

BPS65606PC-2009032056
SEQUENCE LISTING

<110> BASF PLANT SCIENCE GMBH

<120> Deasaturase and method for the production of polyunsaturated fatty acids in transgenic organisms

<130> BPS65606PC

<160> 35

<170> PatentIn version 3.5

<210> 1

<211> 1368

<212> DNA

<213> Emiliana huxleyi

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<210> 2

<211> 455

<212> PRT

<213> Emiliana huxleyi

<400> 2

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 Gly Arg Val Tyr Asp Val Ser Asp Phe Ile Lys Arg His Pro Gly Gly
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 Ser Ile Ile Lys Leu Ser Leu Gly Ser Asp Ala Thr Asp Ala Tyr Asn
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 Pro Ser Arg Pro Val Ala Asp Gly Phe Ala Arg Asp Ala Leu Ser Ala
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 Asp Phe Glu Ala Leu Arg Ala Gln Leu Glu Ala Glu Gly Tyr Phe Glu
 115 120 125
 Pro Asn Leu Trp His Val Ala Tyr Arg Val Ala Glu Val Val Ala Met
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 Tyr Trp Ala Gly Ile Arg Leu Ile Trp Ala Gly Tyr Trp Phe Leu Gly
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 Ala Ile Val Ala Gly Ile Ala Gln Gly Arg Cys Gly Trp Leu Gln His
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 Glu Gly Gly His Tyr Ser Leu Thr Gly Asn Ile Lys Leu Asp Arg His
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 Met Gln Met Ile Ile Tyr Gly Leu Gly Cys Gly Met Ser Gly Cys Tyr
 195 200 205
 Trp Arg Asn Gln His Asn Lys His His Ala Thr Pro Gln Lys Leu Gly
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 Ala Asp Pro Asp Leu Gln Thr Met Pro Leu Val Ala Phe His Gly Leu
 225 230 235 240
 Ile Gly Ala Lys Ala Arg Gly Ala Gly Lys Ser Trp Leu Ala Trp Gln
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 Ala Pro Leu Phe Phe Gly Gly Val Ile Thr Thr Leu Val Ser Phe Gly

260

265

270

Trp Gln Phe Val Gln His Pro Lys His Ala Leu Arg Val Gly Asn Gln
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Leu Glu Leu Gly Tyr Met Ala Leu Arg Tyr Ala Leu Trp Tyr Ala Ala
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Phe Gly His Leu Gly Leu Gly Gly Ala Phe Arg Leu Tyr Ala Phe Tyr
 305 310 315 320

Val Ala Val Gly Gly Thr Tyr Ile Phe Thr Asn Phe Ala Val Ser His
 325 330 335

Thr His Lys Asp Val Val Pro His Asp Lys His Ile Ser Trp Thr Leu
 340 345 350

Tyr Ser Ala Asn His Thr Thr Asn Gln Ser Asn Thr Pro Leu Val Asn
 355 360 365

Trp Trp Met Ala Tyr Leu Asn Phe Gln Ile Glu His His Leu Phe Pro
 370 375 380

Ser Met Pro Gln Tyr Asn His Pro Lys Ile Cys Gly Arg Val Lys Gln
 385 390 395 400

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

Ser Met Arg Asp Thr Tyr Val Asn Leu Leu Ala Val Gly Asn Ala Ser
 420 425 430

His Ser Leu His Gln Arg Asn Glu Gly Leu Thr Thr Arg Glu Ser Ala
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Ala Val Arg Val Thr Gly His
 450 455

<210> 3
 <211> 1371
 <212> DNA
 <213> *Ostreococcus tauri*

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<210> 4
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<212> PRT
<213> Ostreococcus tauri

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      20             25             30
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Ala Glu Lys Met Glu Pro Ala Ala Leu Ala Lys Thr Phe Ala Arg Arg
      35             40             45
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Tyr Val Val Ile Glu Gly Val Glu Tyr Asp Val Thr Asp Phe Lys His
      50             55             60
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Pro Gly Gly Thr Val Ile Phe Tyr Ala Leu Ser Asn Thr Gly Ala Asp
      65             70             75             80
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Ala Thr Glu Ala Phe Lys Glu Phe His His Arg Ser Arg Lys Ala Arg
      85             90             95
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Lys Ala Leu Ala Ala Leu Pro Ser Arg Pro Ala Lys Thr Ala Lys Val
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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
 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
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 <211> 1380
 <212> DNA
 <213> *Pythium irregulare*

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<210> 6
 <211> 459
 <212> PRT
 <213> Pythium irregulare

<400> 6

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Ile Arg Glu His Ala Thr Pro Ala Thr Ala Trp Ile Val Ile His His
 20 25 30

Lys Val Tyr Asp Ile Ser Lys Trp Asp Ser His Pro Gly Gly Ser Val
 35 40 45

Met Leu Thr Gln Ala Gly Glu Asp Ala Thr Asp Ala Phe Ala Val Phe
 50 55 60

His Pro Ser Ser Ala Leu Lys Leu Leu Glu Gln Phe Tyr Val Gly Asp
 65 70 75 80

Val Asp Glu Thr Ser Lys Ala Glu Ile Glu Gly Glu Pro Ala Ser Asp
 85 90 95

Glu Glu Arg Ala Arg Arg Glu Arg Ile Asn Glu Phe Ile Ala Ser Tyr
 100 105 110

Arg Arg Leu Arg Val Lys Val Lys Gly Met Gly Leu Tyr Asp Ala Ser
 115 120 125

Ala Leu Tyr Tyr Ala Trp Lys Leu Val Ser Thr Phe Gly Ile Ala Val
 130 135 140

Leu Ser Met Ala Ile Cys Phe Phe Phe Asn Ser Phe Ala Met Tyr Met
 145 150 155 160

Val Ala Gly Val Ile Met Gly Leu Phe Tyr Gln Gln Ser Gly Trp Leu
 165 170 175

Ala His Asp Phe Leu His Asn Gln Val Cys Glu Asn Arg Thr Leu Gly
 180 185 190

Asn Leu Ile Gly Cys Leu Val Gly Asn Ala Trp Gln Gly Phe Ser Met
 195 200 205

Gln Trp Trp Lys Asn Lys His Asn Leu His His Ala Val Pro Asn Leu
 210 215 220

His Ser Ala Lys Asp Glu Gly Phe Ile Gly Asp Pro Asp Ile Asp Thr
 225 230 235 240

Met Pro Leu Leu Ala Trp Ser Lys Glu Met Ala Arg Lys Ala Phe Glu
 245 250 255

Ser Ala His Gly Pro Phe Phe Ile Arg Asn Gln Ala Phe Leu Tyr Phe
 260 265 270

Pro Leu Leu Leu Leu Ala Arg Leu Ser Trp Leu Ala Gln Ser Phe Phe
 275 280 285

Tyr Val Phe Thr Glu Phe Ser Phe Gly Ile Phe Asp Lys Val Glu Phe
 290 295 300

Asp Gly Pro Glu Lys Ala Gly Leu Ile Val His Tyr Ile Trp Gln Leu
 305 310 315 320

Ala Ile Pro Tyr Phe Cys Asn Met Ser Leu Phe Glu Gly Val Ala Tyr
 325 330 335

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

Ser Ile Gly His Asn Gly Met Ser Val Tyr Glu Arg Glu Thr Lys Pro
 355 360 365

Asp Phe Trp Gln Leu Gln Val Thr Thr Thr Arg Asn Ile Arg Ala Ser
 370 375 380

Val Phe Met Asp Trp Phe Thr Gly Gly Leu Asn Tyr Gln Ile Asp His
 385 390 395 400

His Leu Phe Pro Leu Val Pro Arg His Asn Leu Pro Lys Val Asn Val
 405 410 415

Leu Ile Lys Ser Leu Cys Lys Glu Phe Asp Ile Pro Phe His Glu Thr
 420 425 430

Gly Phe Trp Glu Gly Ile Tyr Glu Val Val Asp His Leu Ala Asp Ile
 435 440 445

Ser Lys Glu Phe Ile Thr Glu Phe Pro Ala Met
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<210> 7
 <211> 873
 <212> DNA
 <213> *Physcomitrella patens*

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<210> 8
 <211> 290
 <212> PRT
 <213> *Physcomitrella patens*

<400> 8

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

Val Leu Gly Val Ser Val Tyr Leu Thr Ile Val Ile Gly Gly Leu Leu
50 55 60

Trp Ile Lys Ala Arg Asp Leu Lys Pro Arg Ala Ser Glu Pro Phe Leu
65 70 75 80

Leu Gln Ala Leu Val Leu Val His Asn Leu Phe Cys Phe Ala Leu Ser
85 90 95

Leu Tyr Met Cys Val Gly Ile Ala Tyr Gln Ala Ile Thr Trp Arg Tyr
100 105 110

Ser Leu Trp Gly Asn Ala Tyr Asn Pro Lys His Lys Glu Met Ala Ile
115 120 125

Leu Val Tyr Leu Phe Tyr Met Ser Lys Tyr Val Glu Phe Met Asp Thr
130 135 140

Val Ile Met Ile Leu Lys Arg Ser Thr Arg Gln Ile Ser Phe Leu His
 145 150 155 160

Val Tyr His His Ser Ser Ile Ser Leu Ile Trp Trp Ala Ile Ala His
 165 170 175

His Ala Pro Gly Gly Glu Ala Tyr Trp Ser Ala Ala Leu Asn Ser Gly
 180 185 190

Val His Val Leu Met Tyr Ala Tyr Tyr Phe Leu Ala Ala Cys Leu Arg
 195 200 205

Ser Ser Pro Lys Leu Lys Asn Lys Tyr Leu Phe Trp Gly Arg Tyr Leu
 210 215 220

Thr Gln Phe Gln Met Phe Gln Phe Met Leu Asn Leu Val Gln Ala Tyr
 225 230 235 240

Tyr Asp Met Lys Thr Asn Ala Pro Tyr Pro Gln Trp Leu Ile Lys Ile
 245 250 255

Leu Phe Tyr Tyr Met Ile Ser Leu Leu Phe Leu Phe Gly Asn Phe Tyr
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Val Gln Lys Tyr Ile Lys Pro Ser Asp Gly Lys Gln Lys Gly Ala Lys
 275 280 285

Thr Glu
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<210> 9
 <211> 1197
 <212> DNA
 <213> *Phytophthora sojae*

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ggaaagtctt acttgaagga taccactcct gttcctgttg ctctctggag atcttacacc     1140
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<210> 10
<211> 398
<212> PRT
<213> Phytophthora sojae

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<400> 10
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Asp Ser Glu Ala Lys Gln Arg Gln Leu Ala Glu Ala Gly Tyr Thr His
          20          25          30
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Val Glu Gly Ala Pro Ala Pro Leu Pro Leu Glu Leu Pro His Phe Ser
          35          40          45
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Leu Arg Asp Leu Arg Ala Ala Ile Pro Lys His Cys Phe Glu Arg Ser
          50          55          60
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Phe Val Thr Ser Thr Tyr Tyr Met Ile Lys Asn Val Leu Thr Cys Ala
65          70          75          80
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Ala Leu Phe Tyr Ala Ala Thr Phe Ile Asp Arg Ala Gly Ala Ala Ala
          85          90          95
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Tyr Val Leu Trp Pro Val Tyr Trp Phe Phe Gln Gly Ser Tyr Leu Thr
          100          105          110
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Gly Val Trp Val Ile Ala His Glu Cys Gly His Gln Ala Tyr Cys Ser
          115          120          125
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Ser Glu Val Val Asn Asn Leu Ile Gly Leu Val Leu His Ser Ala Leu
          130          135          140
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```
Leu Val Pro Tyr His Ser Trp Arg Ile Ser His Arg Lys His His Ser
          145          150          155          160
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Asn Thr Gly Ser Cys Glu Asn Asp Glu Val Phe Val Pro Val Thr Arg
          165          170          175
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Ser Val Leu Ala Ser Ser Trp Asn Glu Thr Leu Glu Asp Ser Pro Leu
180 185 190

Tyr Gln Leu Tyr Arg Ile Val Tyr Met Leu Val Val Gly Trp Met Pro
195 200 205

Gly Tyr Leu Phe Phe Asn Ala Thr Gly Pro Thr Lys Tyr Trp Gly Lys
210 215 220

Ser Arg Ser His Phe Asn Pro Tyr Ser Ala Ile Tyr Ala Asp Arg Glu
225 230 235 240

Arg Trp Met Ile Val Leu Ser Asp Ile Phe Leu Val Ala Met Leu Ala
245 250 255

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

Phe Tyr Val Val Pro Tyr Phe Ile Val Asn Ala Tyr Leu Val Leu Ile
275 280 285

Thr Tyr Leu Gln His Thr Asp Thr Tyr Ile Pro His Phe Arg Glu Gly
290 295 300

Glu Trp Asn Trp Leu Arg Gly Ala Leu Cys Thr Val Asp Arg Ser Phe
305 310 315 320

Gly Pro Phe Leu Asp Ser Val Val His Arg Ile Val Asp Thr His Val
325 330 335

Cys His His Ile Phe Ser Lys Met Pro Phe Tyr His Cys Glu Glu Ala
340 345 350

Thr Asn Ala Ile Lys Pro Leu Leu Gly Lys Phe Tyr Leu Lys Asp Thr
355 360 365

Thr Pro Val Pro Val Ala Leu Trp Arg Ser Tyr Thr His Cys Lys Phe
370 375 380

Val Glu Asp Asp Gly Lys Val Val Phe Tyr Lys Asn Lys Leu
385 390 395

<210> 11
<211> 1086
<212> DNA
<213> Phytophthora infestans

<400> 11
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 <211> 361
 <212> PRT
 <213> Phytophthora infestans

<400> 12

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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
 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
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Asp Gln Glu Ala Lys Leu Phe Thr Leu Lys Glu Ala Lys Ala Ala Thr
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Glu Ala Ala Ala Lys Thr Lys Ser Thr
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<210> 13
 <211> 1176
 <212> DNA
 <213> *Perilla fruticosa*

<400> 13
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 <212> PRT
 <213> *Perilla fruticosa*
 <400> 14

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Ala Asp Lys Phe Asp Pro Ala Ala Pro Pro Pro Phe Lys Ile Ala Asp
 35 40 45

Ile Arg Ala Ala Ile Pro Ala His Cys Trp Val Lys Asn Pro Trp Arg
 50 55 60

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

Ala Ala Ala Val Tyr Ile Asn Ser Trp Ala Phe Trp Pro Val Tyr Trp
 85 90 95

Ile Ala Gln Gly Thr Met Phe Trp Ala Leu Phe Val Leu Gly His Asp
 100 105 110
 Cys Gly His Gly Ser Phe Ser Asp Asn Thr Thr Leu Asn Asn Val Val
 115 120 125
 Gly His Val Leu His Ser Ser Ile Leu Val Pro Tyr His Gly Trp Arg
 130 135 140
 Ile Ser His Arg Thr His His Gln Asn His Gly His Val Glu Lys Asp
 145 150 155 160
 Glu Ser Trp Val Pro Leu Pro Glu Asn Leu Tyr Lys Lys Leu Asp Phe
 165 170 175
 Ser Thr Lys Phe Leu Arg Tyr Lys Ile Pro Phe Pro Met Phe Ala Tyr
 180 185 190
 Pro Leu Tyr Leu Trp Tyr Arg Ser Pro Gly Lys Thr Gly Ser His Phe
 195 200 205
 Asn Pro Tyr Ser Asp Leu Phe Lys Pro Asn Glu Arg Gly Leu Ile Val
 210 215 220
 Thr Ser Thr Met Cys Trp Ala Ala Met Gly Val Phe Leu Leu Tyr Ala
 225 230 235 240
 Ser Thr Ile Val Gly Pro Asn Met Met Phe Lys Leu Tyr Gly Val Pro
 245 250 255
 Tyr Leu Ile Phe Val Met Trp Leu Asp Thr Val Thr Tyr Leu His His
 260 265 270
 His Gly Tyr Asp Lys Lys Leu Pro Trp Tyr Arg Ser Lys Glu Trp Ser
 275 280 285
 Tyr Leu Arg Gly Gly Leu Thr Thr Val Asp Gln Asp Tyr Gly Phe Phe
 290 295 300
 Asn Lys Ile His His Asp Ile Gly Thr His Val Ile His His Leu Phe
 305 310 315 320
 Pro Gln Ile Pro His Tyr His Leu Val Glu Ala Thr Arg Glu Ala Lys
 325 330 335
 Arg Val Leu Gly Asn Tyr Tyr Arg Glu Pro Arg Lys Ser Gly Pro Val
 340 345 350
 Pro Leu His Leu Ile Pro Ala Leu Leu Lys Ser Leu Gly Arg Asp His
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Tyr Val Ser Asp Asn Gly Asp Ile Val Tyr Tyr Gln Thr Asp Asp Glu
 370 375 380

Leu Phe Pro Ser Lys Lys Ile
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<210> 15
 <211> 903
 <212> DNA
 <213> *Ostreococcus tauri*

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 tga 903

<210> 16
 <211> 300
 <212> PRT
 <213> *Ostreococcus tauri*

<400> 16

Met Ser Ala Ser Gly Ala Leu Leu Pro Ala Ile Ala Phe Ala Ala Tyr
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 20 25 30

Ile Asp Asn Val Asp Ala Arg Glu Trp Ile Gly Ala Leu Ser Leu Arg
 35 40 45

Leu Pro Ala Ile Ala Thr Thr Met Tyr Leu Leu Phe Cys Leu Val Gly
 50 55 60

Pro Arg Leu Met Ala Lys Arg Glu Ala Phe Asp Pro Lys Gly Phe Met
65 70 75 80

Leu Ala Tyr Asn Ala Tyr Gln Thr Ala Phe Asn Val Val Val Leu Gly
85 90 95

Met Phe Ala Arg Glu Ile Ser Gly Leu Gly Gln Pro Val Trp Gly Ser
100 105 110

Thr Met Pro Trp Ser Asp Arg Lys Ser Phe Lys Ile Leu Leu Gly Val
115 120 125

Trp Leu His Tyr Asn Asn Lys Tyr Leu Glu Leu Leu Asp Thr Val Phe
130 135 140

Met Val Ala Arg Lys Lys Thr Lys Gln Leu Ser Phe Leu His Val Tyr
145 150 155 160

His His Ala Leu Leu Ile Trp Ala Trp Trp Leu Val Cys His Leu Met
165 170 175

Ala Thr Asn Asp Cys Ile Asp Ala Tyr Phe Gly Ala Ala Cys Asn Ser
180 185 190

Phe Ile His Ile Val Met Tyr Ser Tyr Tyr Leu Met Ser Ala Leu Gly
195 200 205

Ile Arg Cys Pro Trp Lys Arg Tyr Ile Thr Gln Ala Gln Met Leu Gln
210 215 220

Phe Val Ile Val Phe Ala His Ala Val Phe Val Leu Arg Gln Lys His
225 230 235 240

Cys Pro Val Thr Leu Pro Trp Ala Gln Met Phe Val Met Thr Asn Met
245 250 255

Leu Val Leu Phe Gly Asn Phe Tyr Leu Lys Ala Tyr Ser Asn Lys Ser
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Arg Gly Asp Gly Ala Ser Ser Val Lys Pro Ala Glu Thr Thr Arg Ala
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Pro Ser Val Arg Arg Thr Arg Ser Arg Lys Ile Asp
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<210> 17
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<212> DNA
<213> Thraustochytrium ssp.

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<210> 18
 <211> 519
 <212> PRT
 <213> Thraustochytrium ssp.

<400> 18

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His Asn Lys Pro Asp Asp Ala Trp Cys Ala Ile His Gly His Val Tyr
 20 25 30

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

Leu Ala Ala Gly Lys Glu Ala Thr Val Leu Tyr Glu Thr Tyr His Val
 50 55 60
 Arg Gly Val Ser Asp Ala Val Leu Arg Lys Tyr Arg Ile Gly Lys Leu
 65 70 75 80
 Pro Asp Gly Gln Gly Gly Ala Asn Glu Lys Glu Lys Arg Thr Leu Ser
 85 90 95
 Gly Leu Ser Ser Ala Ser Tyr Tyr Thr Trp Asn Ser Asp Phe Tyr Arg
 100 105 110
 Val Met Arg Glu Arg Val Val Ala Arg Leu Lys Glu Arg Gly Lys Ala
 115 120 125
 Arg Arg Gly Gly Tyr Glu Leu Trp Ile Lys Ala Phe Leu Leu Leu Val
 130 135 140
 Gly Phe Trp Ser Ser Leu Tyr Trp Met Cys Thr Leu Asp Pro Ser Phe
 145 150 155 160
 Gly Ala Ile Leu Ala Ala Met Ser Leu Gly Val Phe Ala Ala Phe Val
 165 170 175
 Gly Thr Cys Ile Gln His Asp Gly Asn His Gly Ala Phe Ala Gln Ser
 180 185 190
 Arg Trp Val Asn Lys Val Ala Gly Trp Thr Leu Asp Met Ile Gly Ala
 195 200 205
 Ser Gly Met Thr Trp Glu Phe Gln His Val Leu Gly His His Pro Tyr
 210 215 220
 Thr Asn Leu Ile Glu Glu Glu Asn Gly Leu Gln Lys Val Ser Gly Lys
 225 230 235 240
 Lys Met Asp Thr Lys Leu Ala Asp Gln Glu Ser Asp Pro Asp Val Phe
 245 250 255
 Ser Thr Tyr Pro Met Met Arg Leu His Pro Trp His Gln Lys Arg Trp
 260 265 270
 Tyr His Arg Phe Gln His Ile Tyr Gly Pro Phe Ile Phe Gly Phe Met
 275 280 285
 Thr Ile Asn Lys Val Val Thr Gln Asp Val Gly Val Val Leu Arg Lys
 290 295 300
 Arg Leu Phe Gln Ile Asp Ala Glu Cys Arg Tyr Ala Ser Pro Met Tyr
 305 310 315 320

Val Ala Arg Phe Trp Ile Met Lys Ala Leu Thr Val Leu Tyr Met Val
 325 330 335

Ala Leu Pro Cys Tyr Met Gln Gly Pro Trp His Gly Leu Lys Leu Phe
 340 345 350

Ala Ile Ala His Phe Thr Cys Gly Glu Val Leu Ala Thr Met Phe Ile
 355 360 365

Val Asn His Ile Ile Glu Gly Val Ser Tyr Ala Ser Lys Asp Ala Val
 370 375 380

Lys Gly Thr Met Ala Pro Pro Lys Thr Met His Gly Val Thr Pro Met
 385 390 395 400

Asn Asn Thr Arg Lys Glu Val Glu Ala Glu Ala Ser Lys Ser Gly Ala
 405 410 415

Val Val Lys Ser Val Pro Leu Asp Asp Trp Ala Ala Val Gln Cys Gln
 420 425 430

Thr Ser Val Asn Trp Ser Val Gly Ser Trp Phe Trp Asn His Phe Ser
 435 440 445

Gly Gly Leu Asn His Gln Ile Glu His His Leu Phe Pro Gly Leu Ser
 450 455 460

His Glu Thr Tyr Tyr His Ile Gln Asp Val Val Gln Ser Thr Cys Ala
 465 470 475 480

Glu Tyr Gly Val Pro Tyr Gln His Glu Pro Ser Leu Trp Thr Ala Tyr
 485 490 495

Trp Lys Met Leu Glu His Leu Arg Gln Leu Gly Asn Glu Glu Thr His
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Glu Ser Trp Gln Arg Ala Ala
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<220>
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 <212> DNA
 <213> Artificial

<220>
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 <400> 20
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<210> 21
 <211> 33
 <212> DNA
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 <400> 21
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<211> 28
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<220>
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