

JPOXMLDOC01-seql.app
SEQUENCE LISTING

<110> API Corporation

<120> Method of producing cis-5-hydroxy-2-piperidine carboxylate derivatives and method of purifying cis-5-hydroxy-2-piperidine carboxylate derivatives

<130> AP340-13366

<150> JP2012-278314

<151> 2012-12-20

<160> 38

<170> PatentIn version 3.5

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<211> 1026

<212> DNA

<213> Pseudomonas putida

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Tyr Ala Tyr Gln Ile Pro Thr Ser Pro Leu Ile Val Glu Val Thr Pro
20 25 30
cag gaa aga aac att ttg tct aat gtg ggc gct ctg ctg gaa aag gca 144
Gln Glu Arg Asn Ile Leu Ser Asn Val Gly Ala Leu Leu Glu Lys Ala
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Phe Lys Ser Tyr Glu Asn Pro Asp Tyr Ile Glu Ala Leu His Leu Tyr
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Ser Phe Gln Leu Leu Pro Glu Arg Ile Ala Arg Ile Leu Ser Arg Phe
65 70 75 80
gga aca gat ttc tca gct gat cag tat ggc gct att att ttt aga ggt 288
Gly Thr Asp Phe Ser Ala Asp Gln Tyr Gly Ala Ile Ile Phe Arg Gly
85 90 95
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Leu Leu His Gly Ala Val Pro Ser Lys Pro Val Gln Tyr Tyr Ala Gln
130 135 140
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Arg Lys Gly Gly Gly Ile Leu His Ala Val Ile Pro Asp Glu Lys Met
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165 170 175
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Thr Glu Asp Ala Phe Leu Leu His Gln Ala Asp Phe Leu Ser Phe Leu
180 185 190
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Tyr Leu Arg Asn Glu Glu Arg Val Pro Ser Thr Leu Tyr Ser Val Arg
195 200 205
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225 230 235 240
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Val	Asp	Glu	Ser	Phe	Ala	Asp	Phe	Leu	Asp	Thr	Arg	Glu	Val	Arg	Gly		
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Pro	Phe	Ser	Ile	Leu	Ser	Gly	Asp	Val	Asp	Asp	Pro	Thr	Met	Leu	Val		
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Asp	Gln	Asp	Leu	Met	His	Gly	Ile	Thr	Lys	His	Ala	Gln	Ala	Leu	Leu		
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Glu	Arg	Val	Leu	Glu	Ile	Tyr	Val	Ala	His	Arg	His	Ala	Val	Val	Leu		
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cag	ccc	ggg	gac	gtg	ctg	ctg	ctg	gac	aac	ctg	cgc	gcc	atg	cac	ggc	864	
Gln	Pro	Gly	Asp	Val	Leu	Leu	Leu	Asp	Asn	Leu	Arg	Ala	Met	His	Gly		
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Arg	Ser	Pro	Phe	Ala	Pro	Arg	Phe	Asp	Gly	Thr	Asp	Arg	Phe	Ile	Ser		
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Arg	Gly	Phe	Val	Val	Arg	Asp	Leu	Arg	Arg	Ser	Arg	Phe	Ala	Arg	Pro		
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ggc	ggg	aac	cgc	gtc	gtg	cag	gcc	agc	ttc	agc	tga					996	
Gly	Gly	Asn	Arg	Val	Val	Gln	Ala	Ser	Phe	Ser							
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Leu Thr Ala Asp Pro Val Thr Glu Pro Asp Ala Phe Gly Arg Gln Ala
35      40      45
Arg Leu Leu Ala Arg Glu Leu Ser Val Glu Val Thr Glu Ala Leu Trp
50      55      60
Ala Phe Glu Glu Arg Gly Ser Asp Ser Gly Val Leu Val Leu Arg Gly
65      70      75      80
Leu Glu Val Gly Glu Leu Pro Pro Thr Pro Ala Asp Asn Thr Gly Gly
85      90      95
Ile Gly Gly Arg Thr Leu Leu Ala Arg Gln Gln Ala Ile Val Ser His
100     105     110
Ala Leu Gly His Met Val Gly Tyr Ala Ala Glu Gly His Gly His Leu
115     120     125
Leu Gln Asp Met Val Pro Asn Ala Arg Leu Ala Ala Thr Gln Gln Ser
130     135     140
Gln Gly Ser Arg Val Glu Leu Glu Ala His Thr Glu Gln Cys Phe Ser
145     150     155     160
Asp Leu Arg Pro Asp Tyr Val Val Leu Gly Cys Leu Arg Gly Asp Ala
165     170     175
Asp Ala Ala Thr Tyr Ala Phe Arg Ala Leu Asp Leu Leu Ala His Val
180     185     190
Asp Pro Thr Asp Val Met Glu Leu Phe Arg Pro Leu Trp Thr Thr Leu
195     200     205
Val Asp Glu Ser Phe Ala Asp Phe Leu Asp Thr Arg Glu Val Arg Gly
210     215     220
Pro Phe Ser Ile Leu Ser Gly Asp Val Asp Asp Pro Thr Met Leu Val
225     230     235     240
Asp Gln Asp Leu Met His Gly Ile Thr Lys His Ala Gln Ala Leu Leu
245     250     255
Glu Arg Val Leu Glu Ile Tyr Val Ala His Arg His Ala Val Val Leu
260     265     270
Gln Pro Gly Asp Val Leu Leu Leu Asp Asn Leu Arg Ala Met His Gly
275     280     285
Arg Ser Pro Phe Ala Pro Arg Phe Asp Gly Thr Asp Arg Phe Ile Ser
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Leu Pro Arg Thr Met His Phe Ala Ala Glu Pro Pro Leu Gln Pro Leu
20      25      30
ata ata gat att act gaa gaa gaa aaa ctg gaa att acc tat atc ggg      144
Ile Ile Asp Ile Thr Glu Glu Glu Lys Leu Glu Ile Thr Tyr Ile Gly
35      40      45
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Lys	Val	Leu	Ser	Asn	Phe	Gly	Thr	Asp	Phe	Ser	Asp	Gln	Gln	Tyr	Gly	
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Ala	Val	Val	Leu	Arg	Gly	Leu	Ile	Glu	Ile	Gly	Gln	Asp	Glu	Leu	Gly	
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Pro	Thr	Pro	Arg	Ser	Trp	Gln	Glu	Thr	Asp	His	Glu	Lys	Ile	Met	Glu	
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Tyr	Gly	Phe	Ile	Ser	Ser	Leu	Leu	His	Gly	Ala	Val	Pro	Ser	Lys	Pro	
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Ile	Pro	Asp	Glu	Asn	Met	Ser	Phe	Thr	Gln	Thr	Gly	Ser	Gly	Ser	Arg	
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Thr	Asp	Leu	Phe	Val	His	Thr	Glu	Asp	Ala	Phe	Leu	His	Asn	Ala	Ala	
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gat	ttt	ctg	agt	ttt	ctt	ttc	ctg	cgg	aat	gaa	gaa	cgt	gtg	cct	tcc	624
Asp	Phe	Leu	Ser	Phe	Leu	Phe	Leu	Arg	Asn	Glu	Glu	Arg	Val	Pro	Ser	
			195					200					205			
acc	tta	tat	tct	atc	cgc	tct	cat	ggc	aga	ccg	gat	gcg	ata	tta	cag	672
Thr	Leu	Tyr	Ser	Ile	Arg	Ser	His	Gly	Arg	Pro	Asp	Ala	Ile	Leu	Gln	
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Glu	Leu	Phe	Lys	Pro	Ile	Tyr	Lys	Cys	Pro	Lys	Asp	Ala	Asn	Tyr	Ala	
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tcc	gaa	gaa	gcc	ctg	gga	gat	gac	atc	cgt	act	tct	gtt	tta	tat	ggg	768
Ser	Glu	Glu	Ala	Leu	Gly	Asp	Asp	Ile	Arg	Thr	Ser	Val	Leu	Tyr	Gly	
			245						250					255		
agc	aga	tcc	gct	ccc	ttc	atg	cgc	ttt	gat	gct	gcg	gaa	cag	att	tat	816
Ser	Arg	Ser	Ala	Pro	Phe	Met	Arg	Phe	Asp	Ala	Ala	Glu	Gln	Ile	Tyr	
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aat	gaa	gac	gcc	aat	cag	gat	cct	gaa	gct	tta	cat	aat	ctg	aaa	aga	864
Asn	Glu	Asp	Ala	Asn	Gln	Asp	Pro	Glu	Ala	Leu	His	Asn	Leu	Lys	Arg	
			275					280					285			
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Phe	Trp	Glu	Glu	Ala	Arg	Lys	Leu	Ile	Tyr	Asn	Asp	Phe	Val	Pro	Glu	
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Ser	Gly	Asp	Leu	Ile	Phe	Val	Asn	Asn	His	Leu	Cys	Ala	His	Gly	Arg	
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aat	gct	ttc	ctg	gca	ggc	ttc	aga	gag	gaa	aat	ggg	cag	ctg	gta	aaa	1008
Asn	Ala	Phe	Leu	Ala	Gly	Phe	Arg	Glu	Glu	Asn	Gly	Gln	Leu	Val	Lys	
			325					330						335		
tgc	gaa	cgc	cgt	ctt	atg	tta	cgt	atg	atg	agc	aaa	acc	agc	ctg	att	1056
Cys	Glu	Arg	Arg	Leu	Met	Leu	Arg	Met	Met	Ser	Lys	Thr	Ser	Leu	Ile	
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aac	atc	cgt	gaa	gta	acc	cac	ccc	gaa	aac	cct	tat	ctc	atc	atg	gaa	1104
Asn	Ile	Arg	Glu	Val	Thr	His	Pro	Glu	Asn	Pro	Tyr	Leu	Ile	Met	Glu	
			355					360					365			
gag	cac	tac	gga	aaa	gta	tat	agc	gct	cac	ctg	gca	aac	ctt	taa		1149
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 35 40 45
 Lys Lys Leu Lys Arg Lys Tyr Lys Ser Tyr Asp Asp Pro Gly Phe Ile
 50 55 60
 Ser Met Leu His Leu Asn Ala Tyr Thr Leu Leu Pro Glu Arg Ile Ala
 65 70 75 80
 Lys Val Leu Ser Asn Phe Gly Thr Asp Phe Ser Asp Gln Gln Tyr Gly
 85 90 95
 Ala Val Val Leu Arg Gly Leu Ile Glu Ile Gly Gln Asp Glu Leu Gly
 100 105 110
 Pro Thr Pro Arg Ser Trp Gln Glu Thr Asp His Glu Lys Ile Met Glu
 115 120 125
 Tyr Gly Phe Ile Ser Ser Leu Leu His Gly Ala Val Pro Ser Lys Pro
 130 135 140
 Val Glu Tyr Phe Ala Gln Arg Lys Gly Gly Gly Leu Met His Ala Ile
 145 150 155 160
 Ile Pro Asp Glu Asn Met Ser Phe Thr Gln Thr Gly Ser Gly Ser Arg
 165 170 175
 Thr Asp Leu Phe Val His Thr Glu Asp Ala Phe Leu His Asn Ala Ala
 180 185 190
 Asp Phe Leu Ser Phe Leu Phe Leu Arg Asn Glu Glu Arg Val Pro Ser
 195 200 205
 Thr Leu Tyr Ser Ile Arg Ser His Gly Arg Pro Asp Ala Ile Leu Gln
 210 215 220
 Glu Leu Phe Lys Pro Ile Tyr Lys Cys Pro Lys Asp Ala Asn Tyr Ala
 225 230 235 240
 Ser Glu Glu Ala Leu Gly Asp Asp Ile Arg Thr Ser Val Leu Tyr Gly
 245 250 255
 Ser Arg Ser Ala Pro Phe Met Arg Phe Asp Ala Ala Glu Gln Ile Tyr
 260 265 270
 Asn Glu Asp Ala Asn Gln Asp Pro Glu Ala Leu His Asn Leu Lys Arg
 275 280 285
 Phe Trp Glu Glu Ala Arg Lys Leu Ile Tyr Asn Asp Phe Val Pro Glu
 290 295 300
 Ser Gly Asp Leu Ile Phe Val Asn Asn His Leu Cys Ala His Gly Arg
 305 310 315 320
 Asn Ala Phe Leu Ala Gly Phe Arg Glu Glu Asn Gly Gln Leu Val Lys
 325 330 335
 Cys Glu Arg Arg Leu Met Leu Arg Met Met Ser Lys Thr Ser Leu Ile
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ctg ctt cct acg gtc ata gaa gtc act tct cag gag aga aga atg ata      96
Leu Leu Pro Thr Val Ile Glu Val Thr Ser Gln Glu Arg Arg Met Ile
      20      25      30
aaa gat gca gcg ctg cat ctt cag aaa aaa tat ggc act tat gaa aac      144
Lys Asp Ala Ala Leu His Leu Gln Lys Lys Tyr Gly Thr Tyr Glu Asn
      35      40      45
cgg gat ttt ata aaa cat gtt cat caa ctg gcc tct tat ttt ctt ccg      192
Arg Asp Phe Ile Lys His Val His Gln Leu Ala Ser Tyr Phe Leu Pro
      50      55      60
gaa agg att cta aat ata gca gct gat ttt gca agt gac ttt tct gaa      240
Glu Arg Ile Leu Asn Ile Ala Ala Asp Phe Ala Ser Asp Phe Ser Glu
      65      70      75      80
aat cag tat gga gcg ctg gtt ttt aca gga ttg atg gag ata gac cag      288
Asn Gln Tyr Gly Ala Leu Val Phe Thr Gly Leu Met Glu Ile Asp Gln
      85      90      95
gaa gaa ata ggt tct act cca ccc aac tgg caa tcg gca gat tat tca      336
Glu Glu Ile Gly Ser Thr Pro Pro Asn Trp Gln Ser Ala Asp Tyr Ser
      100      105      110
aag ttt aat tta tat ggt ttt gcg tgt gcg ctt att cat ggg gca ctt      384
Lys Phe Asn Leu Tyr Gly Phe Ala Cys Ala Leu Ile His Gly Ala Leu
      115      120      125
ccc tca aag cct gta caa tat tat tca cag cgt aaa ggc ggt gga ttg      432
Pro Ser Lys Pro Val Gln Tyr Tyr Ser Gln Arg Lys Gly Gly Gly Leu
      130      135      140
atc cac gct att att cct gat gaa aaa atg aaa gaa aca cag aca gga      480
Ile His Ala Ile Ile Pro Asp Glu Lys Met Lys Glu Thr Gln Thr Gly
      145      150      155      160
tca gga tcc tca acg gat ctg tat gta cat aca gaa gat gct ttt ctg      528
Ser Gly Ser Ser Thr Asp Leu Tyr Val His Thr Glu Asp Ala Phe Leu
      165      170      175
aaa cat cag gct gac ttt tta agc ttt atg tat gtc cga aat gaa gag      576
Lys His Gln Ala Asp Phe Leu Ser Phe Met Tyr Val Arg Asn Glu Glu
      180      185      190
cag gta cct tca act ctt tat tct atc cgt tct cat gag tct att ggg      624
Gln Val Pro Ser Thr Leu Tyr Ser Ile Arg Ser His Glu Ser Ile Gly
      195      200      205
gaa aag tac agg aca ctt ttt gag cct att tat aaa atc cct aaa gat      672
Glu Lys Tyr Arg Thr Leu Phe Glu Pro Ile Tyr Lys Ile Pro Lys Asp
      210      215      220
gcc aat ctg gaa acg gga gaa aat gaa gaa gaa act ctg gat tct gta      720
Ala Asn Leu Glu Thr Gly Glu Asn Glu Glu Glu Thr Leu Asp Ser Val
      225      230      235      240
ttg tat gga aat acc aac ctt cct ttt atg cga ttt gat gcg gcg gaa      768
Leu Tyr Gly Asn Thr Asn Leu Pro Phe Met Arg Phe Asp Ala Ala Glu
      245      250      255
cag ctt ttc aat tcc agt atc aga cag tca gaa gaa gcg cag cat aca      816
Gln Leu Phe Asn Ser Ser Ile Arg Gln Ser Glu Glu Ala Gln His Thr
      260      265      270
ctg cat gag ttc tgg gaa gaa gcc aga cat ttg att tat tca gga ttt      864
Leu His Glu Phe Trp Glu Glu Ala Arg His Leu Ile Tyr Ser Gly Phe
      275      280      285
acg cct cag gcc gga gat gtt att ctg gtt aat aat cat tta tgt gct      912
Thr Pro Gln Ala Gly Asp Val Ile Leu Val Asn Asn His Leu Cys Ala
      290      295      300
cac gga aga tct gct ttc cgt gcg gga gta aga aat att gac ggt ata      960
His Gly Arg Ser Ala Phe Arg Ala Gly Val Arg Asn Ile Asp Gly Ile
      305      310      315      320
gaa cag ccg tgc gaa cga aga att atg ctt cgg atg atg agt aaa gtg      1008
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gtc ata gaa gaa cat ctg ggt aaa aac ttt caa cat ttt taa						1098
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	20														
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Arg Asp Phe Ile Lys His Val His Gln Leu Ala Ser Tyr Phe Leu Pro							55					60			
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Asn Gln Tyr Gly Ala Leu Val Phe Thr Gly Leu Met Glu Ile Asp Gln															
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Glu Glu Ile Gly Ser Thr Pro Pro Asn Trp Gln Ser Ala Asp Tyr Ser															
		100					105							110	
Lys Phe Asn Leu Tyr Gly Phe Ala Cys Ala Leu Ile His Gly Ala Leu															
	115						120							125	
Pro Ser Lys Pro Val Gln Tyr Tyr Ser Gln Arg Lys Gly Gly Gly Leu															
	130						135							140	
Ile His Ala Ile Ile Pro Asp Glu Lys Met Lys Glu Thr Gln Thr Gly															
	145					150						155			160
Ser Gly Ser Ser Thr Asp Leu Tyr Val His Thr Glu Asp Ala Phe Leu															
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Lys His Gln Ala Asp Phe Leu Ser Phe Met Tyr Val Arg Asn Glu Glu															
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Gln Val Pro Ser Thr Leu Tyr Ser Ile Arg Ser His Glu Ser Ile Gly															
	195						200							205	
Glu Lys Tyr Arg Thr Leu Phe Glu Pro Ile Tyr Lys Ile Pro Lys Asp															
	210						215							220	
Ala Asn Leu Glu Thr Gly Glu Asn Glu Glu Glu Thr Leu Asp Ser Val															
	225						230							235	240
Leu Tyr Gly Asn Thr Asn Leu Pro Phe Met Arg Phe Asp Ala Ala Glu															
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Gln Leu Phe Asn Ser Ser Ile Arg Gln Ser Glu Glu Ala Gln His Thr															
		260													270
Leu His Glu Phe Trp Glu Glu Ala Arg His Leu Ile Tyr Ser Gly Phe															
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Thr Pro Gln Ala Gly Asp Val Ile Leu Val Asn Asn His Leu Cys Ala															
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His Gly Arg Ser Ala Phe Arg Ala Gly Val Arg Asn Ile Asp Gly Ile															
	305														320
Glu Gln Pro Cys Glu Arg Arg Ile Met Leu Arg Met Met Ser Lys Val															
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Ser Leu Ile Asp Met Arg Ala His Thr Leu Thr Glu Asp Pro Phe Phe															
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Leu Pro Pro Pro Leu Ser Pro Leu Ile Val Asp Val Thr Pro Lys Glu	
20 25 30	
cgt gcc tcc att tca aac gtg gcc aat atc tta tta aaa gcc ttt ggc	144
Arg Ala Ser Ile Ser Asn Val Ala Asn Ile Leu Leu Lys Ala Phe Gly	
35 40 45	
cat tat gaa cat cct gat ttc atc tcc gct ttg cac ctg aat gct ttt	192
His Tyr Glu His Pro Asp Phe Ile Ser Ala Leu His Leu Asn Ala Phe	
50 55 60	
cag tta tta ccg gaa cgt att gcg ggg ata ctg agc cgt ttt ggt acc	240
Gln Leu Leu Pro Glu Arg Ile Ala Gly Ile Leu Ser Arg Phe Gly Thr	
65 70 75 80	
gac ttc tcg cgc cac caa tac ggc gcg ttg gtg ttc aga ggc ctt aca	288
Asp Phe Ser Arg His Gln Tyr Gly Ala Leu Val Phe Arg Gly Leu Thr	
85 90 95	
gaa gta gat cag gag gcg ctt ggc cct acc ccg ccc tcg tgg aaa gaa	336
Glu Val Asp Gln Glu Ala Leu Gly Pro Thr Pro Pro Ser Trp Lys Glu	
100 105 110	
acc gat tac agc aag ctt gtt aaa tat gga ttt att tgc tcg ctg ctg	384
Thr Asp Tyr Ser Lys Leu Val Lys Tyr Gly Phe Ile Cys Ser Leu Leu	
115 120 125	
cat ggc gcc att cca tca aaa cca gta caa tat tat gcg cag cga aaa	432
His Gly Ala Ile Pro Ser Lys Pro Val Gln Tyr Tyr Ala Gln Arg Lys	
130 135 140	
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Gly Gly Gly Leu Leu His Ala Val Ile Pro Asp Glu Lys Met Ser His	
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Thr Gln Thr Gly Ser Gly Ser Arg Thr Asp Leu Phe Val His Thr Glu	
165 170 175	
gat gcg ttc tta ttt aac cag gcc gat ttt ctc agc ttc ctg ttc ctg	576
Asp Ala Phe Leu Phe Asn Gln Ala Asp Phe Leu Ser Phe Leu Phe Leu	
180 185 190	
cgg aat gaa gaa cag gtg cca tct acg tta tat tcg atc cgg tcg cat	624
Arg Asn Glu Glu Gln Val Pro Ser Thr Leu Tyr Ser Ile Arg Ser His	
195 200 205	
ggc gat acc aac gcc atc atg gcg gag ctg ttc aaa ccc att tat aag	672
Gly Asp Thr Asn Ala Ile Met Ala Glu Leu Phe Lys Pro Ile Tyr Lys	
210 215 220	
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Cys Pro Lys Asp Ala Asn Tyr Ala Asp Asp Glu Asn Ala Gly Glu Glu	
225 230 235 240	
gtg acc act tct atc tta tac ggt aac cgc gaa cgg ccc ttt atc cgc	768
Val Thr Thr Ser Ile Leu Tyr Gly Asn Arg Glu Arg Pro Phe Ile Arg	
245 250 255	
ttc gat gcc gcg gaa cag atc tac aac gaa aag gcc gga caa acg ccg	816
Phe Asp Ala Ala Glu Gln Ile Tyr Asn Glu Lys Ala Gly Gln Thr Pro	
260 265 270	
gaa gcc atg cac aac ctg gtg cgt ttt tgg gac gaa gcc aaa caa ctt	864
Glu Ala Met His Asn Leu Val Arg Phe Trp Asp Glu Ala Lys Gln Leu	
275 280 285	
atc tac aat gat ttc gtg ccc gat tcg ggc gat ctc att ttt gta aac	912
Ile Tyr Asn Asp Phe Val Pro Asp Ser Gly Asp Leu Ile Phe Val Asn	

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290	295	300	
aac cat ttg tgc gcg cat ggc cgg aat tca ttt gtg gcc ggt tat cgt			960
Asn His Leu Cys Ala His Gly Arg Asn Ser Phe Val Ala Gly Tyr Arg			
305	310	315	320
aat gaa aac ggt cag ctg gta aaa tgt gaa cgc cgg ttg atg tta cgc			1008
Asn Glu Asn Gly Gln Leu Val Lys Cys Glu Arg Arg Leu Met Leu Arg			
	325	330	335
atg atg agc aag acc agc ctc atc aat att cag tcg gtg acc cag tta			1056
Met Met Ser Lys Thr Ser Leu Ile Asn Ile Gln Ser Val Thr Gln Leu			
	340	345	350
aac gac ccg tat ttc att atg gaa gaa cac tac ggc aaa ttg ttt cat			1104
Asn Asp Pro Tyr Phe Ile Met Glu Glu His Tyr Gly Lys Leu Phe His			
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tca caa caa taa			1116
Ser Gln Gln			
370			

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<211> 371

<212> PRT

<213> Niastella koreensis NBRC106392

<400> 26

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Arg Ala Ser Ile Ser Asn Val Ala Asn Ile Leu Leu Lys Ala Phe Gly	
	35 40 45
His Tyr Glu His Pro Asp Phe Ile Ser Ala Leu His Leu Asn Ala Phe	
	50 55 60
Gln Leu Leu Pro Glu Arg Ile Ala Gly Ile Leu Ser Arg Phe Gly Thr	
65	70 75 80
Asp Phe Ser Arg His Gln Tyr Gly Ala Leu Val Phe Arg Gly Leu Thr	
	85 90 95
Glu Val Asp Gln Glu Ala Leu Gly Pro Thr Pro Pro Ser Trp Lys Glu	
	100 105 110
Thr Asp Tyr Ser Lys Leu Val Lys Tyr Gly Phe Ile Cys Ser Leu Leu	
	115 120 125
His Gly Ala Ile Pro Ser Lys Pro Val Gln Tyr Tyr Ala Gln Arg Lys	
	130 135 140
Gly Gly Gly Leu Leu His Ala Val Ile Pro Asp Glu Lys Met Ser His	
145	150 155 160
Thr Gln Thr Gly Ser Gly Ser Arg Thr Asp Leu Phe Val His Thr Glu	
	165 170 175
Asp Ala Phe Leu Phe Asn Gln Ala Asp Phe Leu Ser Phe Leu Phe Leu	
	180 185 190
Arg Asn Glu Glu Gln Val Pro Ser Thr Leu Tyr Ser Ile Arg Ser His	
	195 200 205
Gly Asp Thr Asn Ala Ile Met Ala Glu Leu Phe Lys Pro Ile Tyr Lys	
	210 215 220
Cys Pro Lys Asp Ala Asn Tyr Ala Asp Asp Glu Asn Ala Gly Glu Glu	
225	230 235 240
Val Thr Thr Ser Ile Leu Tyr Gly Asn Arg Glu Arg Pro Phe Ile Arg	
	245 250 255
Phe Asp Ala Ala Glu Gln Ile Tyr Asn Glu Lys Ala Gly Gln Thr Pro	
	260 265 270
Glu Ala Met His Asn Leu Val Arg Phe Trp Asp Glu Ala Lys Gln Leu	
	275 280 285
Ile Tyr Asn Asp Phe Val Pro Asp Ser Gly Asp Leu Ile Phe Val Asn	
	290 295 300
Asn His Leu Cys Ala His Gly Arg Asn Ser Phe Val Ala Gly Tyr Arg	
305	310 315 320
Asn Glu Asn Gly Gln Leu Val Lys Cys Glu Arg Arg Leu Met Leu Arg	

				325					330					335			
Met	Met	Ser	Lys	Thr	Ser	Leu	Ile	Asn	Ile	Gln	Ser	Val	Thr	Gln	Leu		
			340					345					350				
Asn	Asp	Pro	Tyr	Phe	Ile	Met	Glu	Glu	His	Tyr	Gly	Lys	Leu	Phe	His		
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agc tta cgt gtc gca cgc agc aaa gag agc gat att acg gtc cac gaa	96
Ser Leu Arg Val Ala Arg Ser Lys Glu Ser Asp Ile Thr Val His Glu	
20 25 30	
ctg cag agc agc ctg ttt acg ctg gat tct gct agc gcg gaa gcg atc	144
Leu Gln Ser Ser Leu Phe Thr Leu Asp Ser Ala Ser Ala Glu Ala Ile	
35 40 45	
cat acc gcg gct gag cgc att acc gcc cac ccg aac gaa aac ccg gac	192
His Thr Ala Ala Glu Arg Ile Thr Ala His Pro Asn Glu Asn Pro Asp	
50 55 60	
gat ttc ggc cgt cag gcg ctg gca gcg gcg ttt agc ttg ccg gaa gag	240
Asp Phe Gly Arg Gln Ala Leu Ala Ala Ala Phe Ser Leu Pro Glu Glu	
65 70 75 80	
gtg cgt gcg gcg gtc ttg aat ttt gcc gag gtg ggt agc gag agc ggc	288
Val Arg Ala Ala Val Leu Asn Phe Ala Glu Val Gly Ser Glu Ser Gly	
85 90 95	
atc atg gtt gtt cgt ggt ctg tac gtg gat gag gac ctg gcc gac acc	336
Ile Met Val Val Arg Gly Leu Tyr Val Asp Glu Asp Leu Ala Asp Thr	
100 105 110	
ccg ctg gat aac aag agc ggc ctg ggt gcg cgt acc gtt ttt gcg aaa	384
Pro Leu Asp Asn Lys Ser Gly Leu Gly Ala Arg Thr Val Phe Ala Lys	
115 120 125	
gag atg gcc atg ctg gcg cat ctg ctg ggc agc atg gtg gcg tac gag	432
Glu Met Ala Met Leu Ala His Leu Leu Gly Ser Met Val Ala Tyr Glu	
130 135 140	
gcg gaa ggc aac ggt cat ctg att caa gac atg gtg ccg aat ccg aag	480
Ala Glu Gly Asn Gly His Leu Ile Gln Asp Met Val Pro Asn Pro Lys	
145 150 155 160	
ctg gcg gtc acg caa caa agc cag ggt agc aag gtt gag ctg gaa gca	528
Leu Ala Val Thr Gln Gln Ser Gln Gly Ser Lys Val Glu Leu Glu Ala	
165 170 175	
cat acc gag cag tgc ttc agc gac ttc aaa ccg gat tat gtt att ctg	576
His Thr Glu Gln Cys Phe Ser Asp Phe Lys Pro Asp Tyr Val Ile Leu	
180 185 190	
ggt gct ctg cgt ggc gac gaa aac gcc aac acc tat gca ttc tcc ggt	624
Gly Ala Leu Arg Gly Asp Glu Asn Ala Asn Thr Tyr Ala Phe Ser Gly	
195 200 205	
cgc aaa ctg gtt cag cac atg tcc gcc gaa gaa gtg gcg aaa ctg cgc	672
Arg Lys Leu Val Gln His Met Ser Ala Glu Glu Val Ala Lys Leu Arg	
210 215 220	

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Gln Pro Leu Trp Ala Thr Thr Ile Asp Glu Ser Phe Gln Pro Tyr Ile
225                230                235                240
ccg aat ccg gac gac gtt cgc ggt ccg ttc ccg att ctg acg ggc cca      768
Pro Asn Pro Asp Asp Val Arg Gly Pro Phe Pro Ile Leu Thr Gly Pro
                245                250                255
gag gac gat ccg tac atc cgt gta gac cag gag ctg atg cac ggt atc      816
Glu Asp Asp Pro Tyr Ile Arg Val Asp Gln Glu Leu Met His Gly Ile
                260                265                270
acc gcg gac gct caa cgc ctg ctg cgc aag gtt gtg gat acg tat atc      864
Thr Ala Asp Ala Gln Arg Leu Leu Arg Lys Val Val Asp Thr Tyr Ile
                275                280                285
gag cac cgc gac gcg cat gtc ttg cag cct ggt gat ctg ctg atg ctg      912
Glu His Arg Asp Ala His Val Leu Gln Pro Gly Asp Leu Leu Met Leu
                290                295                300
gac aat ctg cgt gca atg cac ggt cgt agc atg ttc gct ccg cgt ttt      960
Asp Asn Leu Arg Ala Met His Gly Arg Ser Met Phe Ala Pro Arg Phe
305                310                315                320
gac ggc aag gat cgt ttc att gca cgt ggt ttc gtc gtg cgt gat cgt      1008
Asp Gly Lys Asp Arg Phe Ile Ala Arg Gly Phe Val Val Arg Asp Arg
                325                330                335
cgt aag ttg tgg ccg cag ctg ttg gaa gat cgt cgc acc ctg ggt gca      1056
Arg Lys Leu Trp Pro Gln Leu Leu Glu Asp Arg Arg Thr Leu Gly Ala
                340                345                350
gtc cac tcc taa
Val His Ser
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<210> 28

<211> 355

<212> PRT

<213> marine actinobacterium PHSC20C1

<400> 28

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20        25        30
Leu Gln Ser Ser Leu Phe Thr Leu Asp Ser Ala Ser Ala Glu Ala Ile
35        40        45
His Thr Ala Ala Glu Arg Ile Thr Ala His Pro Asn Glu Asn Pro Asp
50        55        60
Asp Phe Gly Arg Gln Ala Leu Ala Ala Ala Phe Ser Leu Pro Glu Glu
65        70        75        80
Val Arg Ala Ala Val Leu Asn Phe Ala Glu Val Gly Ser Glu Ser Gly
85        90        95
Ile Met Val Val Arg Gly Leu Tyr Val Asp Glu Asp Leu Ala Asp Thr
100       105       110
Pro Leu Asp Asn Lys Ser Gly Leu Gly Ala Arg Thr Val Phe Ala Lys
115       120       125
Glu Met Ala Met Leu Ala His Leu Leu Gly Ser Met Val Ala Tyr Glu
130       135       140
Ala Glu Gly Asn Gly His Leu Ile Gln Asp Met Val Pro Asn Pro Lys
145       150       155       160
Leu Ala Val Thr Gln Gln Ser Gln Gly Ser Lys Val Glu Leu Glu Ala
165       170       175
His Thr Glu Gln Cys Phe Ser Asp Phe Lys Pro Asp Tyr Val Ile Leu
180       185       190
Gly Ala Leu Arg Gly Asp Glu Asn Ala Asn Thr Tyr Ala Phe Ser Gly
195       200       205
Arg Lys Leu Val Gln His Met Ser Ala Glu Glu Val Ala Lys Leu Arg
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Gln Pro Leu Trp Ala Thr Thr Ile Asp Glu Ser Phe Gln Pro Tyr Ile

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			245						250					255	
Glu	Asp	Asp	Pro	Tyr	Ile	Arg	Val	Asp	Gln	Glu	Leu	Met	His	Gly	Ile
			260						265					270	
Thr	Ala	Asp	Ala	Gln	Arg	Leu	Leu	Arg	Lys	Val	Val	Asp	Thr	Tyr	Ile
			275						280					285	
Glu	His	Arg	Asp	Ala	His	Val	Leu	Gln	Pro	Gly	Asp	Leu	Leu	Met	Leu
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Asp	Asn	Leu	Arg	Ala	Met	His	Gly	Arg	Ser	Met	Phe	Ala	Pro	Arg	Phe
			305											310	
Asp	Gly	Lys	Asp	Arg	Phe	Ile	Ala	Arg	Gly	Phe	Val	Val	Arg	Asp	Arg
									315					320	
Arg	Lys	Leu	Trp	Pro	Gln	Leu	Leu	Glu	Asp	Arg	Arg	Thr	Leu	Gly	Ala
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aatagctcga gaaaatgttg aaagttttta cc 32

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ataatcatat ggaaactatc attgaatcc 29

<210> 38

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<212> DNA

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33