

SEQUENCE LISTING

<110> DSM IP Assets B.V.
 Raamsdonk, L.M.
 Mueller, U.

<120> Butanol production in eukaryotic cell

<130> 26531WO

<140> 26531WO
 <141> 2008-07-11

<160> 32

<170> PatentIn version 3.2

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<220>
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 cgc 63

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 ctg 63

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 cgcacgtcaa gactgtcaag 20

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 ccggtagagg tgtggtcaat 20

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 tcgtatgtga atgctggtcg 20

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<400> 7
 acggccttcc ttccagttac 20

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<400> 8

ccggtagagg tgtggtcaat 20

<210> 9
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<400> 9
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 acgc 64

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 <212> DNA
 <213> Artificial sequence

<220>
 <223> Primer P10

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 ggatctg 67

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 <213> Artificial sequence

<220>
 <223> Primer P11

<400> 11
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<210> 12
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 <212> DNA
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<400> 12
 cgcacgtcaa gactgtcaag 20

<210> 13
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<400> 13
 ggagacgatt cagaggagca 20

<210> 14
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 <223> Primer P14

<400> 14
 tcgtatgtga atgctggtcg 20

<210> 15
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 <212> PRT
 <213> Clostridium acetobutylicum

<400> 15

Met Lys Glu Val Val Ile Ala Ser Ala Val Arg Thr Ala Ile Gly Ser
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Tyr Gly Lys Ser Leu Lys Asp Val Pro Ala Val Asp Leu Gly Ala Thr
 20 25 30

Ala Ile Lys Glu Ala Val Lys Lys Ala Gly Ile Lys Pro Glu Asp Val
 35 40 45

Asn Glu Val Ile Leu Gly Asn Val Leu Gln Ala Gly Leu Gly Gln Asn
 50 55 60

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

Ala Met Thr Ile Asn Lys Val Cys Gly Ser Gly Leu Arg Thr Val Ser
 85 90 95

Leu Ala Ala Gln Ile Ile Lys Ala Gly Asp Ala Asp Val Ile Ile Ala
 100 105 110

Gly Gly Met Glu Asn Met Ser Arg Ala Pro Tyr Leu Ala Asn Asn Ala
 115 120 125

Arg Trp Gly Tyr Arg Met Gly Asn Ala Lys Phe Val Asp Glu Met Ile
 130 135 140

Thr Asp Gly Leu Trp Asp Ala Phe Asn Asp Tyr His Met Gly Ile Thr
 145 150 155 160

Ala Glu Asn Ile Ala Glu Arg Trp Asn Ile Ser Arg Glu Glu Gln Asp
 165 170 175

Glu Phe Ala Leu Ala Ser Gln Lys Lys Ala Glu Glu Ala Ile Lys Ser
 180 185 190

Gly Gln Phe Lys Asp Glu Ile Val Pro Val Val Ile Lys Gly Arg Lys
 195 200 205

Gly Glu Thr Val Val Asp Thr Asp Glu His Pro Arg Phe Gly Ser Thr
 210 215 220

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

Val Thr Ala Gly Asn Ala Ser Gly Leu Asn Asp Cys Ala Ala Val Leu
 245 250 255

Val Ile Met Ser Ala Glu Lys Ala Lys Glu Leu Gly Val Lys Pro Leu
 260 265 270

Ala Lys Ile Val Ser Tyr Gly Ser Ala Gly Val Asp Pro Ala Ile Met
 275 280 285

Gly Tyr Gly Pro Phe Tyr Ala Thr Lys Ala Ala Ile Glu Lys Ala Gly
 290 295 300

Trp Thr Val Asp Glu Leu Asp Leu Ile Glu Ser Asn Glu Ala Phe Ala
 305 310 315 320

Ala Gln Ser Leu Ala Val Ala Lys Asp Leu Lys Phe Asp Met Asn Lys
 325 330 335

Val Asn Val Asn Gly Gly Ala Ile Ala Leu Gly His Pro Ile Gly Ala

Val Met Lys Leu Val Glu Val Ile Arg Gly Ile Ala Thr Ser Gln Glu
145 150 155 160

Thr Phe Asp Ala Val Lys Glu Thr Ser Ile Ala Ile Gly Lys Asp Pro
165 170 175

Val Glu Val Ala Glu Ala Pro Gly Phe Val Val Asn Arg Ile Leu Ile
180 185 190

Pro Met Ile Asn Glu Ala Val Gly Ile Leu Ala Glu Gly Ile Ala Ser
195 200 205

Val Glu Asp Ile Asp Lys Ala Met Lys Leu Gly Ala Asn His Pro Met
210 215 220

Gly Pro Leu Glu Leu Gly Asp Phe Ile Gly Leu Asp Ile Cys Leu Ala
225 230 235 240

Ile Met Asp Val Leu Tyr Ser Glu Thr Gly Asp Ser Lys Tyr Arg Pro
245 250 255

His Thr Leu Leu Lys Lys Tyr Val Arg Ala Gly Trp Leu Gly Arg Lys
260 265 270

Ser Gly Lys Gly Phe Tyr Asp Tyr Ser Lys
275 280

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<212> PRT
<213> Clostridium acetobutylicum

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

Leu Lys Glu Met Asp Tyr Val Ile Gly Glu Ile Glu Asn Asp Ser Glu
35 40 45

Val Leu Ala Val Ile Leu Thr Gly Ala Gly Glu Lys Ser Phe Val Ala

50		55		60											
Gly 65	Ala	Asp	Ile	Ser	Glu 70	Met	Lys	Glu	Met	Asn 75	Thr	Ile	Glu	Gly	Arg 80
Lys	Phe	Gly	Ile	Leu 85	Gly	Asn	Lys	Val	Phe 90	Arg	Arg	Leu	Glu	Leu 95	Leu
Glu	Lys	Pro	Val 100	Ile	Ala	Ala	Val	Asn 105	Gly	Phe	Ala	Leu	Gly 110	Gly	Gly
Cys	Glu	Ile 115	Ala	Met	Ser	Cys	Asp 120	Ile	Arg	Ile	Ala	Ser 125	Ser	Asn	Ala
Arg	Phe 130	Gly	Gln	Pro	Glu	Val 135	Gly	Leu	Gly	Ile	Thr 140	Pro	Gly	Phe	Gly
Gly 145	Thr	Gln	Arg	Leu	Ser 150	Arg	Leu	Val	Gly	Met 155	Gly	Met	Ala	Lys	Gln 160
Leu	Ile	Phe	Thr	Ala 165	Gln	Asn	Ile	Lys	Ala 170	Asp	Glu	Ala	Leu	Arg 175	Ile
Gly	Leu	Val 180	Asn	Lys	Val	Val	Glu	Pro 185	Ser	Glu	Leu	Met	Asn 190	Thr	Ala
Lys	Glu	Ile 195	Ala	Asn	Lys	Ile	Val 200	Ser	Asn	Ala	Pro	Val 205	Ala	Val	Lys
Leu	Ser 210	Lys	Gln	Ala	Ile	Asn 215	Arg	Gly	Met	Gln	Cys 220	Asp	Ile	Asp	Thr
Ala 225	Leu	Ala	Phe	Glu	Ser 230	Glu	Ala	Phe	Gly	Glu 235	Cys	Phe	Ser	Thr	Glu 240
Asp	Gln	Lys	Asp	Ala 245	Met	Thr	Ala	Phe	Ile 250	Glu	Lys	Arg	Lys	Ile 255	Glu
Gly	Phe	Lys	Asn	Arg											

<210> 18
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<212> PRT

<213> Clostridium acetobutylicum

<400> 18

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Arg Glu Phe Ala Glu Asn Glu Val Lys Pro Ile Ala Ala Glu Ile Asp
20 25 30

Glu Thr Glu Arg Phe Pro Met Glu Asn Val Lys Lys Met Gly Gln Tyr
35 40 45

Gly Met Met Gly Ile Pro Phe Ser Lys Glu Tyr Gly Gly Ala Gly Gly
50 55 60

Asp Val Leu Ser Tyr Ile Ile Ala Val Glu Glu Leu Ser Lys Val Cys
65 70 75 80

Gly Thr Thr Gly Val Ile Leu Ser Ala His Thr Ser Leu Cys Ala Ser
85 90 95

Leu Ile Asn Glu His Gly Thr Glu Glu Gln Lys Gln Lys Tyr Leu Val
100 105 110

Pro Leu Ala Lys Gly Glu Lys Ile Gly Ala Tyr Gly Leu Thr Glu Pro
115 120 125

Asn Ala Gly Thr Asp Ser Gly Ala Gln Gln Thr Val Ala Val Leu Glu
130 135 140

Gly Asp His Tyr Val Ile Asn Gly Ser Lys Ile Phe Ile Thr Asn Gly
145 150 155 160

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

Gly Thr Lys Gly Ile Ser Ala Phe Ile Ile Glu Lys Gly Phe Lys Gly
180 185 190

Phe Ser Ile Gly Lys Val Glu Gln Lys Leu Gly Ile Arg Ala Ser Ser
195 200 205

Thr Thr Glu Leu Val Phe Glu Asp Met Ile Val Pro Val Glu Asn Met
210 215 220

Ile Gly Lys Glu Gly Lys Gly Phe Pro Ile Ala Met Lys Thr Leu Asp
225 230 235 240

Gly Gly Arg Ile Gly Ile Ala Ala Gln Ala Leu Gly Ile Ala Glu Gly
245 250 255

Ala Phe Asn Glu Ala Arg Ala Tyr Met Lys Glu Arg Lys Gln Phe Gly
260 265 270

Arg Ser Leu Asp Lys Phe Gln Gly Leu Ala Trp Met Met Ala Asp Met
275 280 285

Asp Val Ala Ile Glu Ser Ala Arg Tyr Leu Val Tyr Lys Ala Ala Tyr
290 295 300

Leu Lys Gln Ala Gly Leu Pro Tyr Thr Val Asp Ala Ala Arg Ala Lys
305 310 315 320

Leu His Ala Ala Asn Val Ala Met Asp Val Thr Thr Lys Ala Val Gln
325 330 335

Leu Phe Gly Gly Tyr Gly Tyr Thr Lys Asp Tyr Pro Val Glu Arg Met
340 345 350

Met Arg Asp Ala Lys Ile Thr Glu Ile Tyr Glu Gly Thr Ser Glu Val
355 360 365

Gln Lys Leu Val Ile Ser Gly Lys Ile Phe Arg
370 375

<210> 19
<211> 858
<212> PRT
<213> Clostridium acetobutylicum

<400> 19

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Arg Glu Ala Gln Lys Lys Phe Ala Thr Tyr Thr Gln Glu Gln Val Asp
20 25 30

Lys Ile Phe Lys Gln Cys Ala Ile Ala Ala Ala Lys Glu Arg Ile Asn
 35 40 45

Leu Ala Lys Leu Ala Val Glu Glu Thr Gly Ile Gly Leu Val Glu Asp
 50 55 60

Lys Ile Ile Lys Asn His Phe Ala Ala Glu Tyr Ile Tyr Asn Lys Tyr
 65 70 75 80

Lys Asn Glu Lys Thr Cys Gly Ile Ile Asp His Asp Asp Ser Leu Gly
 85 90 95

Ile Thr Lys Val Ala Glu Pro Ile Gly Ile Val Ala Ala Ile Val Pro
 100 105 110

Thr Thr Asn Pro Thr Ser Thr Ala Ile Phe Lys Ser Leu Ile Ser Leu
 115 120 125

Lys Thr Arg Asn Ala Ile Phe Phe Ser Pro His Pro Arg Ala Lys Lys
 130 135 140

Ser Thr Ile Ala Ala Ala Lys Leu Ile Leu Asp Ala Ala Val Lys Ala
 145 150 155 160

Gly Ala Pro Lys Asn Ile Ile Gly Trp Ile Asp Glu Pro Ser Ile Glu
 165 170 175

Leu Ser Gln Asp Leu Met Ser Glu Ala Asp Ile Ile Leu Ala Thr Gly
 180 185 190

Gly Pro Ser Met Val Lys Ala Ala Tyr Ser Ser Gly Lys Pro Ala Ile
 195 200 205

Gly Val Gly Ala Gly Asn Thr Pro Ala Ile Ile Asp Glu Ser Ala Asp
 210 215 220

Ile Asp Met Ala Val Ser Ser Ile Ile Leu Ser Lys Thr Tyr Asp Asn
 225 230 235 240

Gly Val Ile Cys Ala Ser Glu Gln Ser Ile Leu Val Met Asn Ser Ile
 245 250 255

Tyr Glu Lys Val Lys Glu Glu Phe Val Lys Arg Gly Ser Tyr Ile Leu
 260 265 270

Asn Gln Asn Glu Ile Ala Lys Ile Lys Glu Thr Met Phe Lys Asn Gly
 275 280 285

Ala Ile Asn Ala Asp Ile Val Gly Lys Ser Ala Tyr Ile Ile Ala Lys
 290 295 300

Met Ala Gly Ile Glu Val Pro Gln Thr Thr Lys Ile Leu Ile Gly Glu
 305 310 315 320

Val Gln Ser Val Glu Lys Ser Glu Leu Phe Ser His Glu Lys Leu Ser
 325 330 335

Pro Val Leu Ala Met Tyr Lys Val Lys Asp Phe Asp Glu Ala Leu Lys
 340 345 350

Lys Ala Gln Arg Leu Ile Glu Leu Gly Gly Ser Gly His Thr Ser Ser
 355 360 365

Leu Tyr Ile Asp Ser Gln Asn Asn Lys Asp Lys Val Lys Glu Phe Gly
 370 375 380

Leu Ala Met Lys Thr Ser Arg Thr Phe Ile Asn Met Pro Ser Ser Gln
 385 390 395 400

Gly Ala Ser Gly Asp Leu Tyr Asn Phe Ala Ile Ala Pro Ser Phe Thr
 405 410 415

Leu Gly Cys Gly Thr Trp Gly Gly Asn Ser Val Ser Gln Asn Val Glu
 420 425 430

Pro Lys His Leu Leu Asn Ile Lys Ser Val Ala Glu Arg Arg Glu Asn
 435 440 445

Met Leu Trp Phe Lys Val Pro Gln Lys Ile Tyr Phe Lys Tyr Gly Cys
 450 455 460

Leu Arg Phe Ala Leu Lys Glu Leu Lys Asp Met Asn Lys Lys Arg Ala
 465 470 475 480

Phe Ile Val Thr Asp Lys Asp Leu Phe Lys Leu Gly Tyr Val Asn Lys
485 490 495

Ile Thr Lys Val Leu Asp Glu Ile Asp Ile Lys Tyr Ser Ile Phe Thr
500 505 510

Asp Ile Lys Ser Asp Pro Thr Ile Asp Ser Val Lys Lys Gly Ala Lys
515 520 525

Glu Met Leu Asn Phe Glu Pro Asp Thr Ile Ile Ser Ile Gly Gly Gly
530 535 540

Ser Pro Met Asp Ala Ala Lys Val Met His Leu Leu Tyr Glu Tyr Pro
545 550 555 560

Glu Ala Glu Ile Glu Asn Leu Ala Ile Asn Phe Met Asp Ile Arg Lys
565 570 575

Arg Ile Cys Asn Phe Pro Lys Leu Gly Thr Lys Ala Ile Ser Val Ala
580 585 590

Ile Pro Thr Thr Ala Gly Thr Gly Ser Glu Ala Thr Pro Phe Ala Val
595 600 605

Ile Thr Asn Asp Glu Thr Gly Met Lys Tyr Pro Leu Thr Ser Tyr Glu
610 615 620

Leu Thr Pro Asn Met Ala Ile Ile Asp Thr Glu Leu Met Leu Asn Met
625 630 635 640

Pro Arg Lys Leu Thr Ala Ala Thr Gly Ile Asp Ala Leu Val His Ala
645 650 655

Ile Glu Ala Tyr Val Ser Val Met Ala Thr Asp Tyr Thr Asp Glu Leu
660 665 670

Ala Leu Arg Ala Ile Lys Met Ile Phe Lys Tyr Leu Pro Arg Ala Tyr
675 680 685

Lys Asn Gly Thr Asn Asp Ile Glu Ala Arg Glu Lys Met Ala His Ala
690 695 700

Ser Asn Ile Ala Gly Met Ala Phe Ala Asn Ala Phe Leu Gly Val Cys

705 710 715 720
 His Ser Met Ala His Lys Leu Gly Ala Met His His Val Pro His Gly
 725 730 735
 Ile Ala Cys Ala Val Leu Ile Glu Glu Val Ile Lys Tyr Asn Ala Thr
 740 745 750
 Asp Cys Pro Thr Lys Gln Thr Ala Phe Pro Gln Tyr Lys Ser Pro Asn
 755 760 765
 Ala Lys Arg Lys Tyr Ala Glu Ile Ala Glu Tyr Leu Asn Leu Lys Gly
 770 775 780
 Thr Ser Asp Thr Glu Lys Val Thr Ala Leu Ile Glu Ala Ile Ser Lys
 785 790 795 800
 Leu Lys Ile Asp Leu Ser Ile Pro Gln Asn Ile Ser Ala Ala Gly Ile
 805 810 815
 Asn Lys Lys Asp Phe Tyr Asn Thr Leu Asp Lys Met Ser Glu Leu Ala
 820 825 830
 Phe Asp Asp Gln Cys Thr Thr Ala Asn Pro Arg Tyr Pro Leu Ile Ser
 835 840 845
 Glu Leu Lys Asp Ile Tyr Ile Lys Ser Phe
 850 855

 <210> 20
 <211> 390
 <212> PRT
 <213> Clostridium acetobutylicum

 <400> 20

 Met Val Asp Phe Glu Tyr Ser Ile Pro Thr Arg Ile Phe Phe Gly Lys
 1 5 10 15

 Asp Lys Ile Asn Val Leu Gly Arg Glu Leu Lys Lys Tyr Gly Ser Lys
 20 25 30

 Val Leu Ile Val Tyr Gly Gly Gly Ser Ile Lys Arg Asn Gly Ile Tyr
 35 40 45

Asp Lys Ala Val Ser Ile Leu Glu Lys Asn Ser Ile Lys Phe Tyr Glu
50 55 60

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

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

Gly Gly Ser Ala Ile Asp Cys Ala Lys Val Ile Ala Ala Ala Cys Glu
100 105 110

Tyr Asp Gly Asn Pro Trp Asp Ile Val Leu Asp Gly Ser Lys Ile Lys
115 120 125

Arg Val Leu Pro Ile Ala Ser Ile Leu Thr Ile Ala Ala Thr Gly Ser
130 135 140

Glu Met Asp Thr Trp Ala Val Ile Asn Asn Met Asp Thr Asn Glu Lys
145 150 155 160

Leu Ile Ala Ala His Pro Asp Met Ala Pro Lys Phe Ser Ile Leu Asp
165 170 175

Pro Thr Tyr Thr Tyr Thr Val Pro Thr Asn Gln Thr Ala Ala Gly Thr
180 185 190

Ala Asp Ile Met Ser His Ile Phe Glu Val Tyr Phe Ser Asn Thr Lys
195 200 205

Thr Ala Tyr Leu Gln Asp Arg Met Ala Glu Ala Leu Leu Arg Thr Cys
210 215 220

Ile Lys Tyr Gly Gly Ile Ala Leu Glu Lys Pro Asp Asp Tyr Glu Ala
225 230 235 240

Arg Ala Asn Leu Met Trp Ala Ser Ser Leu Ala Ile Asn Gly Leu Leu
245 250 255

Thr Tyr Gly Lys Asp Thr Asn Trp Ser Val His Leu Met Glu His Glu
260 265 270

Leu Ser Ala Tyr Tyr Asp Ile Thr His Gly Val Gly Leu Ala Ile Leu
275 280 285

Thr Pro Asn Trp Met Glu Tyr Ile Leu Asn Asn Asp Thr Val Tyr Lys
290 295 300

Phe Val Glu Tyr Gly Val Asn Val Trp Gly Ile Asp Lys Glu Lys Asn
305 310 315 320

His Tyr Asp Ile Ala His Gln Ala Ile Gln Lys Thr Arg Asp Tyr Phe
325 330 335

Val Asn Val Leu Gly Leu Pro Ser Arg Leu Arg Asp Val Gly Ile Glu
340 345 350

Glu Glu Lys Leu Asp Ile Met Ala Lys Glu Ser Val Lys Leu Thr Gly
355 360 365

Gly Thr Ile Gly Asn Leu Arg Pro Val Asn Ala Ser Glu Val Leu Gln
370 375 380

Ile Phe Lys Lys Ser Val
385 390

<210> 21
<211> 2577
<212> DNA
<213> artificial sequence

<220>
<223> AdhE codon pair optimised for *S. cerevisiae*

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gctgctgcc aagaaagtat caacttggcc aagttggctg tcgaagaaac cggtattggt 180
ttggttgaag acaagatcat caagaaccac ttcgctgctg aatacatcta caacaagtac 240
aagaacgaaa agacctgtgg tatcatcgac cacgatgact ctttgggtat caccaagggt 300
gctgaaccaa tcggtattgt cgccgccatt gtcccaacca ctaaccaac ttccactgcc 360
atcttcaaat ctttgatctc cttgaagacc agaaacgcta tcttcttctc cccacacca 420
agagccaaga agtccaccat tgctgctgcc aaattaatct tggatgctgc tgtaaggct 480

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ggtgtcatct	gtgcctctga	acaatccatc	ttggttatga	actctatcta	cgaaaaggct	780
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aaggaaacca	tgttcaagaa	cggtgccatc	aacgctgaca	ttgtcggtaa	atctgcttac	900
atcattgcca	agatggctgg	tattgaagtt	ccacaaacca	ctaagatttt	gatcggtgaa	960
gttcaatctg	tcgaaaagtc	tgaattattc	tctcacgaaa	agttgtctcc	agtcttgget	1020
atgtacaagg	tcaaggattt	cgacgaagct	ttgaagaagg	ctcaaagatt	aattgaatta	1080
ggtgggttctg	gtcacacctc	ttctctatac	attgactctc	aaaacaacaa	ggacaaggct	1140
aaggaattcg	gtctagctat	gaagacttcc	agaactttca	tcaacatgcc	atcttctcaa	1200
ggtgcttctg	gtgatttgta	caactttgcc	attgctccat	ctttcacttt	aggttggtgt	1260
acctgggggtg	gtaactctgt	ttctcaaaac	gttgaaccaa	agcatttgct	aaacatcaag	1320
tccgttgctg	aaagaagaga	aaacatggtg	tggttcaagg	ttccacaaaa	gatctacttc	1380
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ttggatgaaa	ttgatatcaa	gtactccatc	ttcactgata	tcaaactctga	cccaaccatt	1560
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tctgaagcta	ctccatttgc	tgtcatcacc	aacgacgaaa	ccggtatgaa	gtaccattg	1860
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ccaagaaagt	tgactgctgc	taccgggtatt	gacgctttag	tccacgctat	cgaagcttac	1980
gtctccgtta	tggccactga	ctacactgac	gaattggctt	tgagagctat	caagatgac	2040
ttcaagtact	tgccaagagc	ttacaagaac	ggtactaacg	atatcgaagc	tcgtgaaaag	2100
atgggtcacg	cttccaacat	tgctgggtatg	gctttcgcta	acgctttctt	gggtgtttgt	2160
cactccatgg	cccacaagtt	gggtgctatg	caccacgttc	ctcacgggat	tgcttgtgct	2220

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gttttgattg aagaagtcac caagtacaac gctactgact gtccaaccaa gcaaactgct 2280
ttcccacaat acaagtctcc aaacgccaaag agaaagtacg ctgaaattgc tgaatacttg 2340
aacttgaaag gtacttctga cactgaaaag gtcactgctt taatcgaagc tatctccaag 2400
ttgaagattg acttatctat tcctcaaaac atctctgctg ctggtattaa caagaaggac 2460
ttctacaaca ctttagacaa gatgtccgaa ttggctttcg atgaccaatg taccaccgct 2520
aacccaagat acccattgat ctctgaattg aaggatatct acatcaagtc cttttaa 2577

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<210> 22

<211> 1179

<212> DNA

<213> Artificial sequence

<220>

<223> Thil gene counterclockwise CPO for *S. cerevisiae*

<400> 22

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ggaagcacca attgggtgac ccaaagcaat ggcaccaccg ttaacgttga ccttgttcat 180
gtcgaatttc aagtccttgg caacagccaa agattgagca gcgaaagctt cgttggttc 240
aatcaaattc aattcgtcaa cgggtccaacc agccttttcg atagcagcct tggtagcgta 300
gaaaggaccg taacctatga tggctgggtc aacaccagca gaaccgtagg agacaatctt 360
ggccaatggc ttgacacca attccttggc cttttcagca gacatgataa caaaaacagc 420
agcacagtcg ttcaaaccgg aagcgttacc agcagtgacg gtaccatcct tcttgaaagc 480
tggtttcaac ttggccaaac cttcaatggg ggaaccgaat cttgggtgtt catcgggtgc 540
gacaacggtt tcaccctttc tacccttgat gacaactggg acaatttcgt ccttgaattg 600
accagatttg atggcttctt cagccttctt ttgagaagcc aaagcaaatt catcttgttc 660
ttctctggag atgttccatc tttcagcaat gttttcagca gtgataccca tgtggtagtc 720
gttgaaagcg tcccataaac cgtcagtgat catttcatcg acgaacttgg cgttacccat 780
tctgtaacc catctagcat tgtagccaa gtatggagct ctggacatgt tttccatacc 840
accagcaatg atgacatcag cgtcaccagc cttgatgatt tgagcagcca aagaaacagt 900
tctcaaacca gaaccacaaa ccttgttgat ggtcatggct ggaatttcaa ctggcaaacc 960
agccttgaaa gaagcttgac gagctgggtt ttgacctaaa ccagcttgca aaacgttacc 1020

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taagataact tcgttaacat cttctggcctt gataccagcc ttcttgacag cttccttgat 1080
 ggcggttagca cccaagtcga cagctgggac gtccttcaaa gacttaccgt aagaaccaat 1140
 ggcagttctg acagcagaag caataacaac ttccttcat 1179

<210> 23
 <211> 849
 <212> DNA
 <213> Artificial sequence

<220>
 <223> hbd gene cpo for *S. cerevisiae*

<400> 23
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 gctgccaagg gtttcgaagt tgttttgaga gatatcaagg acgaattcgt tgaccgtggt 120
 ttggattttca tcaacaagaa cttgtccaag ttggtcaaga agggtaagat tgaagaagct 180
 accaaggtcg aaatcttgac cagaatctcc ggtactgttg acttgaacat ggctgctgac 240
 tgtgatttgg tcattgaagc tgccgttgaa agaatggaca tcaagaagca aatctttgct 300
 gatttgagaca acatctgtaa gccagaaacc attttggtt ccaacacttc ttctttgtcc 360
 atcactgaag ttgcttctgc taccaagaga ccagacaagg ttatcgggat gcacttcttc 420
 aaccagctc cagtcatgaa gttggtcgaa gtcacagag gtattgccac ctctcaagaa 480
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 attttggttg aaggatttgc ttctgttgaa gatatcgaca aggccatgaa attgggtgct 660
 aaccacccaa tgggtccatt ggaattaggt gacttcatcg gtttgatgat ctgtttggcc 720
 atcatggatg tcttatactc tgaaaccggt gactctaagt acagacctca cactttattg 780
 aagaagtacg ttagagctgg ttggttaggt agaaagtctg gtaagggttt ctacgactac 840
 tccaaatag 849

<210> 24
 <211> 1173
 <212> DNA
 <213> Artificial sequence

<220>
 <223> bdhB gene cpo for *S. cerevisiae*

<400> 24
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aaattctacg aattggctgg tgttgaacca aaccaagag ttaccaccgt cgaaaagggt 240
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ggtttaccat ccagattaag agatgttggt attgaagaag aaaaattgga tatcatggct 1080
aaggaatctg tcaaattgac tgggtgtacc attggtaact tgagacctgt taacgcttct 1140
gaagttttgc aaatcttcaa gaaatctgtt tag 1173

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<210> 25

<211> 789

<212> DNA

<213> Artificial sequence

<220>

<223> crt gene counterclockwise CPO for *S. cerevisiae*

<400> 25

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```

```
cttttggctt tcagtggaga aacattcacc gaaagcttca gattcaaagg ccaaagcggg 120
```

```
gtcgatatca cattgcatac ctctgttgat ggcttgcttg gacaatttga cagcaactgg 180
```

```
agcgttgagg acgatcttgt tagcaatttc cttggcagtg ttcattcaatt cagatgggtc 240
```

```

aacaaccttg ttgactaaac caattctcaa agcttcgtca gccttgatgt tttgagcgg 300
gaagatcaat tgcttggcca taccataacc aaccaatctg gataatcttt gagtaccacc 360
gaaacctgga gtgataccta gaccgacttc tggttgaccg aaacgagcgt tagaagaagc 420
aattctgatg tcacaggaca tggcaatttc acaaccacca cccaaagcga aaccgttgac 480
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aacgaaagac ttttcaccgg caccgggtcaa gatgacagcc aaaacttcag aatcgttttc 660
aatttcacca atgacgtagt ccatttcctt caaagtgtca gagttcaaag cattcaaagc 720
ctttggtctg ttgatgggtga caacggcaac cttaccttcc ttttccaaga taacgttggt 780
caattccat 789

```

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<210> 26
<211> 1140
<212> DNA
<213> Artificial sequence

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<220>
<223> bcd cpo for S. cerevisiae

```

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<400> 26
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aacgtcaaga agatgggtca atacggtatg atgggtattc cattctctaa ggaatacgg 180
ggtgctgggtg gtgacgtcct gtcttacatc attgctgtcg aagaattgtc caaggtttgt 240
ggtaccactg gtgtcatcct atctgtctac acttctctat gtgcctcctt gatcaacgaa 300
cacggtactg aagaacaaaa gcaaaagtac ttgggttccat tggccaaggg tgaaaagatt 360
ggtgcctacg gtttgactga accaaacgct ggtactgact ctggtgctca acaaactggt 420
gccgttttgg aaggtgacca ctacgtcatc aacgggtcca agatcttcat caccaacgg 480
ggtgttgctg acacctttgt catcttcgct atgaccgatc gtaccaaggg taccaagggt 540
atctctgctt tcattattga aaagggtttc aagggtttct ccatcggtaa ggtcgaacaa 600
aagttgggta tcagagcttc ctctaccact gaattgggtt tcgaagacat gattgttcca 660
gttgaaaaca tgatcggtaa ggaaggtaag ggtttcccaa ttgccatgaa gactttagat 720
ggtggtagaa ttggtattgc tgctcaagct ttgggtattg ctgaagggtc cttcaacgaa 780
gctagagctt acatgaagga aagaaagcaa ttcggtagat ctttggacaa attccaagg 840

```

```

ttggcttggg  tgatggctga  catggacgtt  gccatcgaat  ctgctcgtta  cttggtctac  900
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ttgcacgctg  ccaacgttgc  catggatgtc  accaccaagg  ctgtccaatt  attcggtggt  1020
tacggttaca  ccaaggacta  cccagttgaa  agaatgatga  gagatgctaa  gatcactgaa  1080
atctacgaag  gtactttctg  agttcaaaaag  ttggttatct  ccggttaagat  cttcagatag  1140

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<210> 27
<211> 332
<212> DNA
<213> Artificial sequence

```

```

<220>
<223> Gal 1 promotor

```

```

<400> 27
aataaagatt  ctacaatact  agcttttatg  gttatgaaga  ggaaaaattg  gcagtaacct  60
ggccccacaa  accttcaaat  taacgaatca  aattaacaac  cataggatga  taatgcgatt  120
agtttttttag  ccttattttct  ggggtaatta  atcagcgaag  cgatgatttt  tgatctatta  180
acagatatat  aaatggaaaa  gctgcataac  cactttaact  aatactttca  acattttcag  240
tttgtattac  ttcttattca  aatgtcataa  aagtatcaac  aaaaaattgt  taatatacct  300
ctatacttta  acgtcaagga  gaaaaaacta  ta  332

```

```

<210> 28
<211> 347
<212> DNA
<213> Artificial sequence

```

```

<220>
<223> Gal 1 terminator

```

```

<400> 28
gtatacttct  tttttttact  ttgttcagaa  caacttctca  tttttttcta  ctcataactt  60
tagcatcaca  aaatacgcaa  taataacgag  tagtaacact  tttatagttc  atacatgctt  120
caactactta  ataaatgatt  gtatgataat  gttttcaatg  taagagattt  cgattatcca  180
caaactttta  aacacaggga  caaaattctt  gatatgcttt  caaccgctgc  gttttggata  240
cctattcttg  acatgatatg  actaccattt  tgttattgta  cgtggggcag  ttgacgtctt  300
atcatatgtc  aaagtcattt  gcgaagttct  tggcaagttg  ccaactg  347

```

```

<210> 29

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<211> 290
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Gal7 promotor

<400> 29
 tccctatact tcggagcact gttgagcgaa ggctcattag atatattttc tgtcattttc 60
 cttaacccaa aaataaggga aaggggtccaa aaagcgctcg gacaactgtt gaccgtgatc 120
 cgaaggactg gctatacagt gttcacaaaa tagccaagct gaaaataatg tgtagctatg 180
 ttcagttagt ttggctagca aagatataaa agcaggctcg aaatatttat gggcattatt 240
 atgcagagca tcaacatgat aaaaaaaaaac agttgaatat tccctcaaaa 290

<210> 30
 <211> 348
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Gal7 terminator

<400> 30
 aaagaaagtg gaatattcat tcatatcata ttttttctat taactgcctg gtttctttta 60
 aattttttat tggttgtcga cttgaacgga gtgacaatat atatataat atatttaata 120
 atgacatcat tatctgtaaa tctgattctt aatgctattc tagttatgta agagtggctc 180
 tttccataaa aaaaaaaaaa aagaaaaaag aatttttagga atacaatgca gcttgtaagt 240
 aaaatctgga atattcatat cgccacaact tcttatgctt ataaaagcac taatgcctga 300
 atttatgttg aaaatatgtg tcacaaataa agaaactgtg acatctgg 348

<210> 31
 <211> 336
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Gal10 promotor counterclockwise

<400> 31
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 atcatattac atggcattac caccatatac atatccatat ctaatcttac ttatatgttg 120
 tggaaatgta aagagcccca ttatcttagc ctaaaaaaac cttctctttg gaactttcag 180
 taatacgctt aactgctcat tgctatattg aagtacggat tagaagccgc cgagcgggag 240

acagccctcc gacggaagac tctcctcgt gcgtcctcgt cttcaccggt cgcgttcctg 300

aaacgcagat gtgcctcgcg ccgcactgct ccgaac 336

<210> 32

<211> 356

<212> DNA

<213> Artificial sequence

<220>

<223> Gal10 terminator counterclockwise

<400> 32

cgcgcccaat aatattttaca acttttcctt atgatttttt cactgaagcg cttcgcaata 60

gttgtgagtg atatcaaaag taacgaaatg aactccgcgg ctcgtgctat attcttgttg 120

ctaccgtcca tatctttcca tagattttca atttttgatg tctccatggt ggtacagaga 180

acttgtaaac aattcgggtcc ctacatgtga ggaaattcgc tgtgacactt ttatcactga 240

actccaaatt taaaaaatag cataaaattc gttatacagc aaatctatgt gttgcaatta 300

agaactaaaa gatatagagt gcatattttc aagaaggata gtaagctggc aaatca 356