

hp3238sgw-sp.sequence listing\_ST25  
SEQUENCE LISTING

<110> CODEXIS, INC.  
OSBORNE, Robert  
MITCHELL, Vesna  
HTWE, Khin Yu Naing  
ZHANG, Xiyun  
MILCZEK, Erika M.  
MOORE, Jeffrey C.

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# hp3238sgw-sp.sequence listing\_ST25

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|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |  |  |  |
| Val | Ala | Asp | Asp | Met | Thr | Arg | Leu | Thr | Leu | Asp | Thr | Ile | Gly | Leu | Cys |  |  |  |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |  |  |  |
| Gly | Phe | Asn | Tyr | Arg | Phe | Asn | Ser | Phe | Tyr | Arg | Asp | Gln | Pro | His | Pro |  |  |  |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |  |  |  |
| Phe | Ile | Thr | Ser | Met | Val | Arg | Ala | Leu | Asp | Glu | Ala | Met | Asn | Lys | Leu |  |  |  |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |  |  |  |
| Gln | Arg | Ala | Asn | Pro | Asp | Asp | Pro | Ala | Tyr | Asp | Glu | Asn | Lys | Arg | Gln |  |  |  |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |  |  |  |
| Phe | Gln | Glu | Asp | Ile | Lys | Val | Met | Asn | Asp | Leu | Val | Asp | Ser | Ile | Ile |  |  |  |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |  |  |  |
| Ala | Glu | Arg | Arg | Ala | Asn | Gly | Asp | Gln | Asp | Glu | Lys | Asp | Leu | Leu | Ala |  |  |  |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |  |  |  |
| Arg | Met | Leu | Asn | Val | Glu | Asp | Pro | Glu | Thr | Gly | Glu | Lys | Leu | Asp | Asp |  |  |  |
|     |     |     | 245 |     |     |     |     |     | 250 |     |     |     |     | 255 |     |  |  |  |
| Glu | Asn | Ile | Arg | Phe | Gln | Ile | Ile | Thr | Phe | Leu | Ile | Ala | Gly | His | Glu |  |  |  |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |  |  |  |
| Thr | Thr | Ser | Gly | Leu | Leu | Ser | Phe | Ala | Ile | Tyr | Cys | Leu | Leu | Thr | His |  |  |  |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |  |  |  |
| Pro | Glu | Lys | Leu | Lys | Lys | Ala | Gln | Glu | Glu | Ala | Asp | Arg | Val | Leu | Thr |  |  |  |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |  |  |  |
| Asp | Asp | Thr | Pro | Glu | Tyr | Lys | Gln | Ile | Gln | Gln | Leu | Lys | Tyr | Ile | Arg |  |  |  |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     | 320 |  |  |  |
| Met | Val | Leu | Asn | Glu | Thr | Leu | Arg | Leu | Tyr | Pro | Thr | Ala | Pro | Ala | Phe |  |  |  |
|     |     |     | 325 |     |     |     |     |     | 330 |     |     |     |     | 335 |     |  |  |  |
| Ser | Leu | Tyr | Ala | Lys | Glu | Asp | Thr | Val | Leu | Gly | Gly | Glu | Tyr | Pro | Ile |  |  |  |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |  |  |  |
| Ser | Lys | Gly | Gln | Pro | Val | Thr | Val | Leu | Ile | Pro | Lys | Leu | His | Arg | Asp |  |  |  |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |  |  |  |
| Gln | Asn | Ala | Trp | Gly | Pro | Asp | Ala | Glu | Asp | Phe | Arg | Pro | Glu | Arg | Phe |  |  |  |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |  |  |  |
| Glu | Asp | Pro | Ser | Ser | Ile | Pro | His | His | Ala | Tyr | Lys | Pro | Phe | Gly | Asn |  |  |  |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |  |  |  |
| Gly | Gln | Arg | Ala | Cys | Ile | Gly | Met | Gln | Phe | Ala | Leu | Gln | Glu | Ala | Thr |  |  |  |
|     |     |     |     | 405 |     |     |     |     | 410 |     |     |     |     | 415 |     |  |  |  |
| Met | Val | Leu | Gly | Leu | Val | Leu | Lys | His | Phe | Glu | Leu | Ile | Asn | His | Thr |  |  |  |
|     |     |     | 420 |     |     |     |     | 425 |     |     |     |     | 430 |     |     |  |  |  |
| Gly | Tyr | Glu | Leu | Lys | Ile | Lys | Glu | Ala | Leu | Thr | Ile | Lys | Pro | Asp | Asp |  |  |  |
|     |     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |  |  |  |
| Phe | Lys | Ile | Thr | Val | Lys | Pro | Arg | Lys | Thr | Ala | Ala | Ile | Asn | Val | Gln |  |  |  |
|     | 450 |     |     |     |     | 455 |     |     |     |     | 460 |     |     |     |     |  |  |  |
| Arg | Lys | Glu | Gln | Ala | Glu | Gln | Ser | Ala | Lys | Lys | Val | Arg | Lys | Lys | Ala |  |  |  |
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|         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
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| Asp     | Lys     | Asn     | Trp 580 | Ala     | Thr     | Thr     | Tyr     | Gln 585 | Lys     | Val     | Pro     | Ala     | Phe 590 | Ile     | Asp     |
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| Ala 610 | Asp     | Ala     | Ser     | Asp     | Asp     | Phe 615 | Glu     | Gly     | Thr     | Tyr     | Glu 620 | Glu     | Trp     | Arg     | Glu     |
| His 625 | Met     | Trp     | Ser     | Asp     | Val 630 | Ala     | Ala     | Tyr     | Phe     | Asn 635 | Leu     | Asp     | Ile     | Glu     | Asn 640 |
| Ser     | Glu     | Asp     | Asn     | Lys 645 | Ser     | Thr     | Leu     | Ser     | Leu 650 | Gln     | Phe     | Val     | Asp     | Ser 655 | Ala     |
| Ala     | Asp     | Met     | Pro 660 | Leu     | Ala     | Lys     | Met     | His 665 | Gly     | Ala     | Phe     | Ser     | Thr 670 | Asn     | Val     |
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| His 705 | Leu     | Gly     | Val     | Ile 710 | Pro     | Arg     | Asn     | Tyr     | Glu 715 | Gly     | Ile     | Val     | Asn     | Arg     | Val 720 |
| Thr     | Ala     | Arg     | Phe 725 | Gly     | Leu     | Asp     | Ala     | Ser     | Gln 730 | Gln     | Ile     | Arg     | Leu 735 | Glu     | Ala     |
| Glu     | Glu     | Glu 740 | Lys     | Leu     | Ala     | His     | Leu 745 | Pro     | Leu     | Ala     | Lys     | Thr 750 | Val     | Ser     | Val     |
| Glu     | Glu     | Leu 755 | Leu     | Gln     | Tyr     | Val     | Glu 760 | Leu     | Gln     | Asp     | Pro     | Val 765 | Thr     | Arg     | Thr     |
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| Glu 785 | Leu     | Glu     | Ala     | Leu 790 | Leu     | Glu     | Lys     | Gln     | Ala 795 | Tyr     | Lys     | Glu     | Gln     | Val     | Leu 800 |
| Ala     | Lys     | Arg     | Leu 805 | Thr     | Met     | Leu     | Glu     | Leu 810 | Leu     | Glu     | Lys     | Tyr     | Pro     | Ala 815 | Cys     |
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| Pro     | His     | Glu     | Asp     | Tyr     | Leu     | Tyr     | Gln     | Glu     | Glu     | Leu     | Glu     | Asn     | Ala     | Gln     | Ser     |

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|                     |                         |                         |      |     |      |     |
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| Pro Lys Thr Tyr Val | Gln His Val Met Glu Gln | Asp Gly Lys Lys Leu     |      |     |      |     |
|                     | 980                     |                         | 985  |     | 990  |     |
| Ile Glu Leu Leu Asp | Gln Gly Ala His Phe Tyr | Ile Cys Gly Asp Gly     |      |     |      |     |
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| Ser Gln Met Ala Pro | Ala Val Glu Ala Thr     | Leu Met Lys Ser Tyr Ala |      |     |      |     |
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| Asp Val His Gln Val | Ser Glu Ala Asp Ala     | Arg Leu Trp Leu Gln Gln |      |     |      |     |
|                     | 1025                    |                         | 1030 |     | 1035 |     |
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ctaaaagaac aaggacagtc acttgagaa gcacatttat acttcggctg ccgttcacct 2820
catgaagact atctgtatca agaagagctt gaaaacgccc aaagcgaagg catcattacg 2880
cttcataccg ctttttctcg catgccaaat cagccgaaaa catacgttca gcacgtaatg 2940
gaacaagacg gcaagaaatt gattgaactt cttgatcaag gagcgcactt ctatatttgc 3000
ggagacggaa gccaaatggc acctgccgtt gaagcaacgc ttatgaaaag ctatgctgac 3060
gttcaccaag tgagtgaagc agacgctgc ttatggctgc agcagctaga agaaaaaggc 3120
cgatacgcaa aagacgtgtg ggctgggtaa 3150

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<210> 4

<211> 1049

<212> PRT

<213> Artificial Sequence

<220>

<223> P450\_BM3

<400> 4

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Met Thr Ile Lys Glu Met Pro Gln Pro Lys Thr Phe Gly Glu Leu Lys
1          5          10          15
Asn Leu Pro Leu Leu Asn Thr Asp Lys Pro Val Gln Ala Leu Met Lys
20        25        30
Ile Ala Asp Glu Leu Gly Glu Ile Phe Lys Phe Glu Ala Pro Gly Cys
35        40        45
Val Thr Arg Tyr Leu Ser Ser Gln Arg Leu Ile Lys Glu Ala Cys Asp
50        55        60
Glu Ser Arg Phe Asp Lys Asn Leu Ser Gln Ala Leu Lys Phe Ala Arg
65        70        75        80
Asp Phe Ala Gly Asp Gly Leu Val Thr Ser Trp Thr His Glu Ile Asn
85        90        95
Trp Lys Lys Ala His Asn Ile Leu Leu Pro Ser Phe Ser Gln Gln Ala
100       105       110
Met Lys Gly Tyr His Ala Met Met Val Asp Ile Ala Val Gln Leu Val
115       120       125

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hp3238sgw-sp.sequence listing\_ST25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Gln | Lys | Trp | Glu | Arg | Leu | Asn | Ala | Asp | Glu | His | Ile | Glu | Val | Ser | Glu | 130 | 135 | 140 |
| Asp | Met | Thr | Arg | Leu | Thr | Leu | Asp | Thr | Ile | Gly | Leu | Cys | Gly | Phe | Asn | 145 | 150 | 155 |
| Tyr | Arg | Phe | Asn | Ser | Phe | Tyr | Arg | Asp | Gln | Pro | His | Pro | Phe | Ile | Ile | 165 | 170 | 175 |
| Ser | Met | Val | Arg | Ala | Leu | Asp | Glu | Val | Met | Asn | Lys | Leu | Gln | Arg | Ala | 180 | 185 | 190 |
| Asn | Pro | Asp | Asp | Pro | Ala | Tyr | Asp | Glu | Asn | Lys | Arg | Gln | Cys | Gln | Glu | 195 | 200 | 205 |
| Asp | Ile | Lys | Val | Met | Asn | Asp | Leu | Val | Asp | Lys | Ile | Ile | Ala | Asp | Arg | 210 | 215 | 220 |
| Lys | Ala | Arg | Gly | Glu | Gln | Ser | Asp | Asp | Leu | Leu | Thr | Gln | Met | Leu | Asn | 225 | 230 | 235 |
| Gly | Lys | Asp | Pro | Glu | Thr | Gly | Glu | Pro | Leu | Asp | Asp | Gly | Asn | Ile | Ser | 245 | 250 | 255 |
| Tyr | Gln | Ile | Ile | Thr | Phe | Leu | Ile | Ala | Gly | His | Glu | Thr | Thr | Ser | Gly | 260 | 265 | 270 |
| Leu | Leu | Ser | Phe | Ala | Leu | Tyr | Phe | Leu | Val | Lys | Asn | Pro | His | Val | Leu | 275 | 280 | 285 |
| Gln | Lys | Val | Ala | Glu | Glu | Ala | Ala | Arg | Val | Leu | Val | Asp | Pro | Val | Pro | 290 | 295 | 300 |
| Ser | Tyr | Lys | Gln | Val | Lys | Gln | Leu | Lys | Tyr | Val | Gly | Met | Val | Leu | Asn | 305 | 310 | 315 |
| Glu | Ala | Leu | Arg | Leu | Trp | Pro | Thr | Ala | Pro | Ala | Phe | Ser | Leu | Tyr | Ala | 325 | 330 | 335 |
| Lys | Glu | Asp | Thr | Val | Leu | Gly | Gly | Glu | Tyr | Pro | Leu | Glu | Lys | Gly | Asp | 340 | 345 | 350 |
| Glu | Val | Met | Val | Leu | Ile | Pro | Gln | Leu | His | Arg | Asp | Lys | Thr | Ile | Trp | 355 | 360 | 365 |
| Gly | Asp | Asp | Val | Glu | Glu | Phe | Arg | Pro | Glu | Arg | Phe | Glu | Asn | Pro | Ser | 370 | 375 | 380 |
| Ala | Ile | Pro | Gln | His | Ala | Phe | Lys | Pro | Phe | Gly | Asn | Gly | Gln | Arg | Ala | 385 | 390 | 395 |
| Cys | Ile | Gly | Gln | Gln | Phe | Ala | Leu | His | Glu | Ala | Thr | Leu | Val | Leu | Gly | 405 | 410 | 415 |
| Met | Met | Leu | Lys | His | Phe | Asp | Phe | Glu | Asp | His | Thr | Asn | Tyr | Glu | Leu | 420 | 425 | 430 |
| Asp | Ile | Lys | Glu | Thr | Leu | Thr | Leu | Lys | Pro | Glu | Gly | Phe | Val | Val | Lys | 435 | 440 | 445 |
| Ala | Lys | Ser | Lys | Lys | Ile | Pro | Leu | Gly | Gly | Ile | Pro | Ser | Pro | Ser | Thr | 450 | 455 | 460 |
| Glu | Gln | Ser | Ala | Lys | Lys | Val | Arg | Lys | Lys | Ala | Glu | Asn | Ala | His | Asn | 465 | 470 | 475 |
| Thr | Pro | Leu | Leu | Val | Leu | Tyr | Gly | Ser | Asn | Met | Gly | Thr | Ala | Glu | Gly | 485 | 490 | 495 |
| Thr | Ala | Arg | Asp | Leu | Ala | Asp | Ile | Ala | Met | Ser | Lys | Gly | Phe | Ala | Pro | 500 | 505 | 510 |
| Gln | Val | Ala | Thr | Leu | Asp | Ser | His | Ala | Gly | Asn | Leu | Pro | Arg | Glu | Gly | 515 | 520 | 525 |
| Ala | Val | Leu | Ile | Val | Thr | Ala | Ser | Tyr | Asn | Gly | His | Pro | Pro | Asp | Asn | 530 | 535 | 540 |

hp3238sgw-sp.sequence listing\_ST25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ala | Lys | Gln | Phe | Val | Asp | Trp | Leu | Asp | Gln | Ala | Ser | Ala | Asp | Glu | Val | 545 | 550 | 555 | 560 |
| Lys | Gly | Val | Arg | Tyr | Ser | Val | Phe | Gly | Cys | Gly | Asp | Lys | Asn | Trp | Ala | 565 | 570 | 575 |     |
| Thr | Thr | Tyr | Gln | Lys | Val | Pro | Ala | Phe | Ile | Asp | Glu | Thr | Leu | Ala | Ala | 580 | 585 | 590 |     |
| Lys | Gly | Ala | Glu | Asn | Ile | Ala | Asp | Arg | Gly | Glu | Ala | Asp | Ala | Ser | Asp | 595 | 600 | 605 |     |
| Asp | Phe | Glu | Gly | Thr | Tyr | Glu | Glu | Trp | Arg | Glu | His | Met | Trp | Ser | Asp | 610 | 615 | 620 |     |
| Val | Ala | Ala | Tyr | Phe | Asn | Leu | Asp | Ile | Glu | Asn | Ser | Glu | Asp | Asn | Lys | 625 | 630 | 635 | 640 |
| Ser | Thr | Leu | Ser | Leu | Gln | Phe | Val | Asp | Ser | Ala | Ala | Asp | Met | Pro | Leu | 645 | 650 | 655 |     |
| Ala | Lys | Met | His | Gly | Ala | Phe | Ser | Thr | Asn | Val | Val | Ala | Ser | Lys | Glu | 660 | 665 | 670 |     |
| Leu | Gln | Gln | Pro | Gly | Ser | Ala | Arg | Ser | Thr | Arg | His | Leu | Glu | Ile | Glu | 675 | 680 | 685 |     |
| Leu | Pro | Lys | Glu | Ala | Ser | Tyr | Gln | Glu | Gly | Asp | His | Leu | Gly | Val | Ile | 690 | 695 | 700 |     |
| Pro | Arg | Asn | Tyr | Glu | Gly | Ile | Val | Asn | Arg | Val | Thr | Ala | Arg | Phe | Gly | 705 | 710 | 715 | 720 |
| Leu | Asp | Ala | Ser | Gln | Gln | Ile | Arg | Leu | Glu | Ala | Glu | Glu | Glu | Lys | Leu | 725 | 730 | 735 |     |
| Ala | His | Leu | Pro | Leu | Ala | Lys | Thr | Val | Ser | Val | Glu | Glu | Leu | Leu | Gln | 740 | 745 | 750 |     |
| Tyr | Val | Glu | Leu | Gln | Asp | Pro | Val | Thr | Arg | Thr | Gln | Leu | Arg | Ala | Met | 755 | 760 | 765 |     |
| Ala | Ala | Lys | Thr | Val | Cys | Pro | Pro | His | Lys | Val | Glu | Leu | Glu | Ala | Leu | 770 | 775 | 780 |     |
| Leu | Glu | Lys | Gln | Ala | Tyr | Lys | Glu | Gln | Val | Leu | Ala | Lys | Arg | Leu | Thr | 785 | 790 | 795 | 800 |
| Met | Leu | Glu | Leu | Leu | Glu | Lys | Tyr | Pro | Ala | Cys | Glu | Met | Lys | Phe | Ser | 805 | 810 | 815 |     |
| Glu | Phe | Ile | Ala | Leu | Leu | Pro | Ser | Ile | Arg | Pro | Arg | Tyr | Tyr | Ser | Ile | 820 | 825 | 830 |     |
| Ser | Ser | Ser | Pro | Arg | Val | Asp | Glu | Lys | Gln | Ala | Ser | Ile | Thr | Val | Ser | 835 | 840 | 845 |     |
| Val | Val | Ser | Gly | Glu | Ala | Trp | Ser | Gly | Tyr | Gly | Glu | Tyr | Lys | Gly | Ile | 850 | 855 | 860 |     |
| Ala | Ser | Asn | Tyr | Leu | Ala | Glu | Leu | Gln | Glu | Gly | Asp | Thr | Ile | Thr | Cys | 865 | 870 | 875 | 880 |
| Phe | Ile | Ser | Thr | Pro | Gln | Ser | Glu | Phe | Thr | Leu | Pro | Lys | Asp | Pro | Glu | 885 | 890 | 895 |     |
| Thr | Pro | Leu | Ile | Met | Val | Gly | Pro | Gly | Thr | Gly | Val | Ala | Pro | Phe | Arg | 900 | 905 | 910 |     |
| Gly | Phe | Val | Gln | Ala | Arg | Lys | Gln | Leu | Lys | Glu | Gln | Gly | Gln | Ser | Leu | 915 | 920 | 925 |     |
| Gly | Glu | Ala | His | Leu | Tyr | Phe | Gly | Cys | Arg | Ser | Pro | His | Glu | Asp | Tyr | 930 | 935 | 940 |     |
| Leu | Tyr | Gln | Glu | Glu | Leu | Glu | Asn | Ala | Gln | Ser | Glu | Gly | Ile | Ile | Thr | 945 | 950 | 955 | 960 |

# hp3238sgw-sp.sequence listing\_ST25

|      |      |     |     |      |      |      |      |     |      |     |      |      |     |     |      |  |
|------|------|-----|-----|------|------|------|------|-----|------|-----|------|------|-----|-----|------|--|
| Leu  | His  | Thr | Ala | Phe  | Ser  | Arg  | Met  | Pro | Asn  | Gln | Pro  | Lys  | Thr | Tyr | Val  |  |
|      |      |     |     | 965  |      |      |      |     | 970  |     |      |      |     | 975 |      |  |
| Gln  | His  | Val | Met | Glu  | Gln  | Asp  | Gly  | Lys | Lys  | Leu | Ile  | Glu  | Leu | Leu | Asp  |  |
|      |      |     | 980 |      |      |      |      | 985 |      |     |      |      | 990 |     |      |  |
| Gln  | Gly  | Ala | His | Phe  | Tyr  | Ile  | Cys  | Gly | Asp  | Gly | Ser  | Gln  | Met | Ala | Pro  |  |
|      |      | 995 |     |      |      |      | 1000 |     |      |     |      | 1005 |     |     |      |  |
| Ala  | Val  | Glu | Ala | Thr  | Leu  | Met  | Lys  | Ser | Tyr  | Ala | Asp  | Val  | His | Gln | Val  |  |
|      | 1010 |     |     |      |      | 1015 |      |     |      |     | 1020 |      |     |     |      |  |
| Ser  | Glu  | Ala | Asp | Ala  | Arg  | Leu  | Trp  | Leu | Gln  | Gln | Leu  | Glu  | Glu | Lys | Gly  |  |
| 1025 |      |     |     |      | 1030 |      |      |     | 1035 |     |      |      |     |     | 1040 |  |
| Arg  | Tyr  | Ala | Lys | Asp  | Val  | Trp  | Ala  | Gly |      |     |      |      |     |     |      |  |
|      |      |     |     | 1045 |      |      |      |     |      |     |      |      |     |     |      |  |

<210> 5

<211> 3150

<212> DNA

<213> Artificial Sequence

<220>

<223> P450\_BM3

<400> 5

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| ttaaacacag  | ataaacgggt | tcaagctttg  | atgaaaattg | cggatgaatt  | aggagaaatc  | 120  |
| tttaaattcg  | aggcgcctgg | ttgtgtaacg  | cgctacttat | caagtcagcg  | tctaattaaa  | 180  |
| gaagcatgcg  | atgaatcacg | ctttgataaa  | aacttaagtc | aagcgcttaa  | atttgcacgt  | 240  |
| gattttcttg  | gagacgggtt | atttacaagc  | tggacgcatg | aaataaattg  | gaaaaaagcg  | 300  |
| cataatatct  | tacttccaag | ctttagtcag  | caggcaatga | aaggctatca  | tgcgatgatg  | 360  |
| gtcgatatcg  | ccgtgcagct | tgttcaaaaag | tgggagcgtc | taaatgcaga  | tgagcatatt  | 420  |
| gaagtatcgg  | aagacatgac | acgtttaacg  | cttgatacaa | ttggtctttg  | cggctttaac  | 480  |
| tatcgcttta  | acagctttta | ccgagatcag  | cctcatccat | ttattataag  | tatggtccgt  | 540  |
| gacttggtatg | aagtaatgaa | caagctgcag  | cgagcaaatc | cagacgaccc  | agcttatgat  | 600  |
| gaaaacaagc  | gccagtgtca | agaagatatc  | aaggtgatga | acgacctagt  | agataaaaatt | 660  |
| attgcagatc  | gcaaagcaag | gggtgaacaa  | agcgatgatt | tattaacgca  | gatgctaaac  | 720  |
| ggaaaagatc  | cagaaacggg | tgagccgctt  | gatgacggga | acattagcta  | tcaaattatt  | 780  |
| acattcttaa  | ttgcgggaca | cgaaacaaca  | agtggctctt | tatcatttgc  | gctgtatttc  | 840  |
| ttagtgaaaa  | atccacatgt | attacaaaaa  | gtagcagaag | aagcagcacg  | agttctagta  | 900  |
| gatcctgttc  | caagctacaa | acaagtcaaa  | cagcttaaat | atgtcggcat  | ggtcttaaac  | 960  |
| gaagcgctgc  | gcttatggcc | aactgctcct  | gcgttttccc | tatatgcaaa  | agaagatacg  | 1020 |
| gtgcttggag  | gagaatatcc | tttagaaaaa  | ggcgacgaag | taatggttct  | gattcctcag  | 1080 |
| cttcaccgtg  | ataaaacaat | ttggggagac  | gatgtggagg | agttccgtcc  | agagcgtttt  | 1140 |
| gaaaatccaa  | gtgcgattcc | gcagcatgcg  | tttaaaccgt | ttggaaacgg  | tcagcggtgcg | 1200 |
| tgtatcggtc  | agcagttcgc | tcttcatgaa  | gcaacgctgg | tacttggtat  | gatgctaaaa  | 1260 |
| cactttgact  | ttgaagatca | tacaaactac  | gagctcgata | ttaaagaaac  | tttaacgtta  | 1320 |
| aaacctgaag  | gctttgtggt | aaaagcaaaa  | tcgaaaaaaa | ttccgcttgg  | cggttattcct | 1380 |
| tcacctagca  | ctgaacagtc | tgctaaaaaa  | gtacgcaaaa | aggcagaaaa  | cgctcataat  | 1440 |
| acgccgctgc  | ttgtgctata | cggttcaaat  | atgggaacag | ctgaagggaac | ggcgcgtgat  | 1500 |
| ttagcagata  | ttgcaatgag | caaaggattt  | gcaccgcagg | tcgcaacgct  | tgattcacac  | 1560 |
| gccggaaatc  | ttccgcgcga | aggagctgta  | ttaattgtaa | cggcgtctta  | taacgggtcat | 1620 |
| ccgcctgata  | acgcaaagca | atttgtcgac  | tggttagacc | aagcgtctgc  | tgatgaagta  | 1680 |
| aaaggcgttc  | gctactccgt | atttggatgc  | ggcgataaaa | actgggctac  | tacgtatcaa  | 1740 |

# hp3238sgw-sp.sequence listing\_ST25

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atgtggagtg acgtagcagc ctactttaac ctcgacattg aaaacagtga agataataaa 1920
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gggtgcgtttt caacgaacgt cgtagcaagc aaagaacttc aacagccagg cagtgcacga 2040
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ggagacggaa gccaaatggc acctgccgtt gaagcaacgc ttatgaaaag ctatgctgac 3060
gttcaccaag tgagtgaagc agacgctcgc ttatggctgc agcagctaga agaaaaaggc 3120
cgatacgcaa aagacgtgtg ggctgggtaa 3150

```

<210> 6

<211> 1049

<212> PRT

<213> Artificial Sequence

<220>

<223> P450\_BM3

<400> 6

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Met Thr Ile Lys Glu Met Pro Gln Pro Lys Thr Phe Gly Glu Leu Lys
1          5          10          15
Asn Leu Pro Leu Leu Asn Thr Asp Lys Pro Val Gln Ala Leu Met Lys
20        25        30
Ile Ala Asp Glu Leu Gly Glu Ile Phe Lys Phe Glu Ala Pro Gly Cys
35        40        45
Val Thr Arg Tyr Leu Ser Ser Gln Arg Leu Ile Lys Glu Ala Cys Asp
50        55        60
Glu Ser Arg Phe Asp Lys Asn Leu Ser Gln Ala Leu Lys Phe Ala Arg
65        70        75        80
Asp Phe Leu Gly Asp Gly Leu Phe Thr Ser Trp Thr His Glu Ile Asn
85        90        95
Trp Lys Lys Ala His Asn Ile Leu Leu Pro Ser Phe Ser Gln Gln Ala
100       105       110
Met Lys Gly Tyr His Ala Met Met Val Asp Ile Ala Val Gln Leu Val
115       120       125
Gln Lys Trp Glu Arg Leu Asn Ala Asp Glu His Ile Glu Val Ser Glu

```

hp3238sgw-sp.sequence listing\_ST25

|                         |                     |                     |     |  |  |  |  |  |  |  |  |  |  |  |  |
|-------------------------|---------------------|---------------------|-----|--|--|--|--|--|--|--|--|--|--|--|--|
| 130                     | 135                 | 140                 |     |  |  |  |  |  |  |  |  |  |  |  |  |
| Asp Met Thr Arg Leu Thr | Leu Asp Thr Ile Gly | Leu Cys Gly Phe Asn |     |  |  |  |  |  |  |  |  |  |  |  |  |
| 145                     | 150                 | 155                 | 160 |  |  |  |  |  |  |  |  |  |  |  |  |
| Tyr Arg Phe Asn Ser Phe | Tyr Arg Asp Gln Pro | His Pro Phe Ile Ile |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 165                 | 170                 | 175 |  |  |  |  |  |  |  |  |  |  |  |  |
| Ser Met Val Arg Ala Leu | Asp Glu Val Met Asn | Lys Leu Gln Arg Ala |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 180                 | 185                 | 190 |  |  |  |  |  |  |  |  |  |  |  |  |
| Asn Pro Asp Asp Pro Ala | Tyr Asp Glu Asn Lys | Arg Gln Cys Gln Glu |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 195                 | 200                 | 205 |  |  |  |  |  |  |  |  |  |  |  |  |
| Asp Ile Lys Val Met Asn | Asp Leu Val Asp Lys | Ile Ile Ala Asp Arg |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 210                 | 215                 | 220 |  |  |  |  |  |  |  |  |  |  |  |  |
| Lys Ala Arg Gly Glu Gln | Ser Asp Asp Leu Leu | Thr Gln Met Leu Asn |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 225                 | 230                 | 235 |  |  |  |  |  |  |  |  |  |  |  |  |
| Gly Lys Asp Pro Glu Thr | Gly Glu Pro Leu Asp | Asp Gly Asn Ile Ser |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 245                 | 250                 | 255 |  |  |  |  |  |  |  |  |  |  |  |  |
| Tyr Gln Ile Ile Thr Phe | Leu Ile Ala Gly His | Glu Thr Thr Ser Gly |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 260                 | 265                 | 270 |  |  |  |  |  |  |  |  |  |  |  |  |
| Leu Leu Ser Phe Ala Leu | Tyr Phe Leu Val Lys | Asn Pro His Val Leu |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 275                 | 280                 | 285 |  |  |  |  |  |  |  |  |  |  |  |  |
| Gln Lys Val Ala Glu Glu | Ala Ala Arg Val Leu | Val Asp Pro Val Pro |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 290                 | 295                 | 300 |  |  |  |  |  |  |  |  |  |  |  |  |
| Ser Tyr Lys Gln Val Lys | Gln Leu Lys Tyr Val | Gly Met Val Leu Asn |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 305                 | 310                 | 315 |  |  |  |  |  |  |  |  |  |  |  |  |
| Glu Ala Leu Arg Leu Trp | Pro Thr Ala Pro Ala | Phe Ser Leu Tyr Ala |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 325                 | 330                 | 335 |  |  |  |  |  |  |  |  |  |  |  |  |
| Lys Glu Asp Thr Val Leu | Gly Gly Glu Tyr Pro | Leu Glu Lys Gly Asp |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 340                 | 345                 | 350 |  |  |  |  |  |  |  |  |  |  |  |  |
| Glu Val Met Val Leu Ile | Pro Gln Leu His Arg | Asp Lys Thr Ile Trp |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 355                 | 360                 | 365 |  |  |  |  |  |  |  |  |  |  |  |  |
| Gly Asp Asp Val Glu Glu | Phe Arg Pro Glu Arg | Phe Glu Asn Pro Ser |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 370                 | 375                 | 380 |  |  |  |  |  |  |  |  |  |  |  |  |
| Ala Ile Pro Gln His Ala | Phe Lys Pro Phe Gly | Asn Gly Gln Arg Ala |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 385                 | 390                 | 395 |  |  |  |  |  |  |  |  |  |  |  |  |
| Cys Ile Gly Gln Gln Phe | Ala Leu His Glu Ala | Thr Leu Val Leu Gly |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 405                 | 410                 | 415 |  |  |  |  |  |  |  |  |  |  |  |  |
| Met Met Leu Lys His Phe | Asp Phe Glu Asp His | Thr Asn Tyr Glu Leu |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 420                 | 425                 | 430 |  |  |  |  |  |  |  |  |  |  |  |  |
| Asp Ile Lys Glu Thr Leu | Thr Leu Lys Pro Glu | Gly Phe Val Val Lys |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 435                 | 440                 | 445 |  |  |  |  |  |  |  |  |  |  |  |  |
| Ala Lys Ser Lys Lys Ile | Pro Leu Gly Gly Ile | Pro Ser Pro Ser Thr |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 450                 | 455                 | 460 |  |  |  |  |  |  |  |  |  |  |  |  |
| Glu Gln Ser Ala Lys Lys | Val Arg Lys Lys Ala | Glu Asn Ala His Asn |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 465                 | 470                 | 475 |  |  |  |  |  |  |  |  |  |  |  |  |
| Thr Pro Leu Leu Val Leu | Tyr Gly Ser Asn Met | Gly Thr Ala Glu Gly |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 485                 | 490                 | 495 |  |  |  |  |  |  |  |  |  |  |  |  |
| Thr Ala Arg Asp Leu Ala | Asp Ile Ala Met Ser | Lys Gly Phe Ala Pro |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 500                 | 505                 | 510 |  |  |  |  |  |  |  |  |  |  |  |  |
| Gln Val Ala Thr Leu Asp | Ser His Ala Gly Asn | Leu Pro Arg Glu Gly |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 515                 | 520                 | 525 |  |  |  |  |  |  |  |  |  |  |  |  |
| Ala Val Leu Ile Val Thr | Ala Ser Tyr Asn Gly | His Pro Pro Asp Asn |     |  |  |  |  |  |  |  |  |  |  |  |  |
|                         | 530                 | 535                 | 540 |  |  |  |  |  |  |  |  |  |  |  |  |
| Ala Lys Gln Phe Val Asp | Trp Leu Asp Gln Ala | Ser Ala Asp Glu Val |     |  |  |  |  |  |  |  |  |  |  |  |  |

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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 545 |     |     |     |     | 550 |     |     |     |     | 555 |     |     |     | 560 |
| Lys | Gly | Val | Arg | Tyr | Ser | Val | Phe | Gly | Cys | Gly | Asp | Lys | Asn | Trp |
|     |     |     |     | 565 |     |     |     |     | 570 |     |     |     |     | 575 |
| Thr | Thr | Tyr | Gln | Lys | Val | Pro | Ala | Phe | Ile | Asp | Glu | Thr | Leu | Ala |
|     |     |     | 580 |     |     |     |     | 585 |     |     |     |     |     | 590 |
| Lys | Gly | Ala | Glu | Asn | Ile | Ala | Asp | Arg | Gly | Glu | Ala | Asp | Ala | Ser |
|     |     | 595 |     |     |     |     | 600 |     |     |     |     | 605 |     | Asp |
| Asp | Phe | Glu | Gly | Thr | Tyr | Glu | Glu | Trp | Arg | Glu | His | Met | Trp | Ser |
|     | 610 |     |     |     |     | 615 |     |     |     |     | 620 |     |     | Asp |
| Val | Ala | Ala | Tyr | Phe | Asn | Leu | Asp | Ile | Glu | Asn | Ser | Glu | Asp | Asn |
| 625 |     |     |     |     | 630 |     |     |     |     | 635 |     |     |     | 640 |
| Ser | Thr | Leu | Ser | Leu | Gln | Phe | Val | Asp | Ser | Ala | Ala | Asp | Met | Pro |
|     |     |     |     | 645 |     |     |     |     |     | 650 |     |     |     | 655 |
| Ala | Lys | Met | His | Gly | Ala | Phe | Ser | Thr | Asn | Val | Val | Ala | Ser | Lys |
|     |     |     | 660 |     |     |     |     | 665 |     |     |     |     |     | 670 |
| Leu | Gln | Gln | Pro | Gly | Ser | Ala | Arg | Ser | Thr | Arg | His | Leu | Glu | Ile |
|     |     | 675 |     |     |     |     | 680 |     |     |     |     |     |     | 685 |
| Leu | Pro | Lys | Glu | Ala | Ser | Tyr | Gln | Glu | Gly | Asp | His | Leu | Gly | Val |
|     | 690 |     |     |     |     | 695 |     |     |     |     | 700 |     |     | Ile |
| Pro | Arg | Asn | Tyr | Glu | Gly | Ile | Val | Asn | Arg | Val | Thr | Ala | Arg | Phe |
| 705 |     |     |     |     | 710 |     |     |     |     | 715 |     |     |     | 720 |
| Leu | Asp | Ala | Ser | Gln | Gln | Ile | Arg | Leu | Glu | Ala | Glu | Glu | Glu | Lys |
|     |     |     |     | 725 |     |     |     |     | 730 |     |     |     |     | 735 |
| Ala | His | Leu | Pro | Leu | Ala | Lys | Thr | Val | Ser | Val | Glu | Glu | Leu | Leu |
|     |     |     | 740 |     |     |     |     | 745 |     |     |     |     |     | 750 |
| Tyr | Val | Glu | Leu | Gln | Asp | Pro | Val | Thr | Arg | Thr | Gln | Leu | Arg | Ala |
|     |     | 755 |     |     |     |     | 760 |     |     |     |     |     |     | 765 |
| Ala | Ala | Lys | Thr | Val | Cys | Pro | Pro | His | Lys | Val | Glu | Leu | Glu | Ala |
|     | 770 |     |     |     |     | 775 |     |     |     |     | 780 |     |     | Leu |
| Leu | Glu | Lys | Gln | Ala | Tyr | Lys | Glu | Gln | Val | Leu | Ala | Lys | Arg | Leu |
| 785 |     |     |     |     | 790 |     |     |     |     | 795 |     |     |     | 800 |
| Met | Leu | Glu | Leu | Leu | Glu | Lys | Tyr | Pro | Ala | Cys | Glu | Met | Lys | Phe |
|     |     |     |     | 805 |     |     |     |     | 810 |     |     |     |     | 815 |
| Glu | Phe | Ile | Ala | Leu | Leu | Pro | Ser | Ile | Arg | Pro | Arg | Tyr | Tyr | Ser |
|     |     |     | 820 |     |     |     |     | 825 |     |     |     |     |     | 830 |
| Ser | Ser | Ser | Pro | Arg | Val | Asp | Glu | Lys | Gln | Ala | Ser | Ile | Thr | Val |
|     |     | 835 |     |     |     |     | 840 |     |     |     |     | 845 |     | Ser |
| Val | Val | Ser | Gly | Glu | Ala | Trp | Ser | Gly | Tyr | Gly | Glu | Tyr | Lys | Gly |
|     | 850 |     |     |     |     | 855 |     |     |     |     | 860 |     |     | Ile |
| Ala | Ser | Asn | Tyr | Leu | Ala | Glu | Leu | Gln | Glu | Gly | Asp | Thr | Ile | Thr |
| 865 |     |     |     |     | 870 |     |     |     |     | 875 |     |     |     | 880 |
| Phe | Ile | Ser | Thr | Pro | Gln | Ser | Glu | Phe | Thr | Leu | Pro | Lys | Asp | Pro |
|     |     |     |     | 885 |     |     |     |     | 890 |     |     |     |     | 895 |
| Thr | Pro | Leu | Ile | Met | Val | Gly | Pro | Gly | Thr | Gly | Val | Ala | Pro | Phe |
|     |     | 900 |     |     |     |     |     | 905 |     |     |     |     |     | 910 |
| Gly | Phe | Val | Gln | Ala | Arg | Lys | Gln | Leu | Lys | Glu | Gln | Gly | Gln | Ser |
|     |     | 915 |     |     |     |     | 920 |     |     |     |     |     |     | 925 |
| Gly | Glu | Ala | His | Leu | Tyr | Phe | Gly | Cys | Arg | Ser | Pro | His | Glu | Asp |
|     | 930 |     |     |     |     | 935 |     |     |     |     | 940 |     |     | Tyr |
| Leu | Tyr | Gln | Glu | Glu | Leu | Glu | Asn | Ala | Gln | Ser | Glu | Gly | Ile | Ile |
| 945 |     |     |     |     | 950 |     |     |     |     | 955 |     |     |     | 960 |
| Leu | His | Thr | Ala | Phe | Ser | Arg | Met | Pro | Asn | Gln | Pro | Lys | Thr | Tyr |

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|      |     |     |     |      |     |     |     |      |     |     |     |      |     |     |     |
|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|
|      |     |     |     | 965  |     |     |     | 970  |     |     |     | 975  |     |     |     |
| Gln  | His | Val | Met | Glu  | Gln | Asp | Gly | Lys  | Lys | Leu | Ile | Glu  | Leu | Leu | Asp |
| 980  |     |     |     | 985  |     |     |     | 990  |     |     |     |      |     |     |     |
| Gln  | Gly | Ala | His | Phe  | Tyr | Ile | Cys | Gly  | Asp | Gly | Ser | Gln  | Met | Ala | Pro |
| 995  |     |     |     | 1000 |     |     |     | 1005 |     |     |     |      |     |     |     |
| Ala  | Val | Glu | Ala | Thr  | Leu | Met | Lys | Ser  | Tyr | Ala | Asp | Val  | His | Gln | Val |
| 1010 |     |     |     | 1015 |     |     |     | 1020 |     |     |     |      |     |     |     |
| Ser  | Glu | Ala | Asp | Ala  | Arg | Leu | Trp | Leu  | Gln | Gln | Leu | Glu  | Glu | Lys | Gly |
| 1025 |     |     |     | 1030 |     |     |     | 1035 |     |     |     | 1040 |     |     |     |
| Arg  | Tyr | Ala | Lys | Asp  | Val | Trp | Ala | Gly  |     |     |     |      |     |     |     |
| 1045 |     |     |     |      |     |     |     |      |     |     |     |      |     |     |     |

<210> 7

<211> 3150

<212> DNA

### <213> Artificial Sequence

 $\langle 220 \rangle$ 

<223> P450 BM3

<400> 7

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| ttaaacacag | ataaacccgt | tcaagccttg  | atgaaaattg  | cggatgaatt | aggagaaatc   | 120  |
| tttaaattcg | aggcgcctgg | tcgtgtaacg  | cgctacttat  | caagtcagcg | tctaattaaa   | 180  |
| gaagcatgcg | atgaatcacg | ctttgataaa  | aacttaagtc  | aagcgcttaa | atttgcacgt   | 240  |
| gattttgcag | gagacgggtt | atttacaagc  | tggacgcatg  | aaaaaaattg | gaaaaaagcg   | 300  |
| cataatatct | tacttccaag | cttttagtcag | caggcaatga  | aaggctatca | tgcgatgatg   | 360  |
| gtcgatatcg | ccgtgcagct | tgttcaaaaag | tgggagcgtc  | taaatgcaga | tgagtatatatt | 420  |
| gaagtaccgg | aagacatgac | acgtttaacg  | cttgatacaa  | ttggctcttg | cggctttaac   | 480  |
| tatcgcttta | acagctttta | ccgagatcag  | cctcatccat  | ttattataag | tatgatccgt   | 540  |
| gcactggatg | aagtaatgaa | caagctgcag  | cgagcaaadc  | cagacgaccc | agcttatgat   | 600  |
| gaaaacaagc | gccagtttca | agaagatatc  | aagggtgatga | acgacctagt | agataaaaatt  | 660  |
| attgcagatc | gcaaagcaag | cggtgaacaa  | agcgatgatt  | tattaacgca | gatgctaaac   | 720  |
| ggaaaagatc | cagaaacggg | tgagccgctt  | gatgacggga  | acattagcta | tcaaattatt   | 780  |
| acattcttaa | ttgcgggaca | cgaacaacaa  | agtggctctt  | tatcatttgc | gctgtatttc   | 840  |
| ttagtgaana | atccacatgt | attacaaaaa  | gtagcagaag  | aagcaacacg | agttctagta   | 900  |
| gatcctgttc | caagctacaa | acaagtcaaa  | cagcttaaat  | atgtcggcat | ggtcttaaac   | 960  |
| gaagcgctgc | gcttatggcc | aactgctcct  | gcgttttccc  | tatatgcaaa | agaagatacg   | 1020 |
| gtgcttggag | gagaatatcc | tttagaaaaa  | ggcgacgaag  | taatggttct | gattcctcag   | 1080 |
| cttcaccgtg | ataaaacaat | ttggggagac  | gatgtggaag  | agttccgtcc | agagcgtttt   | 1140 |
| gaaaatccaa | gtgcgattcc | gcagcatgcg  | tttaaaccgt  | ttggaaacgg | tcaacgtgcg   | 1200 |
| tgtatcggtc | agcagttcgc | tcttcatgaa  | gcaacgctgg  | tacttggtat | gatgctaaaa   | 1260 |
| cactttgact | ttgaagatca | tacaaactac  | gagctcgata  | ttaaagaaac | tttaacgtta   | 1320 |
| aaacctgaag | gctttgtggt | aaaagcaaaa  | tcgaaaaaaa  | ttccgcttgg | cggtattcct   | 1380 |
| tcacctagca | ctgaacagtc | tgctaaaaaa  | gtacgcaaaa  | aggcagaaaa | cgctcataat   | 1440 |
| acgccgctgc | ttgtgctata | cggttcaaat  | atgggaacag  | ctgaaggaac | ggcgcgtgat   | 1500 |
| ttagcagata | ttgcaatgag | caaaggattt  | gcaccgcagg  | tcgcaacgct | tgattcacac   | 1560 |
| gccggaaatc | ttccgcgcga | aggagctgta  | ttaatgttaa  | cggcgtctta | taacggtcac   | 1620 |
| ccgcctgata | acgcaaagca | atttgtcgac  | tggttagacc  | aagcgtctgc | tgatgaagta   | 1680 |
| aaaggcgctt | gctactccgt | atttgggatgc | ggcgataaaa  | actgggctac | tacgtatcaa   | 1740 |
| aaagtgcctg | cttttatcga | tgaaacgctt  | gccgctaaag  | gggcagaaaa | catcgctgac   | 1800 |

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```

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tctactcttt cacttcaatt tgtcgacagc gccgcggata tgccgcttgc gaaaatgcac 1980
gggtgcgtttt caacgaacgt cgtagcaagc aaagaacttc aacagccagg cagtgcacga 2040
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ttaggtgtta ttcttcgcaa ctatgaagga atagtaaacc gtgtaacagc aaggttcggc 2160
ctagatgcat cacagcaaat ccgtctggaa gcagaagaag aaaaattagc tcatttgcca 2220
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ggagacggaa gccaaatggc acctgccgtt gaagcaacgc ttatgaaaag ctatgctgac 3060
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<210> 8

<211> 1049

<212> PRT

<213> Artificial Sequence

<220>

<223> P450\_BM3

<400> 8

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          20          25          30
Ile Ala Asp Glu Leu Gly Glu Ile Phe Lys Phe Glu Ala Pro Gly Arg
          35          40          45
Val Thr Arg Tyr Leu Ser Ser Gln Arg Leu Ile Lys Glu Ala Cys Asp
          50          55          60
Glu Ser Arg Phe Asp Lys Asn Leu Ser Gln Ala Leu Lys Phe Ala Arg
65          70          75          80
Asp Phe Ala Gly Asp Gly Leu Phe Thr Ser Trp Thr His Glu Lys Asn
          85          90          95
Trp Lys Lys Ala His Asn Ile Leu Leu Pro Ser Phe Ser Gln Gln Ala
          100          105          110
Met Lys Gly Tyr His Ala Met Met Val Asp Ile Ala Val Gln Leu Val
          115          120          125
Gln Lys Trp Glu Arg Leu Asn Ala Asp Glu Tyr Ile Glu Val Pro Glu
          130          135          140

```

hp3238sgw-sp.sequence listing\_ST25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Asp | Met | Thr | Arg | Leu | Thr | Leu | Asp | Thr | Ile | Gly | Leu | Cys | Gly | Phe | Asn | 145 | 150 | 155 | 160 |
| Tyr | Arg | Phe | Asn | Ser | Phe | Tyr | Arg | Asp | Gln | Pro | His | Pro | Phe | Ile | Ile | 165 | 170 | 175 |     |
| Ser | Met | Ile | Arg | Ala | Leu | Asp | Glu | Val | Met | Asn | Lys | Leu | Gln | Arg | Ala | 180 | 185 | 190 |     |
| Asn | Pro | Asp | Asp | Pro | Ala | Tyr | Asp | Glu | Asn | Lys | Arg | Gln | Phe | Gln | Glu | 195 | 200 | 205 |     |
| Asp | Ile | Lys | Val | Met | Asn | Asp | Leu | Val | Asp | Lys | Ile | Ile | Ala | Asp | Arg | 210 | 215 | 220 |     |
| Lys | Ala | Ser | Gly | Glu | Gln | Ser | Asp | Asp | Leu | Leu | Thr | Gln | Met | Leu | Asn | 225 | 230 | 235 | 240 |
| Gly | Lys | Asp | Pro | Glu | Thr | Gly | Glu | Pro | Leu | Asp | Asp | Gly | Asn | Ile | Ser | 245 | 250 | 255 |     |
| Tyr | Gln | Ile | Ile | Thr | Phe | Leu | Ile | Ala | Gly | His | Glu | Thr | Thr | Ser | Gly | 260 | 265 | 270 |     |
| Leu | Leu | Ser | Phe | Ala | Leu | Tyr | Phe | Leu | Val | Lys | Asn | Pro | His | Val | Leu | 275 | 280 | 285 |     |
| Gln | Lys | Val | Ala | Glu | Glu | Ala | Thr | Arg | Val | Leu | Val | Asp | Pro | Val | Pro | 290 | 295 | 300 |     |
| Ser | Tyr | Lys | Gln | Val | Lys | Gln | Leu | Lys | Tyr | Val | Gly | Met | Val | Leu | Asn | 305 | 310 | 315 | 320 |
| Glu | Ala | Leu | Arg | Leu | Trp | Pro | Thr | Ala | Pro | Ala | Phe | Ser | Leu | Tyr | Ala | 325 | 330 | 335 |     |
| Lys | Glu | Asp | Thr | Val | Leu | Gly | Gly | Glu | Tyr | Pro | Leu | Glu | Lys | Gly | Asp | 340 | 345 | 350 |     |
| Glu | Val | Met | Val | Leu | Ile | Pro | Gln | Leu | His | Arg | Asp | Lys | Thr | Ile | Trp | 355 | 360 | 365 |     |
| Gly | Asp | Asp | Val | Glu | Glu | Phe | Arg | Pro | Glu | Arg | Phe | Glu | Asn | Pro | Ser | 370 | 375 | 380 |     |
| Ala | Ile | Pro | Gln | His | Ala | Phe | Lys | Pro | Phe | Gly | Asn | Gly | Gln | Arg | Ala | 385 | 390 | 395 | 400 |
| Cys | Ile | Gly | Gln | Gln | Phe | Ala | Leu | His | Glu | Ala | Thr | Leu | Val | Leu | Gly | 405 | 410 | 415 |     |
| Met | Met | Leu | Lys | His | Phe | Asp | Phe | Glu | Asp | His | Thr | Asn | Tyr | Glu | Leu | 420 | 425 | 430 |     |
| Asp | Ile | Lys | Glu | Thr | Leu | Thr | Leu | Lys | Pro | Glu | Gly | Phe | Val | Val | Lys | 435 | 440 | 445 |     |
| Ala | Lys | Ser | Lys | Lys | Ile | Pro | Leu | Gly | Gly | Ile | Pro | Ser | Pro | Ser | Thr | 450 | 455 | 460 |     |
| Glu | Gln | Ser | Ala | Lys | Lys | Val | Arg | Lys | Lys | Ala | Glu | Asn | Ala | His | Asn | 465 | 470 | 475 | 480 |
| Thr | Pro | Leu | Leu | Val | Leu | Tyr | Gly | Ser | Asn | Met | Gly | Thr | Ala | Glu | Gly | 485 | 490 | 495 |     |
| Thr | Ala | Arg | Asp | Leu | Ala | Asp | Ile | Ala | Met | Ser | Lys | Gly | Phe | Ala | Pro | 500 | 505 | 510 |     |
| Gln | Val | Ala | Thr | Leu | Asp | Ser | His | Ala | Gly | Asn | Leu | Pro | Arg | Glu | Gly | 515 | 520 | 525 |     |
| Ala | Val | Leu | Ile | Val | Thr | Ala | Ser | Tyr | Asn | Gly | His | Pro | Pro | Asp | Asn | 530 | 535 | 540 |     |
| Ala | Lys | Gln | Phe | Val | Asp | Trp | Leu | Asp | Gln | Ala | Ser | Ala | Asp | Glu | Val | 545 | 550 | 555 | 560 |

hp3238sgw-sp.sequence listing\_ST25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
| Lys | Gly | Val | Arg | Tyr | Ser | Val | Phe | Gly | Cys | Gly | Asp | Lys | Asn | Trp | Ala |  |  |
|     |     |     |     | 565 |     |     |     |     | 570 |     |     |     |     | 575 |     |  |  |
| Thr | Thr | Tyr | Gln | Lys | Val | Pro | Ala | Phe | Ile | Asp | Glu | Thr | Leu | Ala | Ala |  |  |
|     |     |     | 580 |     |     |     |     | 585 |     |     |     |     | 590 |     |     |  |  |
| Lys | Gly | Ala | Glu | Asn | Ile | Ala | Asp | Arg | Gly | Glu | Ala | Asp | Ala | Ser | Asp |  |  |
|     |     | 595 |     |     |     |     | 600 |     |     |     |     | 605 |     |     |     |  |  |
| Asp | Phe | Glu | Gly | Thr | Tyr | Glu | Glu | Trp | Arg | Glu | His | Met | Trp | Ser | Asp |  |  |
|     | 610 |     |     |     | 615 |     |     |     |     |     | 620 |     |     |     |     |  |  |
| Val | Ala | Ala | Tyr | Phe | Asn | Leu | Asp | Ile | Glu | Asn | Ser | Glu | Asp | Asn | Lys |  |  |
| 625 |     |     |     |     | 630 |     |     |     |     | 635 |     |     |     |     | 640 |  |  |
| Ser | Thr | Leu | Ser | Leu | Gln | Phe | Val | Asp | Ser | Ala | Ala | Asp | Met | Pro | Leu |  |  |
|     |     |     | 645 |     |     |     |     |     | 650 |     |     |     |     | 655 |     |  |  |
| Ala | Lys | Met | His | Gly | Ala | Phe | Ser | Thr | Asn | Val | Val | Ala | Ser | Lys | Glu |  |  |
|     |     |     | 660 |     |     |     |     | 665 |     |     |     |     | 670 |     |     |  |  |
| Leu | Gln | Gln | Pro | Gly | Ser | Ala | Arg | Ser | Thr | Arg | His | Leu | Glu | Ile | Glu |  |  |
|     | 675 |     |     |     |     |     | 680 |     |     |     |     | 685 |     |     |     |  |  |
| Leu | Pro | Lys | Glu | Ala | Ser | Tyr | Gln | Glu | Gly | Asp | His | Leu | Gly | Val | Ile |  |  |
|     | 690 |     |     |     |     | 695 |     |     |     |     | 700 |     |     |     |     |  |  |
| Pro | Arg | Asn | Tyr | Glu | Gly | Ile | Val | Asn | Arg | Val | Thr | Ala | Arg | Phe | Gly |  |  |
| 705 |     |     |     | 710 |     |     |     |     |     | 715 |     |     |     |     | 720 |  |  |
| Leu | Asp | Ala | Ser | Gln | Ile | Arg | Leu | Glu | Ala | Glu | Glu | Glu | Lys | Leu |     |  |  |
|     |     |     | 725 |     |     |     |     | 730 |     |     |     |     | 735 |     |     |  |  |
| Ala | His | Leu | Pro | Leu | Ala | Lys | Thr | Val | Ser | Val | Glu | Glu | Leu | Leu | Gln |  |  |
|     |     | 740 |     |     |     |     |     | 745 |     |     |     |     | 750 |     |     |  |  |
| Tyr | Val | Glu | Leu | Gln | Asp | Pro | Val | Thr | Arg | Thr | Gln | Leu | Arg | Ala | Met |  |  |
|     | 755 |     |     |     |     | 760 |     |     |     |     |     | 765 |     |     |     |  |  |
| Ala | Ala | Lys | Thr | Val | Cys | Pro | Pro | His | Lys | Val | Glu | Leu | Glu | Ala | Leu |  |  |
|     | 770 |     |     |     |     | 775 |     |     |     |     | 780 |     |     |     |     |  |  |
| Leu | Glu | Lys | Gln | Ala | Tyr | Lys | Glu | Gln | Val | Leu | Ala | Lys | Arg | Leu | Thr |  |  |
| 785 |     |     |     |     | 790 |     |     |     |     | 795 |     |     |     |     | 800 |  |  |
| Met | Leu | Glu | Leu | Leu | Glu | Lys | Tyr | Pro | Ala | Cys | Glu | Met | Lys | Phe | Ser |  |  |
|     |     |     | 805 |     |     |     |     |     | 810 |     |     |     |     | 815 |     |  |  |
| Glu | Phe | Ile | Ala | Leu | Leu | Pro | Ser | Ile | Arg | Pro | Arg | Tyr | Tyr | Ser | Ile |  |  |
|     |     | 820 |     |     |     |     |     | 825 |     |     |     |     | 830 |     |     |  |  |
| Ser | Ser | Ser | Pro | Arg | Val | Asp | Glu | Lys | Gln | Ala | Ser | Ile | Thr | Val | Ser |  |  |
|     |     | 835 |     |     |     |     | 840 |     |     |     |     | 845 |     |     |     |  |  |
| Val | Val | Ser | Gly | Glu | Ala | Trp | Ser | Gly | Tyr | Gly | Glu | Tyr | Lys | Gly | Ile |  |  |
|     | 850 |     |     |     |     | 855 |     |     |     |     | 860 |     |     |     |     |  |  |
| Ala | Ser | Asn | Tyr | Leu | Ala | Glu | Leu | Gln | Glu | Gly | Asp | Thr | Ile | Thr | Cys |  |  |
| 865 |     |     |     |     | 870 |     |     |     |     | 875 |     |     |     |     | 880 |  |  |
| Phe | Ile | Ser | Thr | Pro | Gln | Ser | Glu | Phe | Thr | Leu | Pro | Lys | Asp | Pro | Glu |  |  |
|     |     |     | 885 |     |     |     |     |     | 890 |     |     |     |     | 895 |     |  |  |
| Thr | Pro | Leu | Ile | Met | Val | Gly | Pro | Gly | Thr | Gly | Val | Ala | Pro | Phe | Arg |  |  |
|     |     | 900 |     |     |     |     |     | 905 |     |     |     |     | 910 |     |     |  |  |
| Gly | Phe | Val | Gln | Ala | Arg | Lys | Gln | Leu | Lys | Glu | Gln | Gly | Gln | Ser | Leu |  |  |
|     | 915 |     |     |     |     |     | 920 |     |     |     |     | 925 |     |     |     |  |  |
| Gly | Glu | Ala | His | Leu | Tyr | Phe | Gly | Cys | Arg | Ser | Pro | His | Glu | Asp | Tyr |  |  |
|     | 930 |     |     |     |     | 935 |     |     |     |     | 940 |     |     |     |     |  |  |
| Leu | Tyr | Gln | Glu | Glu | Leu | Glu | Asn | Ala | Gln | Ser | Glu | Gly | Ile | Ile | Thr |  |  |
| 945 |     |     |     |     | 950 |     |     |     |     | 955 |     |     |     |     | 960 |  |  |
| Leu | His | Thr | Ala | Phe | Ser | Arg | Met | Pro | Asn | Gln | Pro | Lys | Thr | Tyr | Val |  |  |
|     |     |     | 965 |     |     |     |     |     | 970 |     |     |     |     | 975 |     |  |  |

# hp3238sgw-sp.sequence listing\_ST25

Gln His Val Met Glu Gln Asp Gly Lys Lys Leu Ile Glu Leu Leu Asp  
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Gln Gly Ala His Phe Tyr Ile Cys Gly Asp Gly Ser Gln Met Ala Pro  
995 1000 1005  
Ala Val Glu Ala Thr Leu Met Lys Ser Tyr Ala Asp Val His Gln Val  
1010 1015 1020  
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# hp3238sgw-sp.sequence listing\_ST25

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35        40        45
Val Thr Arg Tyr Leu Ser Ser Gln Arg Leu Ile Lys Glu Ala Cys Asp
50        55        60
Glu Ser Arg Phe Asp Lys Asn Leu Ser Gln Ala Leu Lys Phe Ala Arg
65        70        75        80
Asp Phe Ala Gly Asp Gly Leu Ala Thr Ser Trp Thr His Glu Ile Asn
85        90        95
Trp Lys Lys Ala His Asn Ile Leu Leu Pro Ser Phe Ser Gln Gln Ala
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Met Lys Gly Tyr His Ala Met Met Val Asp Ile Ala Val Gln Leu Val
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Gln Lys Trp Glu Arg Leu Asn Ala Asp Glu His Ile Glu Val Ser Glu
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hp3238sgw-sp.sequence listing\_ST25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     | 160 |
| Tyr | Arg | Phe | Asn | Ser | Phe | Tyr | Arg | Asp | Gln | Pro | His | Pro | Phe | Ile |
|     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |
| Ser | Met | Val | Arg | Ala | Leu | Asp | Glu | Val | Met | Asn | Lys | Leu | Gln | Arg |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |
| Asn | Pro | Asp | Asp | Pro | Ala | Tyr | Asp | Glu | Asn | Lys | Arg | Gln | Cys | Gln |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |
| Asp | Ile | Lys | Val | Met | Asn | Asp | Leu | Val | Asp | Lys | Ile | Ile | Ala | Asp |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |
| Lys | Ala | Arg | Gly | Glu | Gln | Ser | Asp | Asp | Leu | Leu | Thr | Gln | Met | Leu |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     | 240 |
| Gly | Lys | Asp | Pro | Glu | Thr | Gly | Glu | Pro | Leu | Asp | Asp | Gly | Asn | Ile |
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |
| Tyr | Gln | Ile | Ile | Thr | Phe | Leu | Ile | Ala | Gly | His | Glu | Thr | Thr | Ser |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     |     | 270 |
| Leu | Leu | Ser | Phe | Ala | Leu | Tyr | Phe | Leu | Val | Lys | Asn | Pro | His | Val |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |
| Gln | Lys | Val | Ala | Glu | Glu | Ala | Ala | Arg | Val | Leu | Val | Asp | Pro | Val |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |
| Ser | Tyr | Lys | Gln | Val | Lys | Gln | Leu | Lys | Tyr | Val | Gly | Met | Val | Leu |
| 305 |     |     |     |     | 310 |     |     |     |     | 315 |     |     |     | 320 |
| Glu | Ala | Leu | Arg | Leu | Trp | Pro | Thr | Ala | Pro | Ala | Phe | Ser | Leu | Tyr |
|     |     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |
| Lys | Glu | Asp | Thr | Val | Leu | Gly | Gly | Glu | Tyr | Pro | Leu | Glu | Lys | Gly |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |
| Glu | Val | Met | Val | Leu | Ile | Pro | Gln | Leu | His | Arg | Asp | Lys | Thr | Ile |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |
| Gly | Asp | Asp | Val | Glu | Glu | Phe | Arg | Pro | Glu | Arg | Phe | Glu | Asn | Pro |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |
| Ala | Ile | Pro | Gln | His | Ala | Phe | Lys | Pro | Phe | Gly | Asn | Gly | Gln | Arg |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     | 400 |
| Cys | Ile | Gly | Gln | Gln | Phe | Ala | Leu | His | Glu | Ala | Thr | Leu | Val | Leu |
|     |     |     | 405 |     |     |     |     |     | 410 |     |     |     |     | 415 |
| Met | Met | Leu | Lys | His | Phe | Asp | Phe | Glu | Asp | His | Thr | Asn | Tyr | Glu |
|     |     |     | 420 |     |     |     |     | 425 |     |     |     |     | 430 |     |
| Asp | Ile | Lys | Glu | Thr | Leu | Thr | Leu | Lys | Pro | Glu | Gly | Phe | Val | Val |
|     | 435 |     |     |     |     | 440 |     |     |     |     |     | 445 |     |     |
| Ala | Lys | Ser | Lys | Lys | Ile | Pro | Leu | Gly | Gly | Ile | Pro | Ser | Pro | Ser |
|     | 450 |     |     |     |     | 455 |     |     |     | 460 |     |     |     |     |
| Glu | Gln | Ser | Ala | Lys | Lys | Val | Arg | Lys | Lys | Ala | Glu | Asn | Ala | His |
| 465 |     |     |     |     | 470 |     |     |     |     | 475 |     |     |     | 480 |
| Thr | Pro | Leu | Leu | Val | Leu | Tyr | Gly | Ser | Asn | Met | Gly | Thr | Ala | Glu |
|     |     |     |     | 485 |     |     |     |     | 490 |     |     |     |     | 495 |
| Thr | Ala | Arg | Asp | Leu | Ala | Asp | Ile | Ala | Met | Ser | Lys | Gly | Phe | Ala |
|     |     |     | 500 |     |     |     |     | 505 |     |     |     |     | 510 |     |
| Gln | Val | Ala | Thr | Leu | Asp | Ser | His | Ala | Gly | Asn | Leu | Pro | Arg | Glu |
|     |     | 515 |     |     |     |     | 520 |     |     |     |     | 525 |     |     |
| Ala | Val | Leu | Ile | Val | Thr | Ala | Ser | Tyr | Asn | Gly | His | Pro | Pro | Asp |
|     | 530 |     |     |     |     | 535 |     |     |     |     | 540 |     |     |     |
| Ala | Lys | Gln | Phe | Val | Asp | Trp | Leu | Asp | Gln | Ala | Ser | Ala | Asp | Glu |
| 545 |     |     |     |     | 550 |     |     |     |     | 555 |     |     |     | 560 |
| Lys | Gly | Val | Arg | Tyr | Ser | Val | Phe | Gly | Cys | Gly | Asp | Lys | Asn | Trp |

## hp3238sgw-sp.sequence listing\_ST25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Thr | Thr | Tyr | Gln | Lys | Val | Pro | Ala | Phe | Ile | Asp | Glu | Thr | Leu | Ala | Ala |
|     |     |     | 580 |     |     |     |     | 585 |     |     |     |     | 590 |     |     |
| Lys | Gly | Ala | Glu | Asn | Ile | Ala | Asp | Arg | Gly | Glu | Ala | Asp | Ala | Ser | Asp |
|     |     | 595 |     |     |     |     | 600 |     |     |     |     | 605 |     |     |     |
| Asp | Phe | Glu | Gly | Thr | Tyr | Glu | Glu | Trp | Arg | Glu | His | Met | Trp | Ser | Asp |
|     | 610 |     |     |     |     | 615 |     |     |     |     | 620 |     |     |     |     |
| Val | Ala | Ala | Tyr | Phe | Asn | Leu | Asp | Ile | Glu | Asn | Ser | Glu | Asp | Asn | Lys |
| 625 |     |     |     |     | 630 |     |     |     |     | 635 |     |     |     |     | 640 |
| Ser | Thr | Leu | Ser | Leu | Gln | Phe | Val | Asp | Ser | Ala | Ala | Asp | Met | Pro | Leu |
|     |     |     |     | 645 |     |     |     |     | 650 |     |     |     |     | 655 |     |
| Ala | Lys | Met | His | Gly | Ala | Phe | Ser | Thr | Asn | Val | Val | Ala | Ser | Lys | Glu |
|     |     |     | 660 |     |     |     |     | 665 |     |     |     |     | 670 |     |     |
| Leu | Gln | Gln | Pro | Gly | Ser | Ala | Arg | Ser | Thr | Arg | His | Leu | Glu | Ile | Glu |
|     |     | 675 |     |     |     |     | 680 |     |     |     |     | 685 |     |     |     |
| Leu | Pro | Lys | Glu | Ala | Ser | Tyr | Gln | Glu | Gly | Asp | His | Leu | Gly | Val | Ile |
|     | 690 |     |     |     |     | 695 |     |     |     |     | 700 |     |     |     |     |
| Pro | Arg | Asn | Tyr | Glu | Gly | Ile | Val | Asn | Arg | Val | Thr | Ala | Arg | Phe | Gly |
| 705 |     |     |     |     | 710 |     |     |     |     | 715 |     |     |     |     | 720 |
| Leu | Asp | Ala | Ser | Gln | Gln | Ile | Arg | Leu | Glu | Ala | Glu | Glu | Glu | Lys | Leu |
|     |     |     |     | 725 |     |     |     |     | 730 |     |     |     |     | 735 |     |
| Ala | His | Leu | Pro | Leu | Ala | Lys | Thr | Val | Ser | Val | Glu | Glu | Leu | Leu | Gln |
|     |     |     | 740 |     |     |     |     | 745 |     |     |     |     | 750 |     |     |
| Tyr | Val | Glu | Leu | Gln | Asp | Pro | Val | Thr | Arg | Thr | Gln | Leu | Arg | Ala | Met |
|     |     | 755 |     |     |     |     | 760 |     |     |     |     | 765 |     |     |     |
| Ala | Ala | Lys | Thr | Val | Cys | Pro | Pro | His | Lys | Val | Glu | Leu | Glu | Ala | Leu |
|     |     |     |     |     |     | 775 |     |     |     |     | 780 |     |     |     |     |
| Leu | Glu | Lys | Gln | Ala | Tyr | Lys | Glu | Gln | Val | Leu | Ala | Lys | Arg | Leu | Thr |
| 785 |     |     |     |     | 790 |     |     |     |     | 795 |     |     |     |     | 800 |
| Met | Leu | Glu | Leu | Leu | Glu | Lys | Tyr | Pro | Ala | Cys | Glu | Met | Lys | Phe | Ser |
|     |     |     |     | 805 |     |     |     |     | 810 |     |     |     |     | 815 |     |
| Glu | Phe | Ile | Ala | Leu | Leu | Pro | Ser | Ile | Arg | Pro | Arg | Tyr | Tyr | Ser | Ile |
|     |     |     | 820 |     |     |     |     | 825 |     |     |     |     | 830 |     |     |
| Ser | Ser | Ser | Pro | Arg | Val | Asp | Glu | Lys | Gln | Ala | Ser | Ile | Thr | Val | Ser |
|     |     | 835 |     |     |     |     | 840 |     |     |     |     | 845 |     |     |     |
| Val | Val | Ser | Gly | Glu | Ala | Trp | Ser | Gly | Tyr | Gly | Glu | Tyr | Lys | Gly | Ile |
|     |     | 850 |     |     |     | 855 |     |     |     |     | 860 |     |     |     |     |
| Ala | Ser | Asn | Tyr | Leu | Ala | Glu | Leu | Gln | Glu | Gly | Asp | Thr | Ile | Thr | Cys |
| 865 |     |     |     |     | 870 |     |     |     |     | 875 |     |     |     |     | 880 |
| Phe | Ile | Ser | Thr | Pro | Gln | Ser | Glu | Phe | Thr | Leu | Pro | Lys | Asp | Pro | Glu |
|     |     |     |     | 885 |     |     |     |     | 890 |     |     |     |     | 895 |     |
| Thr | Pro | Leu | Ile | Met | Val | Gly | Pro | Gly | Thr | Gly | Val | Ala | Pro | Phe | Arg |
|     |     |     | 900 |     |     |     |     | 905 |     |     |     |     | 910 |     |     |
| Gly | Phe | Val | Gln | Ala | Arg | Lys | Gln | Leu | Lys | Glu | Gln | Gly | Gln | Ser | Leu |
|     |     | 915 |     |     |     |     | 92  |     |     |     |     |     |     |     |     |

## hp3238sgw-sp.sequence listing ST25

|      |     |     |     |      |      |     |      |      |      |     |     |      |     |     |      |  |  |  |  |
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| 980  |     |     |     |      |      |     |      |      |      | 985 |     |      |     |     | 990  |  |  |  |  |
| Gln  | Gly | Ala | His | Phe  | Tyr  | Ile | Cys  | Gly  | Asp  | Gly | Ser | Gln  | Met | Ala | Pro  |  |  |  |  |
| 995  |     |     |     |      |      |     | 1000 |      |      |     |     | 1005 |     |     |      |  |  |  |  |
| Ala  | Val | Glu | Ala | Thr  | Leu  | Met | Lys  | Ser  | Tyr  | Ala | Asp | Val  | His | Gln | Val  |  |  |  |  |
| 1010 |     |     |     | 1015 |      |     |      |      | 1020 |     |     |      |     |     |      |  |  |  |  |
| Ser  | Glu | Ala | Asp | Ala  | Arg  | Leu | Trp  | Leu  | Gln  | Gln | Leu | Glu  | Glu | Lys | Gly  |  |  |  |  |
| 1025 |     |     |     |      | 1030 |     |      | 1035 |      |     |     |      |     |     | 1040 |  |  |  |  |
| Arg  | Tyr | Ala | Lys | Asp  | Val  | Trp | Ala  | Gly  |      |     |     |      |     |     |      |  |  |  |  |
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| tttaaattcg | aggcgcctgg | ttgtgtaacg  | cgctacttat | caagtcagcg | tctaattaaa  | 180  |
| gaagcatgcg | atgaatcacg | ctttgataaa  | aacttaagtc | aagcgcttaa | attttcccgt  | 240  |
| gattttgcag | gagacgggtt | atttacaagc  | tggacgcatg | aaataaattg | gaaaaaagcg  | 300  |
| cataatatct | tacttccaag | ctttagtcag  | caggcaatga | aaggctatca | tgcgatgatg  | 360  |
| gtcgatatcg | ccgtgcagct | tgttcaaaaag | tgggagcgtc | taaatgcaga | tgagcatatt  | 420  |
| gaagtatcgg | aagacatgac | acgtttaacg  | cttgatacaa | ttggctcttg | cggctttaac  | 480  |
| tatcgcttta | acagctttta | ccgagatcag  | cctcatccat | ttattataag | tatgggtccgt | 540  |
| gcactggatg | aagtaatgaa | caagctgcag  | cgagcaaatc | cagacgacc  | agcttatgat  | 600  |
| gaaaacaagc | gccagtgtca | agaagatatc  | aaggtgatga | acgacctagt | agataaaatt  | 660  |
| attgcagatc | gcaaagcaag | gggtgaacaa  | agcgatgatt | tattaacgca | gatgctaaac  | 720  |
| ggaaaagatc | cagaaacggg | tgagccgctt  | gatgacggga | acattagcta | tcaaattatt  | 780  |
| acattcttaa | ttgcgggaca | cgaacaaca   | agtggctctt | tatcatttgc | gctgtatttc  | 840  |
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| gaaaatccaa | gtgcgattcc | gcagcatgcg  | tttaaaccgt | ttggaaacgg | tcagcgtgcg  | 1200 |
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# hp3238sgw-sp.sequence listing\_ST25

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Glu Ser Arg Phe Asp Lys Asn Leu Ser Gln Ala Leu Lys Phe Ser Arg
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hp3238sgw-sp.sequence listing\_ST25

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| Tyr | Arg | Phe | Asn | Ser | Phe | Tyr | Arg | Asp | Gln | Pro | His | Pro | Phe | Ile | Ile | 165 | 170 | 175 |
| Ser | Met | Val | Arg | Ala | Leu | Asp | Glu | Val | Met | Asn | Lys | Leu | Gln | Arg | Ala | 180 | 185 | 190 |
| Asn | Pro | Asp | Asp | Pro | Ala | Tyr | Asp | Glu | Asn | Lys | Arg | Gln | Cys | Gln | Glu | 195 | 200 | 205 |
| Asp | Ile | Lys | Val | Met | Asn | Asp | Leu | Val | Asp | Lys | Ile | Ile | Ala | Asp | Arg | 210 | 215 | 220 |
| Lys | Ala | Arg | Gly | Glu | Gln | Ser | Asp | Asp | Leu | Leu | Thr | Gln | Met | Leu | Asn | 225 | 230 | 235 |
| Gly | Lys | Asp | Pro | Glu | Thr | Gly | Glu | Pro | Leu | Asp | Asp | Gly | Asn | Ile | Ser | 245 | 250 | 255 |
| Tyr | Gln | Ile | Ile | Thr | Phe | Leu | Ile | Ala | Gly | His | Glu | Thr | Thr | Ser | Gly | 260 | 265 | 270 |
| Leu | Leu | Ser | Phe | Ala | Leu | Tyr | Phe | Leu | Val | Lys | Asn | Pro | His | Val | Leu | 275 | 280 | 285 |
| Gln | Lys | Val | Ala | Glu | Glu | Ala | Ala | Arg | Val | Leu | Val | Asp | Pro | Val | Pro | 290 | 295 | 300 |
| Ser | Tyr | Lys | Gln | Val | Lys | Gln | Leu | Lys | Tyr | Val | Gly | Met | Val | Leu | Asn | 305 | 310 | 315 |
| Glu | Ala | Leu | Arg | Leu | Trp | Pro | Thr | Ala | Pro | Ala | Phe | Ser | Leu | Tyr | Ala | 325 | 330 | 335 |
| Lys | Glu | Asp | Thr | Val | Leu | Gly | Gly | Glu | Tyr | Pro | Leu | Glu | Lys | Gly | Asp | 340 | 345 | 350 |
| Glu | Val | Met | Val | Leu | Ile | Pro | Gln | Leu | His | Arg | Asp | Lys | Thr | Ile | Trp | 355 | 360 | 365 |
| Gly | Asp | Asp | Val | Glu | Glu | Phe | Arg | Pro | Glu | Arg | Phe | Glu | Asn | Pro | Ser | 370 | 375 | 380 |
| Ala | Ile | Pro | Gln | His | Ala | Phe | Lys | Pro | Phe | Gly | Asn | Gly | Gln | Arg | Ala | 385 | 390 | 395 |
| Cys | Ile | Gly | Gln | Gln | Phe | Ala | Leu | His | Glu | Ala | Thr | Leu | Val | Leu | Gly | 405 | 410 | 415 |
| Met | Met | Leu | Lys | His | Phe | Asp | Phe | Glu | Asp | His | Thr | Asn | Tyr | Glu | Leu | 420 | 425 | 430 |
| Asp | Ile | Lys | Glu | Thr | Leu | Thr | Leu | Lys | Pro | Glu | Gly | Phe | Val | Val | Lys | 435 | 440 | 445 |
| Ala | Lys | Ser | Lys | Lys | Ile | Pro | Leu | Gly | Gly | Ile | Pro | Ser | Pro | Ser | Thr | 450 | 455 | 460 |
| Glu | Gln | Ser | Ala | Lys | Lys | Val | Arg | Lys | Lys | Ala | Glu | Asn | Ala | His | Asn | 465 | 470 | 475 |
| Thr | Pro | Leu | Leu | Val | Leu | Tyr | Gly | Ser | Asn | Met | Gly | Thr | Ala | Glu | Gly | 485 | 490 | 495 |
| Thr | Ala | Arg | Asp | Leu | Ala | Asp | Ile | Ala | Met | Ser | Lys | Gly | Phe | Ala | Pro | 500 | 505 | 510 |
| Gln | Val | Ala | Thr | Leu | Asp | Ser | His | Ala | Gly | Asn | Leu | Pro | Arg | Glu | Gly | 515 | 520 | 525 |
| Ala | Val | Leu | Ile | Val | Thr | Ala | Ser | Tyr | Asn | Gly | His | Pro | Pro | Asp | Asn | 530 | 535 | 540 |
| Ala | Lys | Gln | Phe | Val | Asp | Trp | Leu | Asp | Gln | Ala | Ser | Ala | Asp | Glu | Val | 545 | 550 | 555 |
| Lys | Gly | Val | Arg | Tyr | Ser | Val | Phe | Gly | Cys | Gly | Asp | Lys | Asn | Trp | Ala | 565 | 570 | 575 |

hp3238sgw-sp.sequence listing\_ST25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
| Thr | Thr | Tyr | Gln | Lys | Val | Pro | Ala | Phe | Ile | Asp | Glu | Thr | Leu | Ala | Ala |  |  |
|     |     |     | 580 |     |     |     |     | 585 |     |     |     |     | 590 |     |     |  |  |
| Lys | Gly | Ala | Glu | Asn | Ile | Ala | Asp | Arg | Gly | Glu | Ala | Asp | Ala | Ser | Asp |  |  |
|     |     | 595 |     |     |     |     | 600 |     |     |     |     | 605 |     |     |     |  |  |
| Asp | Phe | Glu | Gly | Thr | Tyr | Glu | Glu | Trp | Arg | Glu | His | Met | Trp | Ser | Asp |  |  |
|     | 610 |     |     |     |     | 615 |     |     |     |     | 620 |     |     |     |     |  |  |
| Val | Ala | Ala | Tyr | Phe | Asn | Leu | Asp | Ile | Glu | Asn | Ser | Glu | Asp | Asn | Lys |  |  |
| 625 |     |     |     |     | 630 |     |     |     |     | 635 |     |     |     |     | 640 |  |  |
| Ser | Thr | Leu | Ser | Leu | Gln | Phe | Val | Asp | Ser | Ala | Ala | Asp | Met | Pro | Leu |  |  |
|     |     |     |     | 645 |     |     |     |     | 650 |     |     |     |     | 655 |     |  |  |
| Ala | Lys | Met | His | Gly | Ala | Phe | Ser | Thr | Asn | Val | Val | Ala | Ser | Lys | Glu |  |  |
|     |     |     | 660 |     |     |     |     | 665 |     |     |     |     | 670 |     |     |  |  |
| Leu | Gln | Gln | Pro | Gly | Ser | Ala | Arg | Ser | Thr | Arg | His | Leu | Glu | Ile | Glu |  |  |
|     |     | 675 |     |     |     |     | 680 |     |     |     |     | 685 |     |     |     |  |  |
| Leu | Pro | Lys | Glu | Ala | Ser | Tyr | Gln | Glu | Gly | Asp | His | Leu | Gly | Val | Ile |  |  |
|     | 690 |     |     |     |     | 695 |     |     |     |     | 700 |     |     |     |     |  |  |
| Pro | Arg | Asn | Tyr | Glu | Gly | Ile | Val | Asn | Arg | Val | Thr | Ala | Arg | Phe | Gly |  |  |
| 705 |     |     |     |     | 710 |     |     |     |     | 715 |     |     |     |     | 720 |  |  |
| Leu | Asp | Ala | Ser | Gln | Gln | Ile | Arg | Leu | Glu | Ala | Glu | Glu | Glu | Lys | Leu |  |  |
|     |     |     |     | 725 |     |     |     |     | 730 |     |     |     |     | 735 |     |  |  |
| Ala | His | Leu | Pro | Leu | Ala | Lys | Thr | Val | Ser | Val | Glu | Glu | Leu | Leu | Gln |  |  |
|     |     |     | 740 |     |     |     |     | 745 |     |     |     |     | 750 |     |     |  |  |
| Tyr | Val | Glu | Leu | Gln | Asp | Pro | Val | Thr | Arg | Thr | Gln | Leu | Arg | Ala | Met |  |  |
|     | 755 |     |     |     |     |     | 760 |     |     |     |     | 765 |     |     |     |  |  |
| Ala | Ala | Lys | Thr | Val | Cys | Pro | Pro | His | Lys | Val | Glu | Leu | Glu | Ala | Leu |  |  |
|     | 770 |     |     |     |     | 775 |     |     |     |     | 780 |     |     |     |     |  |  |
| Leu | Glu | Lys | Gln | Ala | Tyr | Lys | Glu | Gln | Val | Leu | Ala | Lys | Arg | Leu | Thr |  |  |
| 785 |     |     |     |     | 790 |     |     |     |     | 795 |     |     |     |     | 800 |  |  |
| Met | Leu | Glu | Leu | Leu | Glu | Lys | Tyr | Pro | Ala | Cys | Glu | Met | Lys | Phe | Ser |  |  |
|     |     |     |     | 805 |     |     |     |     | 810 |     |     |     |     | 815 |     |  |  |
| Glu | Phe | Ile | Ala | Leu | Leu | Pro | Ser | Ile | Arg | Pro | Arg | Tyr | Tyr | Ser | Ile |  |  |
|     |     |     | 820 |     |     |     |     | 825 |     |     |     |     | 830 |     |     |  |  |
| Ser | Ser | Ser | Pro | Arg | Val | Asp | Glu | Lys | Gln | Ala | Ser | Ile | Thr | Val | Ser |  |  |
|     |     | 835 |     |     |     |     | 840 |     |     |     |     | 845 |     |     |     |  |  |
| Val | Val | Ser | Gly | Glu | Ala | Trp | Ser | Gly | Tyr | Gly | Glu | Tyr | Lys | Gly | Ile |  |  |
|     | 850 |     |     |     |     | 855 |     |     |     |     | 860 |     |     |     |     |  |  |
| Ala | Ser | Asn | Tyr | Leu | Ala | Glu | Leu | Gln | Glu | Gly | Asp | Thr | Ile | Thr | Cys |  |  |
| 865 |     |     |     |     | 870 |     |     |     |     | 875 |     |     |     |     | 880 |  |  |
| Phe | Ile | Ser | Thr | Pro | Gln | Ser | Glu | Phe | Thr | Leu | Pro | Lys | Asp | Pro | Glu |  |  |
|     |     |     |     | 885 |     |     |     |     | 890 |     |     |     |     | 895 |     |  |  |
| Thr | Pro | Leu | Ile | Met | Val | Gly | Pro | Gly | Thr | Gly | Val | Ala | Pro | Phe | Arg |  |  |
|     |     |     | 900 |     |     |     |     | 905 |     |     |     |     | 910 |     |     |  |  |
| Gly | Phe | Val | Gln | Ala | Arg | Lys | Gln | Leu | Lys | Glu | Gln | Gly | Gln | Ser | Leu |  |  |
|     |     | 915 |     |     |     |     | 920 |     |     |     |     | 925 |     |     |     |  |  |
| Gly | Glu | Ala | His | Leu | Tyr | Phe | Gly | Cys | Arg | Ser | Pro | His | Glu | Asp | Tyr |  |  |
|     | 930 |     |     |     |     | 935 |     |     |     |     | 940 |     |     |     |     |  |  |
| Leu | Tyr | Gln | Glu | Glu | Leu | Glu | Asn | Ala | Gln | Ser | Glu | Gly | Ile | Ile | Thr |  |  |
| 945 |     |     |     |     | 950 |     |     |     |     | 955 |     |     |     |     | 960 |  |  |
| Leu | His | Thr | Ala | Phe | Ser | Arg | Met | Pro | Asn | Gln | Pro | Lys | Thr | Tyr | Val |  |  |
|     |     |     |     | 965 |     |     |     |     | 970 |     |     |     |     | 975 |     |  |  |
| Gln | His | Val | Met | Glu | Gln | Asp | Gly | Lys | Lys | Leu | Ile | Glu | Leu | Leu | Asp |  |  |
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# hp3238sgw-sp.sequence listing\_ST25

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# hp3238sgw-sp.sequence listing\_ST25

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ggagacggaa gccaaatggc acctgccgtt gaagcaacgc ttatgaaaag ctatgctgac 3060
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<210> 14

<211> 1049

<212> PRT

<213> Artificial Sequence

<220>

<223> P450\_BM3

<400> 14

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

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## hp3238sgw-sp.sequence listing\_ST25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|     |     |     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |
| Ser | Met | Val | Arg | Ala | Leu | Asp | Glu | Ala | Met | Asn | Lys | Gln | Gln | Arg | Ala |
|     |     |     | 180 |     |     |     |     | 185 |     |     |     |     | 190 |     |     |
| Asn | Pro | Asp | Asp | Pro | Ala | Tyr | Asp | Glu | Asn | Lys | Arg | Gln | Phe | Gln | Glu |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |
| Asp | Ile | Lys | Val | Met | Asn | Asp | Leu | Val | Asp | Lys | Ile | Ile | Ala | Asp | Arg |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |
| Lys | Ala | Ser | Gly | Glu | Gln | Ser | Asp | Asp | Leu | Leu | Thr | His | Met | Leu | Asn |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |
| Gly | Lys | Asp | Pro | Glu | Thr | Gly | Glu | Pro | Leu | Asp | Asp | Glu | Asn | Ile | Arg |
|     |     |     |     | 245 |     |     |     | 250 |     |     |     |     |     | 255 |     |
| Tyr | Gln | Ile | Ile | Thr | Phe | Leu | Ile | Ala | Gly | His | Glu | Thr | Thr | Ser | Gly |
|     |     |     | 260 |     |     |     |     | 265 |     |     |     |     | 270 |     |     |
| Leu | Leu | Ser | Phe | Ala | Leu | Tyr | Phe | Leu | Val | Lys | Asn | Pro | His | Val | Leu |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |
| Gln | Lys | Ala | Ala | Glu | Glu | Ala | Ala | Arg | Val | Leu | Val | Asp | Pro | Val | Pro |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |
| Ser | Tyr | Lys | Gln | Val | Lys | Gln | Leu | Lys | Tyr | Val | Gly | Met | Val | Leu | Asn |
| 305 |     |     |     |     | 310 |     |     |     | 315 |     |     |     |     |     | 320 |
| Glu | Ala | Leu | Arg | Leu | Trp | Pro | Thr | Ala | Pro | Ala | Phe | Ser | Leu | Tyr | Ala |
|     |     |     |     | 325 |     |     |     | 330 |     |     |     |     |     | 335 |     |
| Lys | Glu | Asp | Thr | Val | Leu | Gly | Gly | Glu | Tyr | Pro | Leu | Glu | Lys | Gly | Asp |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |
| Glu | Leu | Met | Val | Leu | Ile | Pro | Gln | Leu | His | Arg | Asp | Lys | Thr | Ile | Trp |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |
| Gly | Asp | Asp | Val | Glu | Glu | Phe | Arg | Pro | Glu | Arg | Phe | Glu | Asn | Pro | Ser |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |
| Ala | Ile | Pro | Gln | His | Ala | Phe | Lys | Pro | Phe | Gly | Asn | Gly | Gln | Arg | Ala |
| 385 |     |     |     |     | 390 |     |     |     |     | 395 |     |     |     |     | 400 |
| Cys | Ile | Gly | Gln | Gln | Phe | Ala | Leu | His | Glu | Ala | Thr | Leu | Val | Leu | Gly |
|     |     |     |     | 405 |     |     |     |     | 410 |     |     |     |     | 415 |     |
| Met | Met | Leu | Lys | His | Phe | Asp | Phe | Glu | Asp | His | Thr | Asn | Tyr | Glu | Leu |
|     |     |     | 420 |     |     |     |     | 425 |     |     |     | 430 |     |     |     |
| Asp | Ile | Lys | Glu | Thr | Leu | Thr | Leu | Lys | Pro | Glu | Gly | Phe | Val | Val | Lys |
|     |     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |
| Ala | Lys | Ser | Lys | Lys | Ile | Pro | Leu | Gly | Gly | Ile | Pro | Ser | Pro | Ser | Thr |
|     | 450 |     |     |     |     | 455 |     |     |     |     | 460 |     |     |     |     |
| Glu | Gln | Ser | Ala | Lys | Lys | Val | Arg | Lys | Lys | Ala | Glu | Asn | Ala | His | Asn |
| 465 |     |     |     |     | 470 |     |     |     |     | 475 |     |     |     |     | 480 |
| Thr | Pro | Leu | Leu | Val | Leu | Tyr | Gly | Ser | Asn | Met | Gly | Thr | Ala | Glu | Gly |
|     |     |     |     | 485 |     |     |     |     | 490 |     |     |     |     | 495 |     |
| Thr | Ala | Arg | Asp | Leu | Ala | Asp | Ile | Ala | Met | Ser | Lys | Gly | Phe | Ala | Pro |
|     |     |     | 500 |     |     |     |     | 505 |     |     |     |     | 510 |     |     |
| Gln | Val | Ala | Thr | Leu | Asp | Ser | His | Ala | Gly | Asn | Leu | Pro | Arg | Glu | Gly |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

## hp3238sgw-sp.sequence listing ST25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |  |     |  |  |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|--|-----|--|--|--|--|
|     |     |     | 580 |     |     |     |     |     |     |     | 585 |     |     |     |     |  |  |  | 590 |  |  |  |  |
| Lys | Gly | Ala | Glu | Asn | Ile | Ala | Asp | Arg | Gly | Glu | Ala | Asp | Ala | Ser | Asp |  |  |  |     |  |  |  |  |
|     |     | 595 |     |     |     |     | 600 |     |     |     |     | 605 |     |     |     |  |  |  |     |  |  |  |  |
| Asp | Phe | Glu | Gly | Thr | Tyr | Glu | Glu | Trp | Arg | Glu | His | Met | Trp | Ser | Asp |  |  |  |     |  |  |  |  |
|     | 610 |     |     |     |     | 615 |     |     |     |     | 620 |     |     |     |     |  |  |  |     |  |  |  |  |
| Val | Ala | Ala | Tyr | Phe | Asn | Leu | Asp | Ile | Glu | Asn | Ser | Glu | Asp | Asn | Lys |  |  |  |     |  |  |  |  |
| 625 |     |     |     |     | 630 |     |     |     |     | 635 |     |     |     |     | 640 |  |  |  |     |  |  |  |  |
| Ser | Thr | Leu | Ser | Leu | Gln | Phe | Val | Asp | Ser | Ala | Ala | Asp | Met | Pro | Leu |  |  |  |     |  |  |  |  |
|     |     |     |     | 645 |     |     |     |     | 650 |     |     |     |     | 655 |     |  |  |  |     |  |  |  |  |
| Ala | Lys | Met | His | Gly | Ala | Phe | Ser | Thr | Asn | Val | Val | Ala | Ser | Lys | Glu |  |  |  |     |  |  |  |  |
|     |     |     | 660 |     |     |     |     | 665 |     |     |     |     | 670 |     |     |  |  |  |     |  |  |  |  |
| Leu | Gln | Gln | Pro | Gly | Ser | Ala | Arg | Ser | Thr | Arg | His | Leu | Glu | Ile | Glu |  |  |  |     |  |  |  |  |
|     |     | 675 |     |     |     |     | 680 |     |     |     |     | 685 |     |     |     |  |  |  |     |  |  |  |  |
| Leu | Pro | Lys | Glu | Ala | Ser | Tyr | Gln | Glu | Gly | Asp | His | Leu | Gly | Val | Ile |  |  |  |     |  |  |  |  |
|     | 690 |     |     |     |     | 695 |     |     |     | 700 |     |     |     |     |     |  |  |  |     |  |  |  |  |
| Pro | Arg | Asn | Tyr | Glu | Gly | Ile | Val | Asn | Arg | Val | Thr | Ala | Arg | Phe | Gly |  |  |  |     |  |  |  |  |
| 705 |     |     |     |     | 710 |     |     |     |     | 715 |     |     |     |     | 720 |  |  |  |     |  |  |  |  |
| Leu | Asp | Ala | Ser | Gln | Gln | Ile | Arg | Leu | Glu | Ala | Glu | Glu | Glu | Lys | Leu |  |  |  |     |  |  |  |  |
|     |     |     |     | 725 |     |     |     |     | 730 |     |     |     |     | 735 |     |  |  |  |     |  |  |  |  |
| Ala | His | Leu | Pro | Leu | Ala | Lys | Thr | Val | Ser | Val | Glu | Glu | Leu | Leu | Gln |  |  |  |     |  |  |  |  |
|     |     |     | 740 |     |     |     |     | 745 |     |     |     |     | 750 |     |     |  |  |  |     |  |  |  |  |
| Tyr | Val | Glu | Leu | Gln | Asp | Pro | Val | Thr | Arg | Thr | Gln | Leu | Arg | Ala | Met |  |  |  |     |  |  |  |  |
|     |     | 755 |     |     |     |     | 760 |     |     |     |     | 765 |     |     |     |  |  |  |     |  |  |  |  |
| Ala | Ala | Lys | Thr | Val | Cys | Pro | Pro | His | Lys | Val | Glu | Leu | Glu | Ala | Leu |  |  |  |     |  |  |  |  |
|     | 770 |     |     |     |     | 775 |     |     |     | 780 |     |     |     |     |     |  |  |  |     |  |  |  |  |
| Leu | Glu | Lys | Gln | Ala | Tyr | Lys | Glu | Gln | Val | Leu | Ala | Lys | Arg | Leu | Thr |  |  |  |     |  |  |  |  |
| 785 |     |     |     |     | 790 |     |     |     |     | 795 |     |     |     |     | 800 |  |  |  |     |  |  |  |  |
| Met | Leu | Glu | Leu | Leu | Glu | Lys | Tyr | Pro | Ala | Cys | Glu | Met | Lys | Phe | Ser |  |  |  |     |  |  |  |  |
|     |     |     |     | 805 |     |     |     |     | 810 |     |     |     |     | 815 |     |  |  |  |     |  |  |  |  |
| Glu | Phe | Ile | Ala | Leu | Leu | Pro | Ser | Ile | Arg | Pro | Arg | Tyr | Tyr | Ser | Ile |  |  |  |     |  |  |  |  |
|     |     |     | 820 |     |     |     |     | 825 |     |     |     |     | 830 |     |     |  |  |  |     |  |  |  |  |
| Ser | Ser | Ser | Pro | Arg | Val | Asp | Glu | Lys | Gln | Ala | Ser | Ile | Thr | Val | Ser |  |  |  |     |  |  |  |  |
|     |     | 835 |     |     |     |     | 840 |     |     |     |     | 845 |     |     |     |  |  |  |     |  |  |  |  |
| Val | Val | Ser | Gly | Glu | Ala | Trp | Ser | Gly | Tyr | Gly | Glu | Tyr | Lys | Gly | Ile |  |  |  |     |  |  |  |  |
|     | 850 |     |     |     |     | 855 |     |     |     | 860 |     |     |     |     |     |  |  |  |     |  |  |  |  |
| Ala | Ser | Asn | Tyr | Leu | Ala | Glu | Leu | Gln | Glu | Gly | Asp | Thr | Ile | Thr | Cys |  |  |  |     |  |  |  |  |
| 865 |     |     |     |     | 870 |     |     |     |     | 875 |     |     |     |     |     |  |  |  |     |  |  |  |  |

## hp3238sgw-sp.sequence listing\_ST25

|                                                                 |      |      |
|-----------------------------------------------------------------|------|------|
| 995                                                             | 1000 | 1005 |
| Ala Val Glu Ala Thr Leu Met Lys Ser Tyr Ala Asp Val His Gln Val |      |      |
| 1010                                                            | 1015 | 1020 |
| Ser Glu Ala Asp Ala Arg Leu Trp Leu Gln Gln Leu Glu Glu Lys Gly |      |      |
| 1025                                                            | 1030 | 1035 |
| Arg Tyr Ala Lys Asp Val Trp Ala Gly                             |      | 1040 |
|                                                                 | 1045 |      |

&lt;210&gt; 15

&lt;211&gt; 3150

&lt;212&gt; DNA

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; P450\_BM3

&lt;400&gt; 15

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# hp3238sgw-sp.sequence listing\_ST25

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<210> 16

<211> 1049

<212> PRT

<213> Artificial Sequence

<220>

<223> P450\_BM3

<400> 16

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Met Thr Ile Lys Glu Met Pro Gln Pro Lys Thr Phe Gly Glu Leu Lys
1           5           10           15
Asn Leu Pro Leu Leu Asn Thr Asp Lys Pro Val Gln Ala Leu Met Lys
          20           25           30
Ile Ala Asp Glu Leu Gly Glu Ile Phe Lys Phe Glu Ala Pro Gly Cys
          35           40           45
Val Thr Arg Tyr Leu Ser Ser Gln Arg Leu Ile Lys Glu Ala Cys Asp
          50           55           60
Glu Ser Arg Phe Asp Lys Asn Leu Ser Gln Ala Leu Lys Phe Ala Arg
65           70           75           80
Asp Phe Leu Gly Asp Gly Leu Val Thr Ser Trp Thr His Glu Ile Asn
          85           90           95
Trp Lys Lys Ala His Asn Ile Leu Leu Pro Ser Phe Ser Gln Gln Ala
          100          105          110
Met Lys Gly Tyr His Ala Met Met Val Asp Ile Ala Val Gln Leu Val
          115          120          125
Gln Lys Trp Glu Arg Leu Asn Ala Asp Glu His Ile Glu Val Ser Glu
          130          135          140
Asp Met Thr Arg Leu Thr Leu Asp Thr Ile Gly Leu Cys Gly Phe Asn
145          150          155          160
Tyr Arg Phe Asn Ser Phe Tyr Arg Asp Gln Pro His Pro Phe Ile Ile
          165          170          175

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hp3238sgw-sp.sequence listing\_ST25

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ser | Met | Val | Arg | Ala | Leu | Asp | Glu | Val | Met | Asn | Lys | Leu | Gln | Arg | Ala | 180 | 185 | 190 |
| Asn | Pro | Asp | Asp | Pro | Ala | Tyr | Asp | Glu | Asn | Lys | Arg | Gln | Cys | Gln | Glu | 195 | 200 | 205 |
| Asp | Ile | Lys | Val | Met | Asn | Asp | Leu | Val | Asp | Lys | Ile | Ile | Ala | Asp | Arg | 210 | 215 | 220 |
| Lys | Ala | Arg | Gly | Glu | Gln | Ser | Asp | Asp | Leu | Leu | Thr | Gln | Met | Leu | Asn | 225 | 230 | 235 |
| Gly | Lys | Asp | Pro | Glu | Thr | Gly | Glu | Pro | Leu | Asp | Asp | Gly | Asn | Ile | Ser | 245 | 250 | 255 |
| Tyr | Gln | Ile | Ile | Thr | Phe | Leu | Ile | Ala | Gly | His | Glu | Thr | Thr | Ser | Gly | 260 | 265 | 270 |
| Leu | Leu | Ser | Phe | Ala | Leu | Tyr | Phe | Leu | Val | Lys | Asn | Pro | His | Val | Leu | 275 | 280 | 285 |
| Gln | Lys | Val | Ala | Glu | Glu | Ala | Ala | Arg | Val | Leu | Val | Asp | Pro | Val | Pro | 290 | 295 | 300 |
| Ser | Tyr | Lys | Gln | Val | Lys | Gln | Leu | Lys | Tyr | Val | Gly | Met | Val | Leu | Asn | 305 | 310 | 315 |
| Glu | Ala | Leu | Arg | Leu | Trp | Pro | Thr | Ala | Pro | Ala | Phe | Ser | Leu | Tyr | Ala | 325 | 330 | 335 |
| Lys | Glu | Asp | Thr | Val | Leu | Gly | Gly | Glu | Tyr | Pro | Leu | Glu | Lys | Gly | Asp | 340 | 345 | 350 |
| Glu | Val | Met | Val | Leu | Ile | Pro | Gln | Leu | His | Arg | Asp | Lys | Thr | Ile | Trp | 355 | 360 | 365 |
| Gly | Asp | Asp | Val | Glu | Glu | Phe | Arg | Pro | Glu | Arg | Phe | Glu | Asn | Pro | Ser | 370 | 375 | 380 |
| Ala | Ile | Pro | Gln | His | Ala | Phe | Lys | Pro | Phe | Gly | Asn | Gly | Gln | Arg | Ala | 385 | 390 | 395 |
| Cys | Ile | Gly | Gln | Gln | Phe | Ala | Leu | His | Glu | Ala | Thr | Leu | Val | Leu | Gly | 405 | 410 | 415 |
| Met | Met | Leu | Lys | His | Phe | Asp | Phe | Glu | Asp | His | Thr | Asn | Tyr | Glu | Leu | 420 | 425 | 430 |
| Asp | Ile | Lys | Glu | Thr | Leu | Thr | Leu | Lys | Pro | Glu | Gly | Phe | Val | Val | Lys | 435 | 440 | 445 |
| Ala | Lys | Ser | Lys | Lys | Ile | Pro | Leu | Gly | Gly | Ile | Pro | Ser | Pro | Ser | Thr | 450 | 455 | 460 |
| Glu | Gln | Ser | Ala | Lys | Lys | Val | Arg | Lys | Lys | Ala | Glu | Asn | Ala | His | Asn | 465 | 470 | 475 |
| Thr | Pro | Leu | Leu | Val | Leu | Tyr | Gly | Ser | Asn | Met | Gly | Thr | Ala | Glu | Gly | 485 | 490 | 495 |
| Thr | Ala | Arg | Asp | Leu | Ala | Asp | Ile | Ala | Met | Ser | Lys | Gly | Phe | Ala | Pro | 500 | 505 | 510 |
| Gln | Val | Ala | Thr | Leu | Asp | Ser | His | Ala | Gly | Asn | Leu | Pro | Arg | Glu | Gly | 515 | 520 | 525 |
| Ala | Val | Leu | Ile | Val | Thr | Ala | Ser | Tyr | Asn | Gly | His | Pro | Pro | Asp | Asn | 530 | 535 | 540 |
| Ala | Lys | Gln | Phe | Val | Asp | Trp | Leu | Asp | Gln | Ala | Ser | Ala | Asp | Glu | Val | 545 | 550 | 555 |
| Lys | Gly | Val | Arg | Tyr | Ser | Val | Phe | Gly | Cys | Gly | Asp | Lys | Asn | Trp | Ala | 565 | 570 | 575 |
| Thr | Thr | Tyr | Gln | Lys | Val | Pro | Ala | Phe | Ile | Asp | Glu | Thr | Leu | Ala | Ala | 580 | 585 | 590 |

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|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |      |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| Lys | Gly | Ala | Glu | Asn | Ile | Ala | Asp | Arg | Gly | Glu | Ala | Asp | Ala | Ser | Asp | 595 | 600  | 605  |
| Asp | Phe | Glu | Gly | Thr | Tyr | Glu | Glu | Trp | Arg | Glu | His | Met | Trp | Ser | Asp | 610 | 615  | 620  |
| Val | Ala | Ala | Tyr | Phe | Asn | Leu | Asp | Ile | Glu | Asn | Ser | Glu | Asp | Asn | Lys | 625 | 630  | 635  |
| Ser | Thr | Leu | Ser | Leu | Gln | Phe | Val | Asp | Ser | Ala | Ala | Asp | Met | Pro | Leu | 645 | 650  | 655  |
| Ala | Lys | Met | His | Gly | Ala | Phe | Ser | Thr | Asn | Val | Val | Ala | Ser | Lys | Glu | 660 | 665  | 670  |
| Leu | Gln | Gln | Pro | Gly | Ser | Ala | Arg | Ser | Thr | Arg | His | Leu | Glu | Ile | Glu | 675 | 680  | 685  |
| Leu | Pro | Lys | Glu | Ala | Ser | Tyr | Gln | Glu | Gly | Asp | His | Leu | Gly | Val | Ile | 690 | 695  | 700  |
| Pro | Arg | Asn | Tyr | Glu | Gly | Ile | Val | Asn | Arg | Val | Thr | Ala | Arg | Phe | Gly | 705 | 710  | 715  |
| Leu | Asp | Ala | Ser | Gln | Gln | Ile | Arg | Leu | Glu | Ala | Glu | Glu | Glu | Lys | Leu | 725 | 730  | 735  |
| Ala | His | Leu | Pro | Leu | Ala | Lys | Thr | Val | Ser | Val | Glu | Glu | Leu | Leu | Gln | 740 | 745  | 750  |
| Tyr | Val | Glu | Leu | Gln | Asp | Pro | Val | Thr | Arg | Thr | Gln | Leu | Arg | Ala | Met | 755 | 760  | 765  |
| Ala | Ala | Lys | Thr | Val | Cys | Pro | Pro | His | Lys | Val | Glu | Leu | Glu | Ala | Leu | 770 | 775  | 780  |
| Leu | Glu | Lys | Gln | Ala | Tyr | Lys | Glu | Gln | Val | Leu | Ala | Lys | Arg | Leu | Thr | 785 | 790  | 795  |
| Met | Leu | Glu | Leu | Leu | Glu | Lys | Tyr | Pro | Ala | Cys | Glu | Met | Lys | Phe | Ser | 805 | 810  | 815  |
| Glu | Phe | Ile | Ala | Leu | Leu | Pro | Ser | Ile | Arg | Pro | Arg | Tyr | Tyr | Ser | Ile | 820 | 825  | 830  |
| Ser | Ser | Ser | Pro | Arg | Val | Asp | Glu | Lys | Gln | Ala | Ser | Ile | Thr | Val | Ser | 835 | 840  | 845  |
| Val | Val | Ser | Gly | Glu | Ala | Trp | Ser | Gly | Tyr | Gly | Glu | Tyr | Lys | Gly | Ile | 850 | 855  | 860  |
| Ala | Ser | Asn | Tyr | Leu | Ala | Glu | Leu | Gln | Glu | Gly | Asp | Thr | Ile | Thr | Cys | 865 | 870  | 875  |
| Phe | Ile | Ser | Thr | Pro | Gln | Ser | Glu | Phe | Thr | Leu | Pro | Lys | Asp | Pro | Glu | 885 | 890  | 895  |
| Thr | Pro | Leu | Ile | Met | Val | Gly | Pro | Gly | Thr | Gly | Val | Ala | Pro | Phe | Arg | 900 | 905  | 910  |
| Gly | Phe | Val | Gln | Ala | Arg | Lys | Gln | Leu | Lys | Glu | Gln | Gly | Gln | Ser | Leu | 915 | 920  | 925  |
| Gly | Glu | Ala | His | Leu | Tyr | Phe | Gly | Cys | Arg | Ser | Pro | His | Glu | Asp | Tyr | 930 | 935  | 940  |
| Leu | Tyr | Gln | Glu | Glu | Leu | Glu | Asn | Ala | Gln | Ser | Glu | Gly | Ile | Ile | Thr | 945 | 950  | 955  |
| Leu | His | Thr | Ala | Phe | Ser | Arg | Met | Pro | Asn | Gln | Pro | Lys | Thr | Tyr | Val | 965 | 970  | 975  |
| Gln | His | Val | Met | Glu | Gln | Asp | Gly | Lys | Lys | Leu | Ile | Glu | Leu | Leu | Asp | 980 | 985  | 990  |
| Gln | Gly | Ala | His | Phe | Tyr | Ile | Cys | Gly | Asp | Gly | Ser | Gln | Met | Ala | Pro | 995 | 1000 | 1005 |

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|      |     |     |     |      |      |      |     |     |      |     |      |     |     |     |      |
|------|-----|-----|-----|------|------|------|-----|-----|------|-----|------|-----|-----|-----|------|
| Ala  | Val | Glu | Ala | Thr  | Leu  | Met  | Lys | Ser | Tyr  | Ala | Asp  | Val | His | Gln | Val  |
| 1010 |     |     |     |      |      | 1015 |     |     |      |     | 1020 |     |     |     |      |
| Ser  | Glu | Ala | Asp | Ala  | Arg  | Leu  | Trp | Leu | Gln  | Gln | Leu  | Glu | Glu | Lys | Gly  |
| 1025 |     |     |     |      | 1030 |      |     |     | 1035 |     |      |     |     |     | 1040 |
| Arg  | Tyr | Ala | Lys | Asp  | Val  | Trp  | Ala | Gly |      |     |      |     |     |     |      |
|      |     |     |     | 1045 |      |      |     |     |      |     |      |     |     |     |      |