leu Leu₁₅₅ Pro Ser Ile Val Leu₁₆₀
 Gly Trp Leu Phe Ala₁₆₅ Leu Ile Gly Leu Asn₁₇₀ Ile Gln His Asp Ala₁₇₅ Asn
 His Gly Ala Leu₁₈₀ Ser Lys Ser Ala Ser₁₈₅ Val Asn Leu Ala Leu₁₉₀ Gly Leu
 Cys Gln Asp Trp Ile Gly Gly Ser₂₀₀ Met Ile Leu Trp Leu₂₀₅ Gln Glu His
 Val Val₂₁₀ Met His His Leu His₂₁₅ Thr Asn Asp Val Asp₂₂₀ Lys Asp Pro Asp
 Gln Lys Ala His Gly Ala₂₃₀ Leu Arg Leu Lys Pro₂₃₅ Thr Asp Ala Trp Ser₂₄₀
 Pro Met His Trp Leu₂₄₅ Gln His Leu Tyr Leu₂₅₀ Leu Pro Gly Glu Thr₂₅₅ Met
 Tyr Ala Phe Lys₂₆₀ Leu Leu Phe Leu Asp₂₆₅ Ile Ser Glu Leu Val₂₇₀ Met Trp
 Arg Trp Glu Gly Glu Pro Ile Ser₂₈₀ Lys Leu Ala Gly Tyr₂₈₅ Leu Phe Met
 Pro Ser Leu Leu Leu Lys Leu₂₉₅ Thr Phe Trp Ala Arg₃₀₀ Phe Val Ala Leu
 Pro Leu Tyr Leu Ala Pro₃₁₀ Ser Val His Thr Ala₃₁₅ Val Cys Ile Ala Ala₃₂₀
 Thr Val Met Thr Gly₃₂₅ Ser Phe Tyr Leu Ala₃₃₀ Phe Phe Phe Phe Ile₃₃₅ Ser
 His Asn Phe Glu Gly Val Ala Ser Val₃₄₅ Gly Pro Asp Gly Ser₃₅₀ Ile Thr

517416 Sequence Listing

Ser Met Thr Arg Gly Ala Ser Phe Leu Lys Arg Gln Ala Glu Thr Ser
355 360 365

Ser Asn Val Gly Gly Pro Leu Leu Ala Thr Leu Asn Gly Gly Leu Asn
370 375 380

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

Pro Arg Leu Ala Pro Leu Val Lys Ala Glu Leu Glu Ala Arg Gly Ile
405 410 415

Glu Tyr Lys His Tyr Pro Thr Ile Trp Ser Asn Leu Ala Ser Thr Leu
420 425 430

Arg His Met Tyr Ala Leu Gly Arg Arg Pro Arg Ser Lys Ala Glu
435 440 445

<210> 29
<211> 263
<212> PRT
<213> Isochrysis galbana

<400> 29

Met Ala Leu Ala Asn Asp Ala Gly Glu Arg Ile Trp Ala Ala Val Thr
1 5 10 15

Asp Pro Glu Ile Leu Ile Gly Thr Phe Ser Tyr Leu Leu Leu Lys Pro
20 25 30

Leu Leu Arg Asn Ser Gly Leu Val Asp Glu Lys Lys Gly Ala Tyr Arg
35 40 45

Thr Ser Met Ile Trp Tyr Asn Val Leu Leu Ala Leu Phe Ser Ala Leu
50 55 60

Ser Phe Tyr Val Thr Ala Thr Ala Leu Gly Trp Asp Tyr Gly Thr Gly
65 70 75 80

Ala Trp Leu Arg Arg Gln Thr Gly Asp Thr Pro Gln Pro Leu Phe Gln
85 90 95

Cys Pro Ser Pro Val Trp Asp Ser Lys Leu Phe Thr Trp Thr Ala Lys
100 105 110

Ala Phe Tyr Tyr Ser Lys Tyr Val Glu Tyr Leu Asp Thr Ala Trp Leu
115 120 125

Val Leu Lys Gly Lys Arg Val Ser Phe Leu Gln Ala Phe His His Phe
130 135 140

517416 Sequence Listing

Gly Ala Pro Trp Asp Val Tyr Leu Gly Ile Arg Leu His Asn Glu Gly
145 150 155 160

Val Trp Ile Phe Met Phe Phe Asn Ser Phe Ile His Thr Ile Met Tyr
165 170 175

Thr Tyr Tyr Gly Leu Thr Ala Ala Gly Tyr Lys Phe Lys Ala Lys Pro
180 185 190

Leu Ile Thr Ala Met Gln Ile Cys Gln Phe Val Gly Gly Phe Leu Leu
195 200 205

Val Trp Asp Tyr Ile Asn Val Pro Cys Phe Asn Ser Asp Lys Gly Lys
210 215 220

Leu Phe Ser Trp Ala Phe Asn Tyr Ala Tyr Val Gly Ser Val Phe Leu
225 230 235 240

Leu Phe Cys His Phe Phe Tyr Gln Asp Asn Leu Ala Thr Lys Lys Ser
245 250 255

Ala Lys Ala Gly Lys Gln Leu
260

<210> 30
<211> 801
<212> DNA
<213> Artificial Sequence

<220>
<223> Codon-optimized open reading frame for expression of Emiliana
huxleyi 9 elongase in plants

<400> 30
atgcttgata gagcttcatac tgatgctgct atttggagcg ctgtttctga tcctgagatc 60
cttatcgga cttctctta cttttgctt aagcctctcc tcagaaactc tggacttggt 120
gatgagagaa agggagctta ccgtacttct atgatctggt acaacgttgt tcttgctctt 180
ttctctgcta cctctttcta cgttactgct actgctcttg gatgggataa gggaactggt 240
gagtggctta gatctcttac tgggtattct cctcaacaac tttggcagt cccttctaga 300
gtttgggaca gcaaactctt cttgtggact gctaaagcct tctactactc caagtacgtt 360
gagtaccttg atactgcttg gcttgttctc aagggaaga aggtttcatt cctccaggga 420
ttccatcatt tcggtgctcc atgggatggt taccttggaa tcaggcttaa gaacgaggga 480
gtttggatct tcatgttctt caacagcttc atccacactg ttatgtacac ttactacgga 540
cttactgctg ctggatacaa gatcagagga aagcctatca tcaccgctat gcaaactctt 600
caattcggtg gtggattcgt tcttggtggt gactacatca acgttccttg tttccatgct 660
gatgctggac aagttttctc ttgggtgttc aactacgctt atgtgggatc tgttttcctt 720
cttttctgcc acttcttcta catggacaac attgctaagg ctaaggctaa aaaggctggt 780

517416 Sequence Listing

801

gctaccagaa aggctctttg a

<210> 31
 <211> 266
 <212> PRT
 <213> *Emiliana huxleyi*

<400> 31

Met Leu Asp Arg Ala Ser Ser Asp Ala Ala Ile Trp Ser Ala Val Ser
 1 5 10 15

Asp Pro Glu Ile Leu Ile Gly Thr Phe Ser Tyr Leu Leu Leu Lys Pro
 20 25 30

Leu Leu Arg Asn Ser Gly Leu Val Asp Glu Arg Lys Gly Ala Tyr Arg
 35 40 45

Thr Ser Met Ile Trp Tyr Asn Val Val Leu Ala Leu Phe Ser Ala Thr
 50 55 60

Ser Phe Tyr Val Thr Ala Thr Ala Leu Gly Trp Asp Lys Gly Thr Gly
 65 70 75 80

Glu Trp Leu Arg Ser Leu Thr Gly Asp Ser Pro Gln Gln Leu Trp Gln
 85 90 95

Cys Pro Ser Arg Val Trp Asp Ser Lys Leu Phe Leu Trp Thr Ala Lys
 100 105 110

Ala Phe Tyr Tyr Ser Lys Tyr Val Glu Tyr Leu Asp Thr Ala Trp Leu
 115 120 125

Val Leu Lys Gly Lys Lys Val Ser Phe Leu Gln Gly Phe His His Phe
 130 135 140

Gly Ala Pro Trp Asp Val Tyr Leu Gly Ile Arg Leu Lys Asn Glu Gly
 145 150 155 160

Val Trp Ile Phe Met Phe Phe Asn Ser Phe Ile His Thr Val Met Tyr
 165 170 175

Thr Tyr Tyr Gly Leu Thr Ala Ala Gly Tyr Lys Ile Arg Gly Lys Pro
 180 185 190

Ile Ile Thr Ala Met Gln Ile Ser Gln Phe Val Gly Gly Phe Val Leu
 195 200 205

Val Trp Asp Tyr Ile Asn Val Pro Cys Phe His Ala Asp Ala Gly Gln
 210 215 220

Val Phe Ser Trp Val Phe Asn Tyr Ala Tyr Val Gly Ser Val Phe Leu
 Page 54

517416 Sequence Listing

Val Phe Ser Leu Val Cys Phe Ile Cys Gln Leu Ala Ala Leu Gly Tyr
65 70 75 80

Asp Met Gly Tyr Leu Gln Trp Val Arg Asp Leu Thr Gly Asp Glu Ile
85 90 95

Val Pro Leu Tyr Gln Asp Val Ser Pro Ser Pro Ala Phe Ser Asn Lys
100 105 110

Leu Phe Lys Tyr Ser Ser Ile Ala Phe His Tyr Ser Lys Tyr Val Glu
115 120 125

Tyr Met Asp Thr Ala Trp Leu Val Met Lys Gly Lys Pro Val Ser Leu
130 135 140

Leu Gln Gly Phe His His Phe Gly Ala Ala Trp Asp Thr Tyr Phe Gly
145 150 155 160

Ile Thr Phe Gln Asn Glu Gly Ile Tyr Val Phe Val Val Leu Asn Ala
165 170 175

Phe Ile His Thr Ile Met Tyr Ala Tyr Tyr Ala Ala Thr Ala Ala Gly
180 185 190

Leu Lys Phe Ser Leu Lys Phe Val Ile Thr Leu Met Gln Ile Thr Gln
195 200 205

Phe Asn Val Gly Phe Val Met Val Tyr His Tyr Ile Thr Leu Glu Tyr
210 215 220

Phe Arg Asn Ser Pro Glu Leu Val Phe Ser Tyr Leu Phe Asn Tyr Ala
225 230 235 240

Tyr Val Cys Thr Val Leu Leu Leu Phe Met Gln Phe Phe Tyr Met Asp
245 250 255

Asn Phe Gly Lys Lys Lys Ala Ala Ala Ala Ala Gly Lys Lys Lys
260 265 270

<210> 34

<211> 840

<212> DNA

<213> Pavlova salina

<400> 34

atggcgactg aagggatgcc ggcgataacg ctggactggc tgctctcgcc cgggctgaag 60

gatgccgtaa ttggcgggga ggtgctctac ttttcgcttg ggtatctgct gctcgagccc 120

atcctcaagc gctcaccgtt tgtggacaag cgcaagggcg cataccgcaa cggcatgatc 180

gcgtacaaca tcctcatgtg cggtttctcg ctggtatgct tcgtgtgcca gatggcggcg 240

ctcggccttg atcgcgcca cctgcagttt gtccgcgacc tcacgggcga cagcgtggtg 300

517416 Sequence Listing

cagctctacc aggacgtgag cccatcccct gcattcgcga acaagctctt ccggtactca 360
gcggtggcgt tccactactc aaagtacgtg gagtacatgg acacagcgtg gcttgctgctg 420
aagggcaagc ccgtctcggt cctgcagggc ttccaccact tcggcgccgc gtgggacacc 480
tactttggca tcacgtttca gaacgagggc acctacgtct ttgtgctgct caacgcattc 540
atccacacaa tcatgtacac ctactacggc gcgacggcag cgggcatcaa aatctcgatg 600
aagccgctga tcaccctcat gcagatcacg cagttcctgc tgggcttcgc gctcgtctac 660
ccgtacattg acctcggcta cttccgtgcg tcgcccgagc tcgtgtggag ctacctgttc 720
aactatgcgt acgtactcat ggtgctcttc ctcttcatgc gcttcttcta ccacgacaac 780
tttagcaagc acaagccaat ctcgcgcacg gactccagca accgcatgaa aaccgagtag 840

<210> 35
<211> 279
<212> PRT
<213> Pavlova salina

<400> 35

Met Ala Thr Glu Gly Met Pro Ala Ile Thr Leu Asp Trp Leu Leu Ser
1 5 10 15

Pro Gly Leu Lys Asp Ala Val Ile Gly Gly Glu Val Leu Tyr Phe Ser
20 25 30

Leu Gly Tyr Leu Leu Leu Glu Pro Ile Leu Lys Arg Ser Pro Phe Val
35 40 45

Asp Lys Arg Lys Gly Ala Tyr Arg Asn Gly Met Ile Ala Tyr Asn Ile
50 55 60

Leu Met Cys Gly Phe Ser Leu Val Cys Phe Val Cys Gln Met Ala Ala
65 70 75 80

Leu Gly Leu Asp Arg Gly His Leu Gln Phe Val Arg Asp Leu Thr Gly
85 90 95

Asp Ser Val Val Gln Leu Tyr Gln Asp Val Ser Pro Ser Pro Ala Phe
100 105 110

Ala Asn Lys Leu Phe Arg Tyr Ser Ala Val Ala Phe His Tyr Ser Lys
115 120 125

Tyr Val Glu Tyr Met Asp Thr Ala Trp Leu Val Leu Lys Gly Lys Pro
130 135 140

Val Ser Phe Leu Gln Gly Phe His His Phe Gly Ala Ala Trp Asp Thr
145 150 155 160

Tyr Phe Gly Ile Thr Phe Gln Asn Glu Gly Thr Tyr Val Phe Val Leu

517416 Sequence Listing

165

170

175

Leu Asn Ala Phe Ile His Thr Ile Met Tyr Thr Tyr Tyr Gly Ala Thr
 180 185 190

Ala Ala Gly Ile Lys Ile Ser Met Lys Pro Leu Ile Thr Leu Met Gln
 195 200 205

Ile Thr Gln Phe Leu Leu Gly Phe Ala Leu Val Tyr Pro Tyr Ile Asp
 210 215 220

Leu Gly Tyr Phe Arg Ala Ser Pro Glu Leu Val Trp Ser Tyr Leu Phe
 225 230 235 240

Asn Tyr Ala Tyr Val Leu Met Val Leu Phe Leu Phe Met Arg Phe Phe
 245 250 255

Tyr His Asp Asn Phe Ser Lys His Lys Pro Ile Ser Arg Ile Asp Ser
 260 265 270

Ser Asn Arg Met Lys Thr Glu
 275

<210> 36

<211> 1284

<212> DNA

<213> Pavlova salina

<400> 36

atgggacgcg gcggagacag cagtgggcag gcgcatccgg cggcggagct ggcggtccc	60
agcgaccgcg cggagggtgag caacgctgac agcaaagcgc tgcacatcgt gctgtatggc	120
aagcgcgtgg atgtgaccaa gttccaacgc acgcacccgg gtggtagcaa ggtcttccgg	180
atcttccagg accgcgatgc gacggagcag ttcgagtcct accactcgaa gcgcgcgatc	240
aagatgatgg agggcatgct caagaagtct gaggatgctc ccgccgacac gcccttgccc	300
tcccagtcac cgatggggaa ggacttcaag gcgatgatcg agcggcacgt tgcagcgggt	360
tactacgatc catgcccgtc cgatgagctg ttcaagctca gcctcgtgct cctcccgacc	420
tttgcgggca tgtacatgct caaggcgggc gtcggctccc cgctctgcgg cgccctcatg	480
gtgagctttg gctggtacct cgatggctgg ctcgcgcacg actatctgca ccactccgtc	540
ttcaaggggt ccgtcgcacg caccgtcggg tggaacaacg cggcgggcta cttcctcggc	600
ttcgtgcagg ggtatgcggt cgagtggtag cgcgcgcggc ataacacgca ccacgtgtgc	660
accaatgagg acggctcgga ccccgacatc aaaacggcgc cgctgctcat atacgtgcgc	720
aacaagccga gcatcgccaa gcgcctgaac gccttccagc gctaccagca gtactactat	780
gtgccggtga tggcaatcct cgacctgtac tggcggctcg agtcgatcgc ctacgtcgcg	840
atgcgcctgc cgaagatgct gccgcaggcc ctcgcactcg tcgcgcacta cgccatcgtc	900
gcgtgggtct ttgcgggcaa ctaccacctg ctcccgtcgc tgacgggttct gcgcgggttt	960

517416 Sequence Listing

```

ggcactggga tcaccgtttt cgcgacgcac tacggtgagg acattctcga cgcggaccag      1020
gtgcgtcaca tgacgctcgt cgagcagacg gcactcacct cgcgcaacat ctcgggcggc      1080
tggctcgtga acgtgctcac cggcttcac tcactgcaga cggagcacca cctgttcccg      1140
atgatgcaa cccgcaacct catgactatc cagcccgagg tgcgcgcctt cttcaagaag      1200
cacggacttg agtaccgcga gggcaacctc attgagtgcg tgcggcagaa catccgtgcg      1260
cttgcatctg agcacctgct ttga                                           1284

```

```

<210> 37
<211> 427
<212> PRT
<213> Pavlova salina

```

```

<400> 37

```

```

Met Gly Arg Gly Gly Asp Ser Ser Gly Gln Ala His Pro Ala Ala Glu
1      5      10      15

```

```

Leu Ala Val Pro Ser Asp Arg Ala Glu Val Ser Asn Ala Asp Ser Lys
20      25      30

```

```

Ala Leu His Ile Val Leu Tyr Gly Lys Arg Val Asp Val Thr Lys Phe
35      40      45

```

```

Gln Arg Thr His Pro Gly Gly Ser Lys Val Phe Arg Ile Phe Gln Asp
50      55      60

```

```

Arg Asp Ala Thr Glu Gln Phe Glu Ser Tyr His Ser Lys Arg Ala Ile
65      70      75      80

```

```

Lys Met Met Glu Gly Met Leu Lys Lys Ser Glu Asp Ala Pro Ala Asp
85      90      95

```

```

Thr Pro Leu Pro Ser Gln Ser Pro Met Gly Lys Asp Phe Lys Ala Met
100     105     110

```

```

Ile Glu Arg His Val Ala Ala Gly Tyr Tyr Asp Pro Cys Pro Leu Asp
115     120     125

```

```

Glu Leu Phe Lys Leu Ser Leu Val Leu Leu Pro Thr Phe Ala Gly Met
130     135     140

```

```

Tyr Met Leu Lys Ala Gly Val Gly Ser Pro Leu Cys Gly Ala Leu Met
145     150     155     160

```

```

Val Ser Phe Gly Trp Tyr Leu Asp Gly Trp Leu Ala His Asp Tyr Leu
165     170     175

```

```

His His Ser Val Phe Lys Gly Ser Val Ala Arg Thr Val Gly Trp Asn
180     185     190

```

517416 Sequence Listing

Asn Ala Ala Gly Tyr Phe Leu Gly Phe Val Gln Gly Tyr Ala Val Glu
 195 200 205
 Trp Trp Arg Ala Arg His Asn Thr His His Val Cys Thr Asn Glu Asp
 210 215 220
 Gly Ser Asp Pro Asp Ile Lys Thr Ala Pro Leu Leu Ile Tyr Val Arg
 225 230 235 240
 Asn Lys Pro Ser Ile Ala Lys Arg Leu Asn Ala Phe Gln Arg Tyr Gln
 245 250 255
 Gln Tyr Tyr Tyr Val Pro Val Met Ala Ile Leu Asp Leu Tyr Trp Arg
 260 265 270
 Leu Glu Ser Ile Ala Tyr Val Ala Met Arg Leu Pro Lys Met Leu Pro
 275 280 285
 Gln Ala Leu Ala Leu Val Ala His Tyr Ala Ile Val Ala Trp Val Phe
 290 295 300
 Ala Gly Asn Tyr His Leu Leu Pro Leu Val Thr Val Leu Arg Gly Phe
 305 310 315 320
 Gly Thr Gly Ile Thr Val Phe Ala Thr His Tyr Gly Glu Asp Ile Leu
 325 330 335
 Asp Ala Asp Gln Val Arg His Met Thr Leu Val Glu Gln Thr Ala Leu
 340 345 350
 Thr Ser Arg Asn Ile Ser Gly Gly Trp Leu Val Asn Val Leu Thr Gly
 355 360 365
 Phe Ile Ser Leu Gln Thr Glu His His Leu Phe Pro Met Met Pro Thr
 370 375 380
 Gly Asn Leu Met Thr Ile Gln Pro Glu Val Arg Ala Phe Phe Lys Lys
 385 390 395 400
 His Gly Leu Glu Tyr Arg Glu Gly Asn Leu Ile Glu Cys Val Arg Gln
 405 410 415
 Asn Ile Arg Ala Leu Ala Phe Glu His Leu Leu
 420 425

<210> 38
 <211> 116
 <212> PRT
 <213> Tomato yellow leaf curl virus
 <400> 38

517416 Sequence Listing

Met Trp Asp Pro Leu Leu Asn Glu Phe Pro Glu Ser Val His Gly Phe
1 5 10 15

Arg Cys Met Leu Ala Ile Lys Tyr Leu Gln Ser Val Glu Glu Thr Tyr
20 25 30

Glu Pro Asn Thr Leu Gly His Asp Leu Ile Arg Asp Leu Ile Ser Val
35 40 45

Val Arg Ala Arg Asp Tyr Val Glu Ala Thr Arg Arg Tyr Asn His Phe
50 55 60

His Ala Arg Leu Glu Gly Ser Pro Lys Ala Glu Leu Arg Gln Pro Ile
65 70 75 80

Gln Gln Pro Cys Cys Cys Pro His Cys Pro Arg His Lys Gln Ala Thr
85 90 95

Ile Met Asp Val Gln Ala His Val Pro Glu Ala Gln Asn Ile Gln Asn
100 105 110

Val Ser Lys Pro
115

<210> 39
<211> 351
<212> DNA
<213> Tomato yellow leaf curl virus

<400> 39
atgtgggatac cacttctaaa tgaatttcct gaatctgttc acggatttcg ttgtatgtta 60
gctattaaat atttgcagtc cgttgaggaa acttacgagc ccaatacatt gggccacgat 120
ttaattaggg atcttatatc tgttgtaagg gcccgtgact atgtcgaagc gaccaggcga 180
tataatcatt tccacgcccg cctcgaaggt tcgccgaagg ctgaacttcg acagcccata 240
cagcagccgt gctgctgtcc ccattgtcca aggcacaaac aagcgacgat catggacgta 300
caggcccatg taccggaagc ccagaatata cagaatgtat cgaagccctg a 351

<210> 40
<211> 389
<212> PRT
<213> Arabidopsis thaliana

<400> 40

Met Val Ile Ala Ala Ala Val Ile Val Pro Leu Gly Leu Leu Phe Phe
1 5 10 15

Ile Ser Gly Leu Ala Val Asn Leu Phe Gln Ala Val Cys Tyr Val Leu
20 25 30

Ile Arg Pro Leu Ser Lys Asn Thr Tyr Arg Lys Ile Asn Arg Val Val
35 40 45

517416 Sequence Listing

Ala Glu Thr Leu Trp Leu Glu Leu Val Trp Ile Val Asp Trp Trp Ala
50 55 60

Gly Val Lys Ile Gln Val Phe Ala Asp Asn Glu Thr Phe Asn Arg Met
65 70 75 80

Gly Lys Glu His Ala Leu Val Val Cys Asn His Arg Ser Asp Ile Asp
85 90 95

Trp Leu Val Gly Trp Ile Leu Ala Gln Arg Ser Gly Cys Leu Gly Ser
100 105 110

Ala Leu Ala Val Met Lys Lys Ser Ser Lys Phe Leu Pro Val Ile Gly
115 120 125

Trp Ser Met Trp Phe Ser Glu Tyr Leu Phe Leu Glu Arg Asn Trp Ala
130 135 140

Lys Asp Glu Ser Thr Leu Lys Ser Gly Leu Gln Arg Leu Ser Asp Phe
145 150 155 160

Pro Arg Pro Phe Trp Leu Ala Leu Phe Val Glu Gly Thr Arg Phe Thr
165 170 175

Glu Ala Lys Leu Lys Ala Ala Gln Glu Tyr Ala Ala Ser Ser Glu Leu
180 185 190

Pro Ile Pro Arg Asn Val Leu Ile Pro Arg Thr Lys Gly Phe Val Ser
195 200 205

Ala Val Ser Asn Met Arg Ser Phe Val Pro Ala Ile Tyr Asp Met Thr
210 215 220

Val Thr Ile Pro Lys Thr Ser Pro Pro Pro Thr Met Leu Arg Leu Phe
225 230 235 240

Lys Gly Gln Pro Ser Val Val His Val His Ile Lys Cys His Ser Met
245 250 255

Lys Asp Leu Pro Glu Ser Asp Asp Ala Ile Ala Gln Trp Cys Arg Asp
260 265 270

Gln Phe Val Ala Lys Asp Ala Leu Leu Asp Lys His Ile Ala Ala Asp
275 280 285

Thr Phe Pro Gly Gln Gln Glu Gln Asn Ile Gly Arg Pro Ile Lys Ser
290 295 300

Leu Ala Val Val Leu Ser Trp Ala Cys Val Leu Thr Leu Gly Ala Ile
305 310 315 320

517416 Sequence Listing

Lys Phe Leu His Trp Ala Gln Leu Phe Ser Ser Trp Lys Gly Ile Thr
325 330 335

Ile Ser Ala Leu Gly Leu Gly Ile Ile Thr Leu Cys Met Gln Ile Leu
340 345 350

Ile Arg Ser Ser Gln Ser Glu Arg Ser Thr Pro Ala Lys Val Val Pro
355 360 365

Ala Lys Pro Lys Asp Asn His His Pro Glu Ser Ser Ser Gln Thr Glu
370 375 380

Thr Glu Lys Glu Lys
385

<210> 41
<211> 281
<212> PRT
<213> Limnanthes alba

<400> 41

Met Ala Lys Thr Arg Thr Ser Ser Leu Arg Asn Arg Arg Gln Leu Lys
1 5 10 15

Thr Ala Val Ala Ala Thr Ala Asp Asp Asp Lys Asp Gly Ile Phe Met
20 25 30

Val Leu Leu Ser Cys Phe Lys Ile Phe Val Cys Phe Ala Ile Val Leu
35 40 45

Ile Thr Ala Val Ala Trp Gly Leu Ile Met Val Leu Leu Leu Pro Trp
50 55 60

Pro Tyr Met Arg Ile Arg Leu Gly Asn Leu Tyr Gly His Ile Ile Gly
65 70 75 80

Gly Leu Val Ile Trp Leu Tyr Gly Ile Pro Ile Glu Ile Gln Gly Ser
85 90 95

Glu His Thr Lys Lys Arg Ala Ile Tyr Ile Ser Asn His Ala Ser Pro
100 105 110

Ile Asp Ala Phe Phe Val Met Trp Leu Ala Pro Ile Gly Thr Val Gly
115 120 125

Val Ala Lys Lys Glu Val Ile Trp Tyr Pro Leu Leu Gly Gln Leu Tyr
130 135 140

Thr Leu Ala His His Ile Arg Ile Asp Arg Ser Asn Pro Ala Ala Ala
145 150 155 160

517416 Sequence Listing

Ile Gln Ser Met Lys Glu Ala Val Arg Val Ile Thr Glu Lys Asn Leu
165 170 175

Ser Leu Ile Met Phe Pro Glu Gly Thr Arg Ser Gly Asp Gly Arg Leu
180 185 190

Leu Pro Phe Lys Lys Gly Phe Val His Leu Ala Leu Gln Ser His Leu
195 200 205

Pro Ile Val Pro Met Ile Leu Thr Gly Thr His Leu Ala Trp Arg Lys
210 215 220

Gly Thr Phe Arg Val Arg Pro Val Pro Ile Thr Val Lys Tyr Leu Pro
225 230 235 240

Pro Ile Asn Thr Asp Asp Trp Thr Val Asp Lys Ile Asp Asp Tyr Val
245 250 255

Lys Met Ile His Asp Ile Tyr Val Arg Asn Leu Pro Ala Ser Gln Lys
260 265 270

Pro Leu Gly Ser Thr Asn Arg Ser Lys
275 280

<210> 42
<211> 303
<212> PRT
<213> Saccharomyces cerevisiae

<400> 42

Met Ser Val Ile Gly Arg Phe Leu Tyr Tyr Leu Arg Ser Val Leu Val
1 5 10 15

Val Leu Ala Leu Ala Gly Cys Gly Phe Tyr Gly Val Ile Ala Ser Ile
20 25 30

Leu Cys Thr Leu Ile Gly Lys Gln His Leu Ala Gln Trp Ile Thr Ala
35 40 45

Arg Cys Phe Tyr His Val Met Lys Leu Met Leu Gly Leu Asp Val Lys
50 55 60

Val Val Gly Glu Glu Asn Leu Ala Lys Lys Pro Tyr Ile Met Ile Ala
65 70 75 80

Asn His Gln Ser Thr Leu Asp Ile Phe Met Leu Gly Arg Ile Phe Pro
85 90 95

Pro Gly Cys Thr Val Thr Ala Lys Lys Ser Leu Lys Tyr Val Pro Phe
100 105 110

517416 Sequence Listing

Leu Gly Trp Phe Met Ala Leu Ser Gly Thr Tyr Phe Leu Asp Arg Ser
 115 120 125

Lys Arg Gln Glu Ala Ile Asp Thr Leu Asn Lys Gly Leu Glu Asn Val
 130 135 140

Lys Lys Asn Lys Arg Ala Leu Trp Val Phe Pro Glu Gly Thr Arg Ser
 145 150 155 160

Tyr Thr Ser Glu Leu Thr Met Leu Pro Phe Lys Lys Gly Ala Phe His
 165 170 175

Leu Ala Gln Gln Gly Lys Ile Pro Ile Val Pro Val Val Val Ser Asn
 180 185 190

Thr Ser Thr Leu Val Ser Pro Lys Tyr Gly Val Phe Asn Arg Gly Cys
 195 200 205

Met Ile Val Arg Ile Leu Lys Pro Ile Ser Thr Glu Asn Leu Thr Lys
 210 215 220

Asp Lys Ile Gly Glu Phe Ala Glu Lys Val Arg Asp Gln Met Val Asp
 225 230 235 240

Thr Leu Lys Glu Ile Gly Tyr Ser Pro Ala Ile Asn Asp Thr Thr Leu
 245 250 255

Pro Pro Gln Ala Ile Glu Tyr Ala Ala Leu Gln His Asp Lys Lys Val
 260 265 270

Asn Lys Lys Ile Lys Asn Glu Pro Val Pro Ser Val Ser Ile Ser Asn
 275 280 285

Asp Val Asn Thr His Asn Glu Gly Ser Ser Val Lys Lys Met His
 290 295 300

<210> 43
 <211> 373
 <212> PRT
 <213> Micromonas pusilla

<400> 43

Met Thr Pro Tyr Gln Trp Phe Asn Val Val Ser Ser Leu Gly Tyr Val
 1 5 10 15

Leu Phe Thr Ala Thr Thr Ser Thr Val Thr Met Leu Val Pro Ala Ile
 20 25 30

Ile Leu Leu Arg Pro Val Ser Ala Asn Leu Tyr Ala Arg Cys Thr Ser
 35 40 45

Trp Ile Phe Ala Cys Trp Trp Thr Ser Cys Leu Phe Ile Thr Glu Arg
 Page 65

517416 Sequence Listing

50

55

60

Leu Asn Gly Val Lys Val Arg Val Thr Gly Asp Ala Leu Pro Leu Asn
65 70 75 80

Ala Pro Leu Leu Ile Met Ser Asn His Lys Cys Asn Leu Asp Trp Met
85 90 95

Phe Leu Trp Ser Ser Ala Ile Arg Thr Gly Ser Met Phe His Val Gly
100 105 110

Val Phe Lys Ala Val Ala Lys Ser Glu Ile Arg Val Ile Pro Ile Phe
115 120 125

Gly Trp Gly Cys Lys Leu Asn Gly Phe Ala Tyr Val Arg Arg Arg Trp
130 135 140

Ser Ser Asp Ala Ser His Leu Thr Ser Trp Ile Gln Ser Gln Ile Arg
145 150 155 160

Arg Arg Leu Asn Ala Asn Trp Thr Leu Ile Phe Pro Glu Gly Thr Arg
165 170 175

Tyr Thr Asp Arg Asn Lys Glu Arg Ser Asp Leu Ser Cys Ala Lys Asp
180 185 190

Gly Leu Glu Pro Met Ala Gly Glu Ile Leu Arg Pro Arg Thr Lys Gly
195 200 205

Leu Ala Leu Leu Leu Arg Glu Ser Ala Lys Gly Gly Gly Tyr Tyr Arg
210 215 220

Lys Ile Val Asp Met Thr Ile Gln Tyr Thr Asp Ala Asp Gly Lys Pro
225 230 235 240

Leu Lys Gly Ala Ala Leu Gly Thr Arg Cys Phe Gly Gln Leu Ala Lys
245 250 255

Gly Gln Leu Pro Val Ala Thr Cys His Val His Phe Asp Val Phe Ser
260 265 270

His Lys Asp Val Pro Ala Gly Glu Asp Glu Asp Glu Val Glu Ala Trp
275 280 285

Val Trp Lys Arg Trp Arg Lys Lys Ala Asn Met Leu Glu Ala Cys Ala
290 295 300

Ser Ala Gly Gln Phe Glu Gly Val Arg Glu Trp Ser Thr Ser Gly Thr
305 310 315 320

Ala Val Pro Leu Lys Thr Gln Thr Ala Leu Arg Cys Phe Phe Val Leu
Page 66

517416 Sequence Listing
330 335

Gln Gly Leu Val Cys Val Gly Val Ala Cys Ser Ser Thr Ala Phe Leu
340 345 350

Ala Tyr Val Ala Cys Ala Ala Val Gly Ala Ala Val Ile Ala Gln Thr
355 360 365

Asp Pro Ala Trp Trp
370

<210> 44
<211> 314
<212> PRT
<213> Mortierella alpina
<400> 44

Met Ser Ile Gly Ser Ser Asn Pro Val Leu Leu Ala Ala Ile Pro Phe
1 5 10 15

Val Tyr Leu Phe Val Leu Pro Arg Val Leu Ala Phe Leu Pro Gln Lys
20 25 30

Ala Gln Phe Leu Ala Lys Cys Ile Val Val Leu Ile Ala Thr Leu Ile
35 40 45

Met Ser Val Ala Gly Cys Phe Ile Ser Ile Val Cys Ala Leu Leu Asp
50 55 60

Lys Arg Tyr Val Ile Asn Tyr Val Val Ser Arg Leu Phe Ser Phe Leu
65 70 75 80

Ala Ala Arg Pro Cys Gly Val Thr Tyr Lys Ile Val Gly Glu Glu His
85 90 95

Leu Asp Lys Tyr Pro Ala Ile Val Val Cys Asn His Gln Ser Ser Met
100 105 110

Asp Met Met Val Leu Gly Arg Val Phe Pro Lys His Cys Val Val Met
115 120 125

Ala Lys Lys Glu Leu Leu Tyr Phe Pro Phe Leu Gly Met Phe Met Lys
130 135 140

Leu Ser Asn Ala Ile Phe Ile Asp Arg Lys Asn His Lys Lys Ala Ile
145 150 155 160

Glu Ser Thr Thr Gln Ala Val Ala Asp Met Lys Lys His Asn Ser Gly
165 170 175

Ile Trp Ile Phe Pro Glu Gly Thr Arg Ser Arg Leu Asp Lys Ala Asp
180 185 190

517416 Sequence Listing

Leu Leu Pro Phe Lys Lys Gly Ala Phe His Leu Ala Ile Gln Ala Gln
195 200 205

Leu Pro Ile Leu Pro Ile Ile Ser Gln Gly Tyr Ser His Ile Tyr Asp
210 215 220

Ser Ser Lys Arg Tyr Phe Pro Gly Gly Glu Leu Glu Ile Arg Val Leu
225 230 235 240

Glu Pro Ile Pro Thr Thr Gly Leu Thr Thr Asp Asp Val Asn Asp Leu
245 250 255

Met Asp Lys Thr Arg Asn Leu Met Leu Lys His Leu Lys Glu Met Asp
260 265 270

Ser Gln Tyr Ser Ser Ser Thr Ala Glu Asn Gly Ser Thr His Ile Asp
275 280 285

Ala Asp Ile Ala Lys Ser Thr Ala Thr Ser Ile Gly Asn Thr Asp Asp
290 295 300

Ala Ile Thr Lys Arg Arg Thr Pro Lys Glu
305 310

<210> 45
<211> 391
<212> PRT
<213> Braccisa napus

<400> 45

Met Ala Met Ala Ala Ala Ala Val Ile Val Pro Leu Gly Ile Leu Phe
1 5 10 15

Phe Ile Ser Gly Leu Val Val Asn Leu Leu Gln Ala Val Cys Tyr Val
20 25 30

Leu Ile Arg Pro Leu Ser Lys Asn Thr Tyr Arg Lys Ile Asn Arg Val
35 40 45

Val Ala Glu Thr Leu Trp Leu Glu Leu Val Trp Ile Val Asp Trp Trp
50 55 60

Ala Gly Val Lys Ile Gln Val Phe Ala Asp Asp Glu Thr Phe Asn Arg
65 70 75 80

Met Gly Lys Glu His Ala Leu Val Val Cys Asn His Arg Ser Asp Ile
85 90 95

Asp Trp Leu Val Gly Trp Ile Leu Ala Gln Arg Ser Gly Cys Leu Gly
100 105 110

517416 Sequence Listing

Ser Ala Leu Ala Val Met Lys Lys Ser Ser Lys Phe Leu Pro Val Ile
 115 120 125
 Gly Trp Ser Met Trp Phe Ser Glu Tyr Leu Phe Leu Glu Arg Asn Trp
 130 135 140
 Ala Lys Asp Glu Ser Thr Leu Lys Ser Gly Leu Gln Arg Leu Asn Asp
 145 150 155 160
 Phe Pro Arg Pro Phe Trp Leu Ala Leu Phe Val Glu Gly Thr Arg Phe
 165 170 175
 Thr Glu Ala Lys Leu Lys Ala Ala Gln Glu Tyr Ala Ala Ser Ser Gln
 180 185 190
 Leu Pro Val Pro Arg Asn Val Leu Ile Pro Arg Thr Lys Gly Phe Val
 195 200 205
 Ser Ala Val Ser Asn Met Arg Ser Phe Val Pro Ala Ile Tyr Asp Met
 210 215 220
 Thr Val Ala Ile Pro Lys Thr Ser Pro Pro Pro Thr Met Leu Arg Leu
 225 230 235 240
 Phe Lys Gly Gln Pro Ser Val Val His Val His Ile Lys Cys His Ser
 245 250 255
 Met Lys Asp Leu Pro Glu Ser Asp Asp Ala Ile Ala Gln Trp Cys Arg
 260 265 270
 Asp Gln Phe Val Ala Lys Asp Ala Leu Leu Asp Lys His Ile Ala Ala
 275 280 285
 Asp Thr Phe Pro Gly Gln Lys Glu His Asn Ile Gly Arg Pro Ile Lys
 290 295 300
 Ser Leu Ala Val Val Val Ser Trp Ala Cys Leu Leu Thr Leu Gly Ala
 305 310 315 320
 Met Lys Phe Leu His Trp Ser Asn Leu Phe Ser Ser Leu Lys Gly Ile
 325 330 335
 Ala Leu Ser Ala Leu Gly Leu Gly Ile Ile Thr Leu Cys Met Gln Ile
 340 345 350
 Leu Ile Arg Ser Ser Gln Ser Glu Arg Ser Thr Pro Ala Lys Val Ala
 355 360 365
 Pro Ala Lys Pro Lys Asp Lys His Gln Ser Gly Ser Ser Ser Gln Thr
 370 375 380

517416 Sequence Listing

Glu Val Glu Glu Lys Gln Lys
385 390

<210> 46
<211> 390
<212> PRT
<213> Braccisa napus

<400> 46

Met Ala Met Ala Ala Ala Val Ile Val Pro Leu Gly Ile Leu Phe Phe
1 5 10 15

Ile Ser Gly Leu Val Val Asn Leu Leu Gln Ala Ile Cys Tyr Val Leu
20 25 30

Ile Arg Pro Leu Ser Lys Asn Thr Tyr Arg Lys Ile Asn Arg Val Val
35 40 45

Ala Glu Thr Leu Trp Leu Glu Leu Val Trp Ile Val Asp Trp Trp Ala
50 55 60

Gly Val Lys Ile Gln Val Phe Ala Asp Asn Glu Thr Phe Asn Arg Met
65 70 75 80

Gly Lys Glu His Ala Leu Val Val Cys Asn His Arg Ser Asp Ile Asp
85 90 95

Trp Leu Val Gly Trp Ile Leu Ala Gln Arg Ser Gly Cys Leu Gly Ser
100 105 110

Ala Leu Ala Val Met Lys Lys Ser Ser Lys Phe Leu Pro Val Ile Gly
115 120 125

Trp Ser Met Trp Phe Ser Glu Tyr Leu Phe Leu Glu Arg Asn Trp Ala
130 135 140

Lys Asp Glu Ser Thr Leu Lys Ser Gly Leu Gln Arg Leu Asn Asp Phe
145 150 155 160

Pro Arg Pro Phe Trp Leu Ala Leu Phe Val Glu Gly Thr Arg Phe Thr
165 170 175

Glu Ala Lys Leu Lys Ala Ala Gln Glu Tyr Ala Ala Ser Ser Glu Leu
180 185 190

Pro Val Pro Arg Asn Val Leu Ile Pro Arg Thr Lys Gly Phe Val Ser
195 200 205

Ala Val Ser Asn Met Arg Ser Phe Val Pro Ala Ile Tyr Asp Met Thr
210 215 220

517416 Sequence Listing

Val Ala Ile Pro Lys Thr Ser Pro Pro Pro Thr Met Leu Arg Leu Phe
225 230 235 240

Lys Gly Gln Pro Ser Val Val His Val His Ile Lys Cys His Ser Met
245 250 255

Lys Asp Leu Pro Glu Ser Asp Asp Ala Ile Ala Gln Trp Cys Arg Asp
260 265 270

Gln Phe Val Ala Lys Asp Ala Leu Leu Asp Lys His Ile Ala Ala Asp
275 280 285

Thr Phe Pro Gly Gln Gln Glu Gln Asn Ile Gly Arg Pro Ile Lys Ser
290 295 300

Leu Ala Val Val Leu Ser Trp Ser Cys Leu Leu Ile Leu Gly Ala Met
305 310 315 320

Lys Phe Leu His Trp Ser Asn Leu Phe Ser Ser Trp Lys Gly Ile Ala
325 330 335

Phe Ser Ala Leu Gly Leu Gly Ile Ile Thr Leu Cys Met Gln Ile Leu
340 345 350

Ile Arg Ser Ser Gln Ser Glu Arg Ser Thr Pro Ala Lys Val Val Pro
355 360 365

Ala Lys Pro Lys Asp Asn His Asn Asp Ser Gly Ser Ser Ser Gln Thr
370 375 380

Glu Val Glu Lys Gln Lys
385 390

<210> 47

<211> 361

<212> PRT

<213> Phytophthora infestans

<400> 47

Met Ala Thr Lys Glu Ala Tyr Val Phe Pro Thr Leu Thr Glu Ile Lys
1 5 10 15

Arg Ser Leu Pro Lys Asp Cys Phe Glu Ala Ser Val Pro Leu Ser Leu
20 25 30

Tyr Tyr Thr Val Arg Cys Leu Val Ile Ala Val Ala Leu Thr Phe Gly
35 40 45

Leu Asn Tyr Ala Arg Ala Leu Pro Glu Val Glu Ser Phe Trp Ala Leu
50 55 60

Asp Ala Ala Leu Cys Thr Gly Tyr Ile Leu Leu Gln Gly Ile Val Phe
Page 71

517416 Sequence Listing

65		70		75		80									
Trp	Gly	Phe	Phe	Thr	Val	Gly	His	Asp	Ala	Gly	His	Gly	Ala	Phe	Ser
				85					90					95	
Arg	Tyr	His	Leu	Leu	Asn	Phe	Val	Val	Gly	Thr	Phe	Met	His	Ser	Leu
			100					105					110		
Ile	Leu	Thr	Pro	Phe	Glu	Ser	Trp	Lys	Leu	Thr	His	Arg	His	His	His
		115					120					125			
Lys	Asn	Thr	Gly	Asn	Ile	Asp	Arg	Asp	Glu	Val	Phe	Tyr	Pro	Gln	Arg
	130					135					140				
Lys	Ala	Asp	Asp	His	Pro	Leu	Ser	Arg	Asn	Leu	Ile	Leu	Ala	Leu	Gly
145					150					155					160
Ala	Ala	Trp	Leu	Ala	Tyr	Leu	Val	Glu	Gly	Phe	Pro	Pro	Arg	Lys	Val
				165					170					175	
Asn	His	Phe	Asn	Pro	Phe	Glu	Pro	Leu	Phe	Val	Arg	Gln	Val	Ser	Ala
			180					185					190		
Val	Val	Ile	Ser	Leu	Leu	Ala	His	Phe	Phe	Val	Ala	Gly	Leu	Ser	Ile
		195					200					205			
Tyr	Leu	Ser	Leu	Gln	Leu	Gly	Leu	Lys	Thr	Met	Ala	Ile	Tyr	Tyr	Tyr
	210					215					220				
Gly	Pro	Val	Phe	Val	Phe	Gly	Ser	Met	Leu	Val	Ile	Thr	Thr	Phe	Leu
225					230					235					240
His	His	Asn	Asp	Glu	Glu	Thr	Pro	Trp	Tyr	Ala	Asp	Ser	Glu	Trp	Thr
				245					250					255	
Tyr	Val	Lys	Gly	Asn	Leu	Ser	Ser	Val	Asp	Arg	Ser	Tyr	Gly	Ala	Leu
			260					265					270		
Ile	Asp	Asn	Leu	Ser	His	Asn	Ile	Gly	Thr	His	Gln	Ile	His	His	Leu
		275					280					285			
Phe	Pro	Ile	Ile	Pro	His	Tyr	Lys	Leu	Lys	Lys	Ala	Thr	Ala	Ala	Phe
	290					295					300				
His	Gln	Ala	Phe	Pro	Glu	Leu	Val	Arg	Lys	Ser	Asp	Glu	Pro	Ile	Ile
305					310					315					320
Lys	Ala	Phe	Phe	Arg	Val	Gly	Arg	Leu	Tyr	Ala	Asn	Tyr	Gly	Val	Val
				325				330						335	
Asp	Gln	Glu	Ala	Lys	Leu	Phe	Thr	Leu	Lys	Glu	Ala	Lys	Ala	Ala	Thr

Glu Ala Ala Ala Lys Thr Lys Ser Thr
355 360

<210> 48
<211> 418
<212> PRT
<213> Thalassiosira pseudonana
<400> 48

Met Tyr Arg Leu Thr Ser Thr Phe Leu Ile Ala Leu Ala Phe Ser Ser
1 5 10 15

Ser Ile Asn Ala Phe Ser Pro Gln Arg Pro Pro Arg Thr Ile Thr Lys
20 25 30

Ser Lys Val Gln Ser Thr Val Leu Pro Ile Pro Thr Lys Asp Asp Leu
35 40 45

Asn Phe Leu Gln Pro Gln Leu Asp Glu Asn Asp Leu Tyr Leu Asp Asp
50 55 60

Val Asn Thr Pro Pro Arg Ala Gly Thr Ile Met Lys Met Leu Pro Lys
65 70 75 80

Glu Thr Phe Asn Ile Asp Thr Ala Thr Ser Leu Gly Tyr Phe Gly Met
85 90 95

Asp Met Ala Ala Val Val Ser Ser Met Thr Leu Leu Asn Ala Ile Val
100 105 110

Thr Ser Asp Gln Tyr His Ala Leu Pro Leu Pro Leu Gln Ala Ala Thr
115 120 125

Val Ile Pro Phe Gln Leu Leu Ala Gly Phe Ala Met Trp Cys Met Trp
130 135 140

Cys Ile Gly His Asp Ala Gly His Ser Thr Val Ser Lys Thr Lys Trp
145 150 155 160

Ile Asn Arg Val Val Gly Glu Val Ala His Ser Val Val Cys Leu Thr
165 170 175

Pro Phe Val Pro Trp Gln Met Ser His Arg Lys His His Leu Asn His
180 185 190

Asn His Ile Glu Lys Asp Tyr Ser His Lys Trp Tyr Ser Arg Asp Glu
195 200 205

Phe Asp Asp Ile Pro Gln Leu Tyr Lys Thr Phe Gly Tyr Asn Pro Arg
210 215 220

517416 Sequence Listing

Met Met Gln Leu Pro Phe Leu Tyr Phe Met Tyr Leu Ala Leu Gly Ile
225 230 235 240

Pro Asp Gly Gly His Val Val Phe Tyr Gly Arg Met Trp Glu Gly Val
245 250 255

Ser Leu Gln Lys Lys Phe Asp Ala Ala Ile Ser Val Ala Val Ser Cys
260 265 270

Ala Thr Ala Gly Ser Leu Trp Met Asn Met Gly Thr Ala Asp Phe Thr
275 280 285

Val Val Cys Met Val Pro Trp Leu Val Leu Ser Trp Trp Leu Phe Met
290 295 300

Val Thr Tyr Leu Gln His His Ser Glu Asp Gly Lys Leu Tyr Thr Asp
305 310 315 320

Glu Thr Phe Thr Phe Glu Lys Gly Ala Phe Glu Thr Val Asp Arg Ser
325 330 335

Tyr Gly Lys Leu Ile Asn Arg Met Ser His His Met Met Asp Gly His
340 345 350

Val Val His His Leu Phe Phe Glu Arg Val Pro His Tyr Arg Leu Glu
355 360 365

Ala Ala Thr Glu Ala Leu Val Lys Gly Met Asp Glu Thr Gly Gln Lys
370 375 380

His Leu Tyr Lys Tyr Ile Asp Thr Pro Asp Phe Asn Ala Glu Ile Val
385 390 395 400

Asn Gly Phe Arg Asp Asn Trp Phe Leu Val Glu Glu Glu Asn Ile Lys
405 410 415

Arg Glu

<210> 49
<211> 363
<212> PRT
<213> Pythium irregulare

<400> 49

Met Ala Ser Thr Ser Ala Ala Gln Asp Ala Ala Pro Tyr Glu Phe Pro
1 5 10 15

Ser Leu Thr Glu Ile Lys Arg Ala Leu Pro Ser Glu Cys Phe Glu Ala
20 25 30

517416 Sequence Listing

Ser Val Pro Leu Ser Leu Tyr Tyr Thr Ala Arg Ser Leu Ala Leu Ala
 35 40 45
 Gly Ser Leu Ala Val Ala Leu Ser Tyr Ala Arg Ala Leu Pro Leu Val
 50 55 60
 Gln Ala Asn Ala Leu Leu Asp Ala Thr Leu Cys Thr Gly Tyr Val Leu
 65 70 75 80
 Leu Gln Gly Ile Val Phe Trp Gly Phe Phe Thr Val Gly His Asp Cys
 85 90 95
 Gly His Gly Ala Phe Ser Arg Ser His Val Leu Asn Phe Ser Val Gly
 100 105 110
 Thr Leu Met His Ser Ile Ile Leu Thr Pro Phe Glu Ser Trp Lys Leu
 115 120 125
 Ser His Arg His His His Lys Asn Thr Gly Asn Ile Asp Lys Asp Glu
 130 135 140
 Ile Phe Tyr Pro Gln Arg Glu Ala Asp Ser His Pro Val Ser Arg His
 145 150 155 160
 Leu Val Met Ser Leu Gly Ser Ala Trp Phe Ala Tyr Leu Phe Ala Gly
 165 170 175
 Phe Pro Pro Arg Thr Met Asn His Phe Asn Pro Trp Glu Ala Met Tyr
 180 185 190
 Val Arg Arg Val Ala Ala Val Ile Ile Ser Leu Gly Val Leu Phe Ala
 195 200 205
 Phe Ala Gly Leu Tyr Ser Tyr Leu Thr Phe Val Leu Gly Phe Thr Thr
 210 215 220
 Met Ala Ile Tyr Tyr Phe Gly Pro Leu Phe Ile Phe Ala Thr Met Leu
 225 230 235 240
 Val Val Thr Thr Phe Leu His His Asn Asp Glu Glu Thr Pro Trp Tyr
 245 250 255
 Ala Asp Ser Glu Trp Thr Tyr Val Lys Gly Asn Leu Ser Ser Val Asp
 260 265 270
 Arg Ser Tyr Gly Ala Leu Ile Asp Asn Leu Ser His Asn Ile Gly Thr
 275 280 285
 His Gln Ile His His Leu Phe Pro Ile Ile Pro His Tyr Lys Leu Asn
 290 295 300

517416 Sequence Listing

Asp Ala Thr Ala Ala Phe Ala Lys Ala Phe Pro Glu Leu Val Arg Lys
305 310 315 320

Asn Ala Ala Pro Ile Ile Pro Thr Phe Phe Arg Met Ala Ala Met Tyr
325 330 335

Ala Lys Tyr Gly Val Val Asp Thr Asp Ala Lys Thr Phe Thr Leu Lys
340 345 350

Glu Ala Lys Ala Ala Ala Lys Thr Lys Ser Ser
355 360

<210> 50
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<223> oligonucleotide primer

<400> 50
gcgaagcaca tcgagtca 18

<210> 51
<211> 20
<212> DNA
<213> Artificial Sequence

<220>
<223> oligonucleotide primer

<400> 51
ggttgagggtg gtagctgagg 20

<210> 52
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> oligonucleotide primer

<220>
<221> misc_feature
<222> (1)..(1)
<223> N = Hex

<220>
<221> misc_feature
<222> (9)..(9)
<223> N = Zen

<220>
<221> misc_feature
<222> (26)..(26)
<223> N = 3IABkFQ

<400> 52
ntctctacnc cgtctcacat gacgcn 26

517416 Sequence Listing

<210> 53
 <211> 19
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> oligonucleotide primer

 <400> 53
 atacaagcac ggtggatgg 19

 <210> 54
 <211> 22
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> oligonucleotide primer

 <400> 54
 tggctaca ggtctaggag ga 22

 <210> 55
 <211> 29
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> oligonucleotide primer

 <220>
 <221> misc_feature
 <222> (1)..(1)
 <223> N = FAM

 <220>
 <221> misc_feature
 <222> (11)..(11)
 <223> N = Zen

 <220>
 <221> misc_feature
 <222> (29)..(29)
 <223> N = 3IABkFQ

 <400> 55
 ntggcaaaga ngatttcgag cttcctgcn 29

 <210> 56
 <211> 22
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> oligonucleotide primer

 <400> 56
 caagcaccgt agtaagagag ca 22

 <210> 57
 <211> 20
 <212> DNA

517416 Sequence Listing

<213> Artificial Sequence

<220>

<223> oligonucleotide primer

<400> 57

cagacagcct gaggttagca

20

<210> 58

<211> 29

<212> DNA

<213> Artificial Sequence

<220>

<223> oligonucleotide primer

<220>

<221> misc_feature

<222> (1)..(1)

<223> N = FAM

<220>

<221> misc_feature

<222> (11)..(11)

<223> N = Zen

<220>

<221> misc_feature

<222> (29)..(29)

<223> N = 3IABkFQ

<400> 58

ntccccactt ncttagcgaa aggaacgan

29