(19)国家知识产权局

(12)发明专利

(10)授权公告号 CN 111465696 B
(45)授权公告日 2025.06.13

(21)申请号 201880080137.9
(22)申请日 2018.12.13
(65)同一申请的已公布的文献号
申请公布号 CN 111465696 A
(43)申请公布日 2020.07.28
(30)优先权数据
62/599,386 2017.12.15 US
(85)PCT国际申请进入国家阶段日
2020.06.11
(86)PCT国际申请的申请数据
PCT/US2018/065449 2018.12.13
(87)PCT国际申请的公布数据
WO2019/118726 EN 2019.06.20
(73)专利权人 孟山都技术公司
地址 美国密苏里州
(72)发明人 C·T·拉鲁 F·莫施里
J·E·里姆 周雪峰
(74)专利代理机构 北京市金杜律师事务所 11256
专利代理师 孟凡宏 谢燕军
(51)Int.Cl.
*C12N 15/82*(2006.01)
*C12N 9/02*(2006.01)
*C12Q 1/32*(2006.01)
(56)对比文件
US 2017037427 A1,2017.02.09
LE 等."ORJ22714.1".《GenBank》.2017,第1-2页.
审查员 蔺娜
权利要求书2页 说明书39页
序列表269页 附图6页

(54)发明名称

用于PPO除草剂耐受性的方法和组合物

(57)摘要

本发明涉及生物技术并且提供用于赋予对原卟啉原氧化酶抑制剂除草剂的耐受性的新颖重组DNA分子和工程化蛋白质。本发明还提供了含有所述重组DNA分子的除草剂耐受性转基因植物、种子、细胞以及植物部分,以及其使用方法。

CN 111465696 B

1.一种重组DNA分子,所述重组DNA分子包含编码具有除草剂耐受性原卟啉原氧化酶活性的基因工程化的蛋白质的核酸分子以及可操作地连接至所述核酸分子的异源启动子,其中所述蛋白质包含HemG类原卟啉原氧化酶,并且其中所述蛋白质的氨基酸序列如SEQ ID NO:1所示,并且经工程化以在对应于SEQ ID NO:1的残基125至146的位置包含一个氨基酸取代,其中所述取代选自由以下组成的组:L125I、Y127W、P128A、P128S、P128T、R129A、R129E、R129K、R129L、R129N、R129Q、Y130L、W132I、K135R、M137A、M137C、M137I、M137L、M137S、M137V、I138L、Q139K、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140T、I141V、M142L、M142S、M142V、R143A、G146A以及G146D。

2.如权利要求1所述的重组DNA分子,其中所述蛋白质的氨基酸序列如选自由SEQ ID NO:24-124和249-263组成的组所示。

3.如权利要求1所述的重组DNA分子,其中所述氨基酸取代位于所述酶中的长链插入环中。

4.如权利要求1所述的重组DNA分子,其中所述异源启动子在植物细胞中具功能性。

5.如权利要求4所述的重组DNA分子,其中所述核酸分子可操作地连接至编码用于定位细胞内的所述蛋白质的转运序列的DNA分子。

6.如权利要求1所述的重组DNA分子,其中所述重组DNA分子包含于植物细胞的基因组中。

7.一种DNA构建体,所述DNA构建体包含如权利要求1所述的重组DNA分子。

8.一种工程化蛋白质,所述工程化蛋白质由如权利要求1所述的重组DNA分子编码。

9.一种赋予植物、种子、细胞或植物部分PPO除草剂耐受性的方法,所述方法包括:使如权利要求8所述的工程化蛋白质在所述植物、种子、细胞或植物部分中异源表达。

10.如权利要求9所述的方法,其中所述除草剂耐受性是针对选自由以下组成的组的至少一种PPO除草剂:三氟羧草醚、氟磺胺草醚、乳氟禾草灵、乙羧氟草醚、乙氧氟草醚、丙炔氟草胺、唑啶草酮、唑酮草酯、甲磺草胺、氟噻甲草酯、丙炔噁草酮、噁草酮、吡草醚、苯嘧磺草胺、氟嘧硫草酯、1,5-二甲基-6-硫代-3-(2,2,7-三氟-3,4-二氢-3-氧代-4-丙-2-炔基-2H-1,4-苯并噁嗪-6-基)-1,3,5-三嗪烷-2,4-二酮以及S-3100。

11.一种产生除草剂耐受性植物的方法,所述方法包括以下步骤:

a)用如权利要求1所述的重组DNA分子转化植物细胞;以及

b)从包含所述重组DNA分子的所述植物细胞再生植物。

12.如权利要求11所述的方法,所述方法还包括针对PPO除草剂耐受性选择所述植物或其子代的步骤。

13.如权利要求11所述的方法,所述方法还包括使再生的植物与自身或与第二植物杂交以产生子代的步骤。

14.一种控制或阻止植物生长区域中的杂草生长的方法,所述方法包括向包含含有如权利要求1所述的重组DNA分子的转基因植物或种子的植物生长区域中施用有效量的至少一种PPO除草剂,其中所述转基因植物或种子对所述PPO除草剂耐受。

15.如权利要求14所述的方法,其中所述PPO除草剂选自由以下组成的组:三氟羧草醚、氟磺胺草醚、乳氟禾草灵、乙羧氟草醚、乙氧氟草醚、丙炔氟草胺、唑啶草酮、唑酮草酯、甲磺草胺、氟噻甲草酯、丙炔噁草酮、噁草酮、吡草醚、苯嘧磺草胺、氟嘧硫草酯、1,5-二甲基-6-

硫代-3-(2,2,7-三氟-3,4-二氢-3-氧代-4-丙-2-炔基-2H-1,4-苯并噁嗪-6-基)-1,3,5-三嗪烷-2,4-二酮以及S-3100。

16.一种鉴定编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核苷酸序列的方法,所述方法包括:

a)用包含如权利要求1所述的重组DNA分子的细菌表达载体转化缺乏除草剂耐受性PPO酶活性的大肠杆菌菌株;以及

b)使所述转化的大肠杆菌生长以鉴定具有除草剂耐受性原卟啉原氧化酶活性的蛋白质。

17.一种筛选除草剂耐受性基因的方法,所述方法包括:

a)使如权利要求1所述的重组DNA分子在植物细胞中表达;以及

b)鉴定对PPO除草剂展现耐受性的植物细胞。

18.一种产生对PPO除草剂和至少一种其他除草剂耐受的植物的方法,所述方法包括:

a)获得包含如权利要求1所述的重组DNA分子的植物;

b)使所述植物与包含对所述至少一种其他除草剂的耐受性的第二植物杂交,以及

c)选择由所述杂交产生的包含对PPO除草剂和所述至少一种其他除草剂的耐受性的子代植物。

19.一种减少除草剂耐受性杂草的发育的方法,所述方法包括:

a)在作物生长环境中培育包含如权利要求1所述的重组DNA分子的植物;以及

b)将PPO除草剂施用于所述作物生长环境,其中所述作物植物对所述PPO除草剂耐受。

20.如权利要求19所述的方法,其中所述PPO除草剂选自由以下组成的组:三氟羧草醚、氟磺胺草醚、乳氟禾草灵、乙羧氟草醚、乙氧氟草醚、丙炔氟草胺、唑啶草酮、唑酮草酯、甲磺草胺、氟噻甲草酯、丙炔噁草酮、噁草酮、吡草醚、苯嘧磺草胺、氟嘧硫草酯、1,5-二甲基-6-硫代-3-(2,2,7-三氟-3,4-二氢-3-氧代-4-丙-2-炔基-2H-1,4-苯并噁嗪-6-基)-1,3,5-三嗪烷-2,4-二酮以及S-3100。

# 用于PPO除草剂耐受性的方法和组合物

[0001] 相关申请的交叉引用

[0002] 本申请要求于2017年12月15日提交的美国临时申请号62/599,386的优先权权益,该临时申请的公开内容以全文引用的方式并入本文中。

## 发明领域

[0003] 本发明涉及农业、植物生物技术以及分子生物学领域。更具体地说,本发明涉及编码提供对抑制原卟啉原氧化酶的除草剂的耐受性的工程化蛋白质的重组DNA分子,以及其使用方法。

[0004] 序列表的并入

[0005] 计算机可读形式的序列表通过电子方式与本申请一起提交,并且以全文引用的方式并入本申请中。序列表含于名为MONS429WO_ST25.txt的文件中,该文件的大小为296千字节(在操作系统MS Windows中测量)并且创建于2018年12月13日。

[0006] 发明背景

[0007] 农作物生产通常利用使用生物技术方法形成的转基因性状。可将异源基因(也称为转基因)引入植物中,以产生转基因性状。转基因在植物中表达赋予植物诸如除草剂耐受性等性状。转基因除草剂耐受性性状的实例包括草甘膦耐受性、草铵膦耐受性以及麦草畏耐受性。随着对常用除草剂具有抗性的杂草种类增加,本领域中需要新的除草剂耐受性性状。特别受关注的除草剂包括抑制原卟啉原氧化酶(PPO,EC 1.3.3.4)的除草剂,称为PPO除草剂。PPO除草剂提供对一系列除草剂抗性杂草的控制,从而使赋予对这些除草剂的耐受性的性状在合并有一种或多种其他除草剂耐受性性状的农作系统中特别有用。本发明提供了可用于在植物中提供PPO除草剂耐受性的新颖工程化除草剂耐受性原卟啉原氧化酶。

## 发明内容

[0008] 在一个方面中,本发明提供了一种重组DNA分子,所述重组DNA分子包含可操作地连接至编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子的异源启动子,其中所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具有至少约50%序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N。在某些实施方案中,所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具

有具有至少约50％序列同一性、至少约60％序列同一性、至少约70％序列同一性、至少约80％序列同一性、至少约85％序列同一性、至少约90％序列同一性、至少约91％序列同一性、至少约92％序列同一性、至少约93％序列同一性、至少约94％序列同一性、至少约95％序列同一性、至少约96％序列同一性、至少约97％序列同一性、至少约98％序列同一性以及至少约99％序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N。在一些实施方案中,所述蛋白质包含所述氨基酸取代中的至少2个、至少3个、至少4个、至少5个、至少6个、至少7个、至少8个、至少9个或至少10个。在另一实施方案中,所述蛋白质与选自由SEQ ID NO:24-124和249-263组成的组的氨基酸序列具有至少约90％序列同一性。在另一实施方案中,所述蛋白质包含HemG类原卟啉原氧化酶。在另一实施方案中,至少一个第一氨基酸取代位于此类HemG类原卟啉原氧化酶的长链插入环中。在另一实施方案中,本发明的重组DNA分子包含在植物细胞的基因组中。

[0009] 在某些实施方案中,异源启动子(例如在植物细胞中具功能性的启动子)可操作地连接至编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子,其中所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具有至少50％序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N。此类所得DNA分子还可包含转运序列,所述转运序列的功能为定位细胞内的蛋白质。

[0010] 在另一方面中,本发明提供了一种DNA构建体,所述DNA构建体包含本文所提供的重组DNA分子,诸如包含可操作地连接至编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子的异源启动子的重组DNA分子,其中所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具有至少50％序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、

W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N。在另一实施方案中,工程化蛋白质由本文提供的重组DNA分子编码。

[0011] 在另一方面中,本发明提供了一种转基因植物、种子、细胞或植物部分,所述转基因植物、种子、细胞或植物部分包含本文所提供的重组DNA分子,诸如包含可操作地连接至编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子的异源启动子的重组DNA分子,其中所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具有至少50%序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N。在一个实施方案中,所述转基因植物、种子、细胞或植物部分对至少一种PPO除草剂耐受。在另一实施方案中,PPO除草剂选自由以下组成的组:三氟羧草醚、氟磺胺草醚、乳氟禾草灵、乙羧氟草醚(fluoroglycofen-ethyl)、乙氧氟草醚、丙炔氟草胺、唑啶草酮、唑酮草酯(carfentrazone-ethyl)、甲磺草胺、氟噻甲草酯(fluthiacet-methyl)、丙炔噁草酮(oxadiargyl)、噁草酮、吡草醚(pyraflufen-ethyl)、苯嘧磺草胺以及S-3100。在另一实施方案中,所述转基因植物、种子、细胞或植物部分对至少一种第二除草剂耐受。

[0012] 在另一方面中,本发明提供了一种用于赋予植物、种子、细胞或植物部分PPO除草剂耐受性的方法,所述方法包括:在所述植物、种子、细胞或植物部分中异源表达本发明的工程化蛋白质。在一些实施方案中,除草剂耐受性是针对选自由以下组成的组的至少一种PPO除草剂:三氟羧草醚、氟磺胺草醚、乳氟禾草灵、乙羧氟草醚、乙氧氟草醚、丙炔氟草胺、唑啶草酮、唑酮草酯、甲磺草胺、氟噻甲草酯、丙炔噁草酮、噁草酮、吡草醚、苯嘧磺草胺以及S-3100。

[0013] 在另一方面中,本发明提供了一种产生除草剂耐受性植物的方法,所述方法包括以下步骤:a)将植物细胞用本文所提供的重组DNA分子,诸如包含可操作地连接至编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子的异源启动子的重组DNA分子转化,其中所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具有至少50%序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、

R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N;以及b)从包含所述重组DNA分子的植物细胞再生植物。在一个实施方案中,所述方法还包括针对PPO除草剂耐受性对所述植物或其后代进行选择的步骤。在另一实施方案中,所述方法还包括使再生的植物与自身或与第二植物杂交以产生后代的步骤。

[0014] 在另一方面中,本发明提供了一种控制或阻止植物生长区域中的杂草生长的方法,所述方法包括将有效量的至少一种PPO除草剂施用于植物生长区域,所述植物生长区域包含如本文所提供的转基因植物或种子,诸如包含含有可操作地连接至编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子的异源启动子的重组DNA分子的转基因植物或种子,其中所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具有至少50%序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N,其中所述转基因植物或种子对PPO除草剂耐受。在某些实施方案中,PPO除草剂选自由以下组成的组:三氟羧草醚、氟磺胺草醚、乳氟禾草灵、乙羧氟草醚、乙氧氟草醚、丙炔氟草胺、唑啶草酮、唑酮草酯、甲磺草胺、氟噻甲草酯、丙炔噁草酮、噁草酮、吡草醚、苯嘧磺草胺以及S-3100。

[0015] 在另一方面中,本发明提供了一种鉴定编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核甘酸序列的方法,所述方法包括a)将缺乏除草剂耐受性PPO酶活性的大肠杆菌(E.coli)菌株用细菌表达载体转化,所述细菌表达载体包含本文所提供的重组DNA分子,诸如包含可操作地连接至编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子的异源启动子的重组DNA分子,其中所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具有至少50%序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、

Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N;以及b)使所述转化的大肠杆菌生长,以鉴定具有除草剂耐受性原卟啉原氧化酶活性的蛋白质。

[0016] 在另一方面中,本发明提供了一种筛选除草剂耐受性基因的方法,所述方法包括a)使本文所提供的重组DNA分子,诸如包含可操作地连接至编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子的异源启动子的重组DNA分子在植物细胞中表达,其中所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具有至少50%序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N;以及b)鉴定对PPO除草剂展现耐受性的植物细胞。

[0017] 在另一方面中,本发明提供了一种产生对PPO除草剂和至少一种其他除草剂耐受的植物的方法,所述方法包括a)获得转基因植物,所述转基因植物包含本文所提供的重组DNA分子,诸如包含可操作地连接至编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子的异源启动子的重组DNA分子,其中所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具有至少50%序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N;b)使所述植物与包含对至少一种其他除草剂的耐受性的第二植物杂交,以及c)选择由所述杂交产生的包含对PPO除草剂和至少一种其他除草剂的耐受性的后代植物。

[0018] 在另一方面中,本发明提供了一种减少除草剂耐受性杂草的发育的方法,所述方法包括a)在作物生长环境中培育转基因植物,所述转基因植物包含本文所提供的重组DNA分子,诸如包含可操作地连接至编码具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子的异源启动子的重组DNA分子,其中所述蛋白质与选自由SEQ ID NO:1-23组成的组的氨基酸序列具有至少50%序列同一性,并且在对应于SEQ ID NO:1的残基125至146的位

置处包含至少一个第一氨基酸取代,其中所述取代选自由以下组成的组:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N;以及b)将PPO除草剂和至少一种其他除草剂施用于作物生长环境,其中所述作物植物对PPO除草剂和至少一种其他除草剂耐受。在一个实施方案中,PPO除草剂选自由以下组成的组:三氟羧草醚、氟磺胺草醚、乳氟禾草灵、乙羧氟草醚、乙氧氟草醚、丙炔氟草胺、唑啶草酮、唑酮草酯、甲磺草胺、氟噻甲草酯、丙炔噁草酮、噁草酮、吡草醚、苯嘧磺草胺以及S-3100。在另一实施方案中,所述至少一种其他除草剂选自由以下组成的组:ACC酶抑制剂、ALS抑制剂、EPSPS抑制剂、合成植物生长素、光合作用抑制剂、谷氨酰胺合成抑制剂、HPPD抑制剂、PPO抑制剂以及长链脂肪酸抑制剂。在另一实施方案中,ACC酶抑制剂为芳氧基苯氧基丙酸酯或环己二酮;ALS抑制剂为磺酰脲、咪唑啉酮、三唑并嘧啶或三唑啉酮;EPSPS抑制剂为草甘膦;合成植物生长素为苯氧基除草剂、苯甲酸、羧酸或缩氨基脲;光合作用抑制剂为三嗪、三嗪酮、腈、苯并噻二唑或脲;谷氨酰胺合成抑制剂为草铵膦;HPPD抑制剂为异噁唑、吡唑啉酮或三酮;PPO抑制剂为二苯醚、N-苯基邻苯二甲酰亚胺、芳基三嗪酮或嘧啶二酮;或者长链脂肪酸抑制剂为氯乙酰胺、氧乙酰胺或吡唑。

## 附图说明

[0019] 本专利或申请文件含有至少一张以彩色展示的图。在请求并支付必要费用后将由专利局提供本专利或专利申请公布的具有一张或多张彩色图的副本。

[0020] 图1A和图1B:示出了23种微生物HemG PPO酶的子集的长链插入环的序列比对,保守长链插入环以黑色突出显示。序列相对于H_N90(SEQ ID NO:1)以降序的总体序列同一性进行排列。HemG001(SEQ ID NO:11)和HemG003(SEQ ID NO:13)代表与H_N90具有超过70%的总体序列同一性的HemG PPO蛋白质。接下来的15个未框起的序列,其是H_N30(SEQ ID NO:4)、H_N40(SEQ ID NO:5)、H_N60(SEQ ID NO:7)、H_N20(SEQ ID NO:3)、H_N70(SEQ ID NO:8)、HemG005(SEQ ID NO:15)、H_N100(SEQ ID NO:9)、HemG002(SEQ ID NO:12)、HemG004(SEQ ID NO:14)、H_N110(SEQ ID NO:10)、H_N10(SEQ ID NO:2)、HemG006(SEQ ID NO:16)、HemG007(SEQ ID NO:17)、H_N50(SEQ ID NO:6)和HemG013(SEQ ID NO:23),代表与H_N90具有50-70%总体序列同一性的HemG PPO蛋白质。最后一个框的5个序列,其是HemG008(SEQ ID NO:18)、HemG009(SEQ ID NO:19)、HemG011(SEQ ID NO:21)、HemG012(SEQ ID NO:22)和HemG010(SEQ ID NO:20),代表与H_N90具有40-50%总体序列同一性的HemG PPO蛋白质。

[0021] 图2:示出了显示所有可能的mRNA三联体密码子(其中DNA分子中的T在RNA分子中被U代替)和由每个密码子编码的氨基酸的通用遗传密码图表。

[0022] 图3:示出了由微生物基因组筛选在H_N90(SEQ ID NO:1)的长链插入环中的每个

残基处发现的所有变化的图解表示。顶部的黑色框代表天然H_N90序列。H_N90序列下方的框列出了20个氨基酸中的每一个。H_N90序列上方所列的编号指明了相对氨基酸位置。实心灰色阴影代表在≥50％序列同一性组中所鉴定的氨基酸变化。竖灰色条纹阴影代表在40％-50％序列同一性组中所鉴定的氨基酸变化。剩余的白色未填充框代表在起始微生物数据集中在≥40％总体序列同一性下未观察到的氨基酸变化。

[0023] 图4:示出了从酶功能分析中获得的结果的图解表示。顶部的黑色框代表天然H_N90序列(SEQ ID NO:1)。H_N90序列下方的框列出了20个氨基酸中的每一个。H_N90序列上方所列的编号为相对氨基酸位置。竖灰色条纹阴影指示氨基酸修饰使得酶为非功能性的。浅灰色阴影与黑色字母指示氨基酸修饰引起酶功能受损。深灰色阴影与白色字母指示氨基酸变化使酶保持完全功能性。黑色阴影代表H_N90序列中的天然氨基酸。剩余的白色未填充框代表此分析中未测到的氨基酸变化。

[0024] 图5:示出了从除草剂耐受性分析获得的结果的图解版本。耐受性是相对于H_N90耐受性加以测量。顶部的黑色框代表天然H_N90序列(SEQ ID NO:1)。H_N90序列下方的框列出了20个氨基酸中的每一个。H_N90序列上方所列的编号为相对氨基酸位置。竖灰色条纹阴影代表0-24的相对耐受性得分,这表明氨基酸修饰几乎不赋予除草剂耐受性。竖灰色条纹阴影代表25-49的相对耐受性得分,这表明氨基酸修饰赋予弱除草剂耐受性。实心浅灰色阴影与黑色字母代表50-74的相对耐受性得分,这表明氨基酸修饰赋予中等除草剂耐受性。实心深灰色阴影与白色字母代表75-100的相对耐受性得分,这表明氨基酸修饰赋予良好除草剂耐受性。具有深灰色阴影和粗黑色边框的框代表显示大于100的相对耐受性得分的氨基酸修饰,这表明氨基酸修饰赋予比H_N90更佳的除草剂耐受性。黑色阴影代表H_N90序列中的天然氨基酸。剩余的白色未填充框代表此分析中未测到的氨基酸变化。

[0025] 序列简述

[0026] SEQ ID NO:1为H_N90的氨基酸序列。

[0027] SEQ ID NO:2至SEQ ID NO:10为具有保守长链插入环的微生物HemG PPO酶的氨基酸序列。

[0028] SEQ ID NO:11至SEQ ID NO:23为长链插入环中具有变化的多种HemG PPO酶的氨基酸序列。

[0029] SEQ ID NO:24至SEQ ID NO:124和SEQ ID NO:249至SEQ ID NO:263为各自将突变合并至长链插入环中的116个重组HemG PPO变体的氨基酸序列。

[0030] SEQ ID NO:125为编码SEQ ID NO:1的DNA序列。

[0031] SEQ ID NO:126至SEQ ID NO:147分别为编码SEQ ID NO:2至SEQ ID NO:23的DNA序列。

[0032] SEQ ID NO:148至SEQ ID NO:248和SEQ ID NO:264至SEQ ID NO:278分别为编码SEQ ID NO:24至SEQ ID NO:124和SEQ ID NO:249至SEQ ID NO:263的DNA序列。

## 具体实施方式

[0033] 提供以下描述和定义以更好地界定本发明并且在本发明的实践中指导本领域的一般技术人员。除非另外说明,否则术语应根据相关领域的一般技术人员的常规用法来理解。

[0034] 原卟啉原氧化酶在叶绿素与血红素生物合成途径中起作用,其中原卟啉原氧化酶将原卟啉原IX转化为原卟啉IX。除草剂耐受性原卟啉原氧化酶可用于产生对施用一种或多种PPO除草剂敏感的细胞、植物以及种子,并且可用于农业和杂草控制方法中。本发明提供了作为除草剂耐受性原卟啉原氧化酶的新颖工程化蛋白质,以及编码这些新颖工程化蛋白质的重组DNA分子、包含这些新颖工程化蛋白质的组合物以及使用这些新颖工程化蛋白质的方法。举例来说,在一个实施方案中,本发明提供了用于在细胞、植物以及种子中表达的DNA构建体,所述DNA构建体包含编码工程化除草剂耐受性原卟啉原氧化酶的重组DNA分子。在另一实施方案中,本发明提供了具有除草剂耐受性原卟啉原氧化酶活性的工程化蛋白质。在另一实施方案中,本发明提供了用于使用蛋白质工程化和生物信息学工具来获得和改进除草剂耐受性原卟啉原氧化酶的方法和组合物。本发明还提供了用于产生对PPO除草剂耐受的细胞、植物以及种子的方法和组合物,以及使用所述细胞、植物以及种子的杂草控制方法。

[0035] 本发明提供了新颖工程化蛋白质和编码它们的重组DNA分子。如本文所用,术语“工程化的”是指通常不会存在于自然界中,而是通过人类干预形成的非天然DNA、蛋白质、细胞或有机体。“工程化蛋白质”、“工程化酶”或“工程化PPO”是指在实验室中使用生物技术、蛋白质设计或蛋白质工程化中的一种或多种技术,诸如分子生物学、蛋白质生物化学、细菌转化、植物转化、定点诱变、使用随机诱变、基因组编辑、基因编辑、基因克隆、DNA连接、DNA合成、蛋白质合成以及DNA改组的定向进化构想并形成氨基酸序列的蛋白质、酶或PPO。举例来说,工程化蛋白质可相对于野生型蛋白质的编码序列具有一个或多个缺失、插入或取代,并且每个缺失、插入或取代可由一个或多个氨基酸组成。可使用基因工程化来形成编码具除草剂耐受性并且如本文所描述相对于野生型PPO蛋白质包含至少一个第一氨基酸取代的工程化蛋白质(例如工程化PPO)的DNA分子。

[0036] 本文提供的工程化蛋白质的实例为包含选自以下的一个或多个氨基酸取代的除草剂耐受性PPO:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N,包括其所有可能的组合,其中一个或多个氨基酸取代的位置是相对于SEQ ID NO:1中所示的氨基酸位置。在特定实施方案中,本文提供的工程化蛋白质包含此类取代的任何组合中的一者、二者、三者、四者、五者、六者、七者、八者、九者、十者或更多者。

[0037] 在一个实施方案中,由本发明提供的工程化蛋白质具有除草剂耐受性原卟啉原氧化酶活性。如本文所用,“除草剂耐受性原卟啉原氧化酶”意指在一种或多种PPO除草剂存在下原卟啉原氧化酶维持至少一些其原卟啉原氧化酶活性的能力。术语“原卟啉原氧化酶活性”意指催化原卟啉原IX的六电子氧化(除去电子)以形成原卟啉IX,即催化原卟啉原脱氢以形成原卟啉的能力。原卟啉原氧化酶的酶活性可通过本领域中已知的任何手段来测量,

例如通过酶分析,其中在一种或多种PPO除草剂存在下原卟啉原氧化酶的产物的产生或原卟啉原氧化酶的底物的消耗经由荧光、高效液相色谱法(HPLC)或质谱法(MS)来测量。用于测量原卟啉原氧化酶的酶活性的分析的另一实例为细菌分析,诸如本文所描述的分析,由此使重组原卟啉原氧化酶在其他情况下缺乏PPO活性的细菌细胞中表达,并且测量重组原卟啉原氧化酶补充此敲除表型的能力。如本文中所用,"hemG敲除菌株"意指缺乏HemG活性以致不能在不含血红素的生长培养基上生长,或使得生长在不存在血红素的情况下相对于包含功能性HemG的在其他方面同基因的菌株可检测地受损的有机体(诸如大肠杆菌)或有机体细胞。例如大肠杆菌的hemG敲除菌株可根据本领域中的知识,例如根据大肠杆菌HemG PPO序列(Ecogene登录号EG11485;Sasarman等,"Nucleotide sequence of the hemG gene involved in the protoporphyrinogen oxidase activity of E.coli K12"Can J Microbiol 39:1155-1161,1993)来制备。

[0038] 工程化蛋白质可通过改变或修饰野生型蛋白质序列以产生新蛋白质来产生,所述新蛋白质具有一种或多种改良的特性或诸如改变的$V_{最大}$、$K_m$、$K_i$、$IC_{50}$、底物特异性、抑制剂/除草剂特异性、底物选择性、与细胞中的其他组分(诸如伴侣蛋白或膜)相互作用的能力以及蛋白质稳定性等有用蛋白质特性的新颖组合。修饰可在蛋白质中的特定氨基酸位置进行,并且可通过用替代氨基酸取代在自然界中(即,在野生型蛋白质中)在相同位置发现的典型氨基酸来进行。可以蛋白质序列中的单个氨基酸取代的形式或与一个或多个其他修饰(诸如一个或多个其他氨基酸取代、缺失或添加)组合实现氨基酸修饰。在本发明的一个实施方案中,工程化蛋白质与野生型蛋白质相比具有改变的蛋白质特性(诸如使得对一种或多种除草剂的敏感性降低的那些蛋白质特性),或具有赋予表达工程化蛋白质的转基因植物对一种或多种除草剂的耐受性的能力。因此在一个实施方案中,本发明提供了一种具有除草剂耐受性原卟啉原氧化酶活性的工程化蛋白质(诸如PPO酶)以及编码它的重组DNA分子,所述工程化蛋白质具有选自由以下组成的的一个或多个氨基酸取代:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N以及其所有组合,其中一个或多个氨基酸取代的位置是相对于SEQ ID NO:1中所示的氨基酸位置。在特定实施方案中,本文提供的工程化蛋白质包含此类取代的任何组合中的一者、二者、三者、四者、五者、六者、七者、八者、九者、十者或更多者,其中修饰在相对于功能与如SEQ ID NO:1中所提供的氨基酸中类似的位置的位置处进行。表1中提供了重组或工程化HemG变体PPO的氨基酸序列。

[0039] 表1.重组或工程化HemG变体PPO的氨基酸序列.

[0040]

| 重组 HemG 变体 | 氨基酸序列(SEQ ID NO) | DNA 序列(SEQ ID NO) | 重组 HemG 变体 | 氨基酸序列(SEQ ID NO) | DNA 序列(SEQ ID NO) |
|---|---|---|---|---|---|
| G123A | 24 | 148 | M137A | 82 | 206 |
| L125A | 25 | 149 | M137C | 83 | 207 |
| L125F | 26 | 150 | M137I | 84 | 208 |
| L125I | 27 | 151 | M137L | 85 | 209 |
| L125V | 28 | 152 | M137S | 86 | 210 |
| R126A | 29 | 153 | M137V | 87 | 211 |
| Y127A | 30 | 154 | I138A | 88 | 212 |
| Y127H | 31 | 155 | I138L | 89 | 213 |

[0041]

| | | | | | |
|---|---|---|---|---|---|
| Y127M | 32 | 156 | I138M | 90 | 214 |
| Y127W | 33 | 157 | I138V | 91 | 215 |
| P128A | 34 | 158 | L140A | 92 | 216 |
| P128D | 35 | 159 | L140C | 93 | 217 |
| P128E | 36 | 160 | L140F | 94 | 218 |
| P128K | 37 | 161 | L140G | 95 | 219 |
| P128L | 38 | 162 | L140H | 96 | 220 |
| P128Q | 39 | 163 | L140I | 97 | 212 |
| P128R | 40 | 164 | L140K | 98 | 222 |
| P128S | 41 | 165 | L140M | 99 | 223 |
| P128T | 42 | 166 | L140R | 100 | 224 |
| R129A | 43 | 167 | L140T | 101 | 225 |
| R129E | 44 | 168 | I141A | 102 | 226 |
| R129G | 45 | 169 | I141L | 103 | 227 |
| R129H | 46 | 170 | I141M | 104 | 228 |
| R129I | 47 | 171 | I141V | 105 | 229 |
| R129K | 48 | 172 | M142A | 106 | 230 |
| R129L | 49 | 173 | M142D | 107 | 231 |
| R129N | 50 | 174 | M142L | 108 | 232 |
| R129Q | 51 | 175 | M142S | 109 | 233 |
| R129S | 52 | 176 | M142V | 110 | 234 |
| Y130A | 53 | 177 | R143A | 111 | 235 |
| Y130C | 54 | 178 | M144A | 112 | 236 |
| Y130L | 55 | 179 | T145A | 113 | 237 |
| Y130W | 56 | 180 | G146A | 114 | 238 |
| R131A | 57 | 181 | G146D | 115 | 239 |
| W132A | 58 | 182 | G146H | 116 | 240 |
| W132F | 59 | 183 | G146K | 117 | 241 |
| W132I | 60 | 184 | G146N | 118 | 242 |
| W132K | 61 | 185 | G147A | 119 | 243 |
| W132L | 62 | 186 | G147K | 120 | 244 |
| W132P | 63 | 187 | G147M | 121 | 245 |
| W132R | 64 | 188 | G147R | 122 | 246 |
| W132S | 65 | 189 | G147S | 123 | 247 |
| W132T | 66 | 190 | Q139A | 124 | 248 |
| W132V | 67 | 191 | Q139C | 249 | 264 |
| W132Y | 68 | 192 | Q139E | 250 | 265 |
| I133A | 69 | 193 | Q139G | 251 | 266 |
| D134A | 70 | 194 | Q139H | 252 | 267 |
| D134K | 71 | 195 | Q139K | 253 | 268 |
| D134N | 72 | 196 | Q139L | 254 | 269 |
| D134Q | 73 | 197 | Q139M | 255 | 270 |

[0042]

| | | | | | |
|---|---|---|---|---|---|
| D134T | 74 | 198 | Q139R | 256 | 271 |
| K135A | 75 | 199 | Q139S | 257 | 272 |
| K135Q | 76 | 200 | L140N | 258 | 273 |
| K135R | 77 | 201 | L140Q | 259 | 274 |
| K135S | 78 | 202 | L140S | 260 | 275 |
| K135T | 79 | 203 | L140V | 261 | 276 |
| K135V | 80 | 204 | L140W | 262 | 277 |
| V136A | 81 | 205 | L140Y | 263 | 278 |

[0043] 可通过将要进行突变的PPO酶的氨基酸序列与具有除草剂耐受性原卟啉原氧化酶活性的PPO酶的氨基酸序列比对在任何PPO酶的类似位置进行类似修饰。编码具有除草剂耐受性原卟啉原氧化酶活性的PPO酶的序列的一个实例为SEQ ID NO:1。图1A和图1B示出了H_N90、SEQ ID NO:1的PPO酶、示例性已知PPO酶(SEQ ID NOs:2-10)以及多种PPO酶(SEQ ID NOs:11-23)的比对。使用如图1A和图1B中所示的序列同一性信息例如在SEQ ID NO:2-23的蛋白质中进行本文所描述的氨基酸修饰以产生具有除草剂耐受性原卟啉原氧化酶活性的PPO酶完全在本领域技术人员的能力范围内。表2中提供了微生物HemG PPO的氨基酸序列。

[0044] 表2.微生物HemG PPO的氨基酸序列.

[0045]

| HemG PPO 蛋白质 | 氨基酸序列 (SEQ ID NO) | DNA 序列 (SEQ ID NO) |
|---|---|---|
| H_N90 | 1 | 125 |
| H_N10 | 2 | 126 |
| H_N20 | 3 | 127 |
| H_N30 | 4 | 128 |
| H_N40 | 5 | 129 |
| H_N50 | 6 | 130 |
| H_N60 | 7 | 131 |
| H_N70 | 8 | 132 |
| H_N100 | 9 | 133 |
| H_N110 | 10 | 134 |
| HemG001 | 11 | 135 |

[0046]

| | | |
|---|---|---|
| HemG002 | 12 | 136 |
| HemG003 | 13 | 137 |
| HemG004 | 14 | 138 |
| HemG005 | 15 | 139 |
| HemG006 | 16 | 140 |
| HemG007 | 17 | 141 |
| HemG008 | 18 | 142 |
| HemG009 | 19 | 143 |
| HemG010 | 20 | 144 |
| HemG011 | 21 | 145 |
| HemG012 | 22 | 146 |
| HemG013 | 23 | 147 |

[0047] 如本文所用,术语“重组”是指作为基因工程化的结果并且通过人类干预形成的非天然存在的DNA、蛋白质、细胞、种子或有机体。“重组DNA分子”为包含非天然存在并且因此为人类干预的结果的DNA序列的DNA分子,诸如包含彼此异源的至少两个DNA分子的DNA分子。重组DNA分子的实例为可操作地连接至异源启动子的编码除草剂耐受性原卟啉原氧化酶的本文所提供的DNA分子。“重组蛋白质”为包含非天然存在并且因此为人类干预的结果的氨基酸序列的蛋白质,诸如工程化蛋白质。重组细胞、种子或有机体为包含转基因或异源DNA或蛋白质的细胞、种子或有机体,例如包含本发明的DNA构建体或工程化蛋白质的转基因植物细胞、种子或植物。

[0048] 如本文所用,“野生型”意指天然存在的。“野生型DNA分子”、“野生型蛋白质”为天然存在的DNA分子或蛋白型式,即自然界中预先存在的DNA分子或蛋白质型式。DNA分子或蛋白质的野生型型式可用于与重组或工程化DNA分子或蛋白质比较。可用于与由本发明提供的工程化蛋白质比较的野生型蛋白质的实例为来自如SEQ ID NO:1所提供的阴沟肠杆菌(E.cloacae)的PPO酶(H_N90)。

[0049] “野生型植物”为天然存在的植物。此类野生型植物还可用于与包含重组或工程化DNA分子或蛋白质的植物比较。可用于与包含重组或工程化DNA分子或蛋白质的植物比较的野生型植物的实例可为与包含工程化DNA分子或蛋白质(诸如赋予除草剂耐受性性状的蛋白质)的植物类型相同的植物,并且因此在遗传上不同于包含除草剂耐受性性状的植物。

[0050] 在某些实施方案中,野生型植物还可用作或称为“对照植物”。如本文所用,“对照”意指出于比较目的而设计的实验对照。举例来说,转基因植物分析中的对照植物为与实验植物(即所要测试的植物)类型相同的植物,但不含实验植物的转基因插入、重组DNA分子或DNA构建体。可用于与转基因植物比较的对照植物的实例包括:对于玉米植物,非转基因LH244玉米(ATCC保藏号PTA-1173);对于与大豆植物比较:非转基因A3555大豆(ATCC保藏号PTA-10207);对于与棉花植物比较:非转基因Coker 130(植物品种保护(PVP)号8900252);对于与芥花或甘蓝型油菜(Brassica napus)植物比较:非转基因甘蓝型油菜品种65037恢复系(加拿大植物育种者权利申请06-5517);对于与小麦植物比较:非转基因小麦品种萨姆森(Samson)种质(PVP 1994)。

[0051] 如本文所用,术语“DNA”或“DNA分子”是指从5′(上游)端至3′(下游)端读取的基因

组或合成来源的双链DNA分子(即,脱氧核糖核苷酸碱基的聚合物或多核苷酸分子)。如本文所用,术语“DNA序列”是指DNA分子的核苷酸序列。本文所用的命名法对应于美国联邦法规§1.822的标题37,并且阐述于WIPO标准ST.25(1998)附录2的表格表1和表3中。

[0052] 本公开提供了一种编码具有选自由以下组成的组的一个或多个胺基酸取代的具有除草剂耐受性原卟啉原氧化酶活性的蛋白质的核酸分子:L125I、L125V、R126A、Y127W、P128A、P128D、P128E、P128K、P128L、P128Q、P128R、P128S、P128T、R129A、R129E、R129G、R129H、R129I、R129K、R129L、R129N、R129Q、R129S、Y130L、R131A、W132A、W132F、W132I、W132K、W132L、W132P、W132R、W132S、W132T、W132V、W132Y、I133A、D134A、D134N、D134Q、D134T、K135A、K135Q、K135R、K135S、K135T、K135V、V136A、M137A、M137C、M137I、M137L、M137S、M137V、I138L、I138M、I138V、Q139A、Q139C、Q139E、Q139G、Q139H、Q139K、Q139L、Q139M、Q139R、Q139S、L140A、L140C、L140F、L140G、L140H、L140I、L140M、L140N、L140Q、L140S、L140T、L140V、L140W、L140Y、I141V、M142L、M142S、M142V、R143A、M144A、T145A、G146A、G146D、G146H、G146K以及G146N以及其所有组合,其中一个或多个胺基酸取代的位置是相对于SEQ ID NO:1中所示的胺基酸位置。

[0053] 如本文所用,术语“编码蛋白质的DNA分子”是指包含编码蛋白质的DNA序列的DNA分子。如本文所用,术语“蛋白质”是指由肽(酰胺)键连接的氨基酸的链,并且包括以生物功能方式折叠或排列的多肽链与不以生物功能方式折叠或排列的多肽链两者。如本文所用,“蛋白质编码序列”意指编码蛋白质的DNA序列。如本文所用,“序列”意指核苷酸或氨基酸的依序排列。“DNA序列”可指核苷酸序列或包含核苷酸序列的DNA分子;“蛋白质序列”可指氨基酸序列或包含氨基酸序列的蛋白质。蛋白质编码序列的边界通常由5’端的翻译起始密码子和3’端的翻译终止密码子确定。

[0054] 如本文所用,术语“分离的”是指至少部分地使分子与在其天然状态下通常与它相关的其他分子分离。在一个实施方案中,术语“分离的”是指DNA分子与在天然状态下通常侧接DNA分子的核酸分离。举例来说,如果编码天然存在于细菌中的蛋白质的DNA分子不在天然地发现编码所述蛋白质的DNA分子的细菌的DNA内,那么它将为分离的DNA分子。因此,在本文中例如因重组DNA或植物转化技术而融合至或可操作地连接至在自然界中不相关的一个或多个其他DNA分子的DNA分子被认为是分离的。此类分子即使在与其他DNA分子一起整合至宿主细胞的染色体中或存在于核酸溶液中时也被认为是分离的。

[0055] 可使用任何数量的本领域技术人员熟知的方法来分离和操纵如本文中所公开的DNA分子或其片段。举例来说,可使用聚合酶链式反应(PCR)技术来扩增特定起始DNA分子或产生原始分子的变体。还可通过其他技术来获得DNA分子或其片段,诸如通过用化学手段直接合成片段,正如通常通过使用自动寡核苷酸合成仪所实施。

[0056] 由于遗传密码的简并性,多种不同DNA序列可编码蛋白质,诸如本文所公开的改变或工程化的蛋白质。举例来说,图2提供了显示所有可能的mRNA三联体密码子(其中DNA分子中的T在RNA分子中被U代替)和由每个密码子编码的氨基酸的通用遗传密码图表。可通过使用本领域已知的方法和图2中提供的信息向编码野生型PPO酶的DNA序列中引入突变来产生编码具有本文所描述的氨基酸取代的PPO酶的DNA序列。形成编码相同或基本上相同的如本文所描述的改变或工程化的蛋白质的替代DNA序列完全在本领域技术人员的能力范围内。这些变体或替代DNA序列在本文所描述的实施方案的范围内。如本文所用,提到“基本上相

同的”序列是指编码不实质上改变由本文所描述的实施方案的DNA分子编码的蛋白质的功能活性的氨基酸取代、缺失、添加或插入的序列。编码野生型或工程化蛋白质的核苷酸序列的等位基因变体也包含在本文所描述的实施方案的范围内。除具体列举或天然存在于野生型或工程化PPO酶中的那些氨基酸取代外的氨基酸取代也预期在本文所描述的实施方案范围内,只要具有取代的PPO酶仍大体上保留相同的本文所描述的功能活性即可。

[0057] 本发明的重组DNA分子可完全或部分通过本领域中已知的方法合成并修饰,其中需要提供可用于DNA操纵的序列(诸如限制性内切酶识别位点或基于重组的克隆位点)、植物偏爱序列(诸如植物-密码子使用或Kozak共有序列)或可用于DNA构建体设计的序列(诸如间隔子或接头序列)。本发明包括与本文所提供的重组DNA分子或氨基酸序列中的任一者具有至少50%序列同一性、至少60%序列同一性、至少70%序列同一性、至少80%序列同一性、至少85%序列同一性、至少90%序列同一性、至少91%序列同一性、至少92%序列同一性、至少93%序列同一性、至少94%序列同一性、至少95%序列同一性、至少96%序列同一性、至少97%序列同一性、至少98%序列同一性及至少99%序列同一性并且具有除草剂耐受性原卟啉原氧化酶活性的重组DNA分子和工程化蛋白质。如本文所用,术语“序列同一性百分比”或“序列同一性%”是指当对两个序列进行最佳比对(在比较窗口中具有共计不到参考序列的20%的适当核苷酸或氨基酸插入、缺失或空隙)时,与测试(‘目标’)序列(或它的互补链)相比,在参考(‘查询’)序列(或它的互补链)的线性多核苷酸或氨基酸序列中相同核苷酸或氨基酸的百分比。用于比对比较窗口的序列的最佳比对为本领域技术人员熟知的并且可通过诸如以下工具来进行:史密斯(Smith)和沃特曼(Waterman)的局部同一性算法、尼德曼(Needleman)和文施(Wunsch)的同一性比对算法、皮尔森(Pearson)和利普曼(Lipman)的相似性检索法以及通过这些算法的计算机实现方式,诸如GAP、BESTFIT、FASTA以及TFASTA,这些计算机实现方式可用作例如使用默认参数的GCG® Wisconsin Package®(Accelrys Inc.,San Diego,CA)、MEGAlign(DNAStar Inc.,1228S.Park St.,Madison,WI 53715)以及MUSCLE(3.6版)(RC Edgar,“MUSCLE:multiple sequence alignment with high accuracy and high throughput”Nucleic Acids Research 32(5):1792-7(2004))的序列分析软件包的一部分。测试序列与参考序列的比对区段的“同一性分数”为两个所比对序列共同拥有的相同组分的数目除以参考序列区段中所比对的部分(即整个参考序列或参考序列的更小的确定部分)中的组分总数目。序列同一性百分比以同一性分数乘以100表示。可将一个或多个序列与全长序列或其部分或与更长的序列比较。

[0058] 如本文所用,“DNA构建体”为包含两个或更多个异源DNA序列的重组DNA分子。DNA构建体可用于转基因表达并且可包含于载体和质粒中。可将DNA构建体用于载体中以进行转化(即,将异源DNA引入宿主细胞中)以产生重组细菌或转基因植物和细胞(并且因而还可含于转基因植物、种子、细胞或植物部分的质体DNA或基因组DNA中)。如本文所用,“载体”意指可用于细菌或植物转化的任何重组DNA分子。由本发明提供的DNA分子可例如作为具有可操作地连接至异源基因表达元件的DNA分子的DNA构建体的一部分插入载体中,所述异源基因表达元件在植物中起作用以实现由DNA分子编码的工程化蛋白质的表达。制备和使用DNA构建体和载体的方法为本领域中熟知的并且详细描述于例如包括Michael R.Green和Joseph Sambrook,“Molecular Cloning:A Laboratory Manual”(Fourth Edition)ISBN:978-1-936113-42-2,Cold Spring Harbor Laboratory Press,NY(2012)的手册和实验规

程中。DNA构建体或包含DNA构建体的载体的组件包括可操作地连接至可转录核酸序列的一个或多个基因表达元件,诸如以下:用于表达可操作地连接的DNA的启动子、可操作地连接的编码蛋白质的DNA分子以及可操作地连接的3'未翻译区(UTR)。可用于实践本发明的基因表达元件包括但不限于以下类型的元件中的一者或多者:启动子、5'UTR、增强子、前导子、顺式作用元件、内含子、转运序列、3'UTR以及一个或多个可选标记物转基因。

[0059] 术语"转基因"是指因人类干预诸如通过植物转化方法而人工合并至有机体的基因组中的DNA分子。如本文所用,术语"转基因的"意指包含转基因,例如"转基因植物"是指基因组中包含转基因的植物,并且"转基因性状"是指因存在合并至植物基因组中的转基因而带来或赋予的特征或表型。由于此类基因组改变,转基因植物为明显不同于相关野生型植物的植物并且转基因性状为不天然存在于野生型植物中的性状。本发明的转基因植物包含由本发明提供的重组DNA分子和工程化蛋白质。

[0060] 如本文所用,术语"异源"是指两个或更多个事物之间在自然界中通常不相关,例如衍生自不同来源或通常不以任何其他方式一起存在于自然界中的关系。举例来说,如果通常不一起存在于自然界中或相同背景中,那么DNA分子或蛋白质可相对于另一DNA分子、蛋白质、细胞、植物、种子或有机体为异源的。在某些实施方案中,如果两个DNA分子通常不在相同背景下一起存在于自然界中,那么第一DNA分子对于第二DNA分子为异源的。举例来说,如果编码蛋白质的重组DNA分子与可操作地连接的启动子的组合通常不存在于自然界中,那么编码蛋白质的重组DNA分子相对于可操作地连接的启动子为异源的。类似地,如果蛋白质与第二可操作地连接的蛋白质(诸如转运肽)的组合通常不存在于自然界中,那么蛋白质相对于第二可操作地连接的蛋白质(诸如转运肽)为异源的。在另一实施方案中,如果编码PPO酶的重组DNA分子与可操作地连接的在植物细胞中具功能性的启动子的组合通常不存在于自然界中,那么编码PPO酶的重组DNA分子相对于可操作地连接的在植物细胞中具功能性的启动子为异源的。当重组DNA分子不会天然地存在于它插入其中的细胞、种子或有机体中时,所述重组DNA分子也可相对于所述细胞、种子或有机体为异源的。

[0061] "异源蛋白质"为存在于不天然存在于其中的植物、种子、细胞、组织或有机体中或可操作地连接至不天然地与其连接的蛋白质的蛋白质。异源蛋白质的实例为包含本文所描述的至少一个第一氨基酸取代并且在任何植物、种子、细胞、组织或有机体中表达的工程化PPO酶。另一实例为可操作地连接至不天然地与其连接的第二蛋白质(诸如转运肽或除草剂耐受性蛋白质)的蛋白质或使用基因工程化技术引入不天然存在于其中的植物细胞中的蛋白质。

[0062] 如本文所用,"可操作地连接"意指两个或更多个DNA分子或两种或更多种蛋白质以使得一者可实现另一者的功能的方式相连接。可操作地连接的DNA分子或可操作地连接的蛋白质可为单一连续分子的一部分并且可能相邻或可能不相邻。举例来说,在DNA构建体中启动子与编码蛋白质的DNA分子可操作地连接,其中两个DNA分子如此排列使得启动子可实现转基因的表达。

[0063] 本发明的DNA构建体可包括可操作地连接至由本发明提供的编码蛋白质的DNA分子的启动子,借此启动子驱使工程化蛋白质表达。可用于实践本发明的启动子包括在细胞中起作用以使可操作地连接的DNA分子表达的那些启动子,诸如细菌或植物启动子。植物启动子为变化的并且为本领域中熟知的并且包括例如可诱导的、病毒的、合成的、组成性的、

时间调控的、空间调控的或空间时间调控的那些启动子。

[0064] 在本发明的一个实施方案中,本文所提供的DNA构建体包括编码转运序列的DNA序列,所述转运序列可操作地连接至编码PPO酶的异源DNA序列,借此转运序列有助于定位细胞内的蛋白质分子。转运序列在本领域中称为信号序列、靶向肽、靶向序列、定位序列以及转运肽。转运序列的实例为叶绿体转运肽(CTP)、线粒体转运序列(MTS)或双重叶绿体和线粒体转运肽。通过促进细胞内的蛋白质定位,转运序列可增加重组蛋白的累积,防止蛋白质发生蛋白降解或提高除草剂耐受性水平,并且由此降低除草剂施用之后细胞、种子或有机体中的损伤水平。可与本发明结合使用的CTP及其他靶向分子为本领域中熟知的。可使编码转运序列的DNA序列可操作地连接至如本文所提供的编码PPO酶的DNA序列。此类可操作的连接可涉及去除PPO序列5'端的起始甲硫氨酸密码子(ATG),不过不一定这样做,并且在去除或不去除起始甲硫氨酸密码子的情况下转运序列均将有助于定位细胞内的蛋白质分子。

[0065] 如本文所用,"转基因表达"、"使转基因表达"、"蛋白质表达"以及"使蛋白质表达"意指通过将DNA分子转录至信使RNA(mRNA)中以及将mRNA翻译为多肽链,多肽链最终折叠成蛋白质的过程来产生蛋白质。可在DNA构建体中使编码蛋白质的DNA分子可操作地连接至异源启动子,用于使蛋白质在用重组DNA分子转化的细胞中表达。

[0066] 在一个方面中,本发明提供了包含本发明的重组DNA分子或工程化蛋白质的细胞、组织、植物以及种子。这些包含重组DNA分子或工程化蛋白质的细胞、组织、植物以及种子对一种或多种PPO除草剂展现耐受性。

[0067] 一种产生此类细胞、组织、植物以及种子的方法为通过植物转化。适合用于本发明的用于转化宿主植物细胞的方法包括使DNA可被引入细胞中的任何方法(例如其中将重组DNA构建体稳定整合至植物染色体中)并且为本领域中熟知的。两种有效并且广泛使用的用于细胞转化的方法为土壤杆菌属(Agrobacterium)介导的转化和微弹轰击介导的转化。举例来说,美国专利号US 5,550,318;US 5,538,880;US 6,160,208;以及US 6,399,861中说明了微弹轰击法。举例来说,以全文引用的方式并入本文中的美国专利号US 5,591,616中描述了土壤杆菌属介导的转化方法。在使此类细胞再生为植物之前或之后,可针对重组DNA分子或工程化蛋白质的存在例如通过它所编码的酶活性选择具有本发明的重组DNA分子或工程化蛋白质的细胞。

[0068] 产生本发明的细胞、植物以及种子的另一方法为通过使用位点特异性整合或基因组编辑进行基因组修饰。可利用通过使用基因组编辑方法对植物基因组进行靶向修饰通过对植物基因组DNA的修饰来形成改良的植物株系。如本文所用,"定点整合"是指使所关注的一个或多个核酸能够靶向插入植物基因组中的基因组编辑方法。适合用于改变野生型DNA序列或预先存在的转基因序列或用于使DNA在预定染色体位点处插入植物基因组中的方法包括本领域中已知的任何方法。示例性方法包括使用序列特异性核酸酶,诸如锌指核酸酶、工程化或天然大范围核酸酶、TALE-核酸内切酶或RNA引导的核酸内切酶(例如成簇规律间隔短回文重复(CRISPR)/Cas9系统、CRISPR/Cpf1系统、CRISPR/CasX系统、CRISPR/CasY系统、CRISPR/级联系统)。若干实施方案涉及如由Sauer等,Plant Physiology 170(4):1917-1928(2016)所描述通过使用单链寡核苷酸将精确碱基对修饰引入植物基因组中的基因组编辑方法。用于对核酸序列进行修饰、使核酸序列缺失或将核酸序列插入基因组DNA中的基因组编辑方法为本领域中已知的。

[0069] 在某些实施方案中,本发明提供了用编码工程化蛋白质的序列(诸如本发明的工程化PPO编码序列)或包含此类工程化蛋白质的表达盒对植物基因组内的现有编码序列(诸如PPO编码序列或另一现有转基因插入物)的修饰或替换。若干实施方案涉及使用已知基因组编辑方法,诸如锌指核酸酶、工程化或天然大范围核酸酶、TALE-核酸内切酶或RNA引导的核酸内切酶(例如成簇规律间隔短回文重复(CRISPR)/Cas9系统、CRISPR/Cpf1系统、CRISPR/CasX系统、CRISPR/CasY系统、CRISPR/级联系统)。

[0070] 因此,若干实施方案可涉及一种重组DNA构建体,所述重组DNA构建体包含编码位点特异性核酸酶的一个或多个表达盒以及任选的一种或多种任何相关蛋白质以执行基因组修饰。这些核酸酶表达盒可与用于模板化编辑的供体模板或包含编码如本文所描述的PPO蛋白质的核酸序列的表达盒存在于相同的分子或载体中(呈顺式)或存在于单独的分子或载体上(呈反式)。本领域中已知若干用于定点整合的方法涉及不同的序列特异性核酸酶(或蛋白质或引导RNA或两者的复合物),从而切割基因组DNA以产生双链断裂(DSB)或在所需基因组位点或基因座处产生切口。如本领域中所了解,在修复由核酸酶引入的DSB或切口的过程期间,供体模板DNA、转基因或表达盒可变得在DSB或切口位点处整合至基因组中。要整合的DNA中存在一个或多个同源臂可促使插入序列在修复过程期间被接受并且通过同源重组靶向至植物基因组中,不过插入事件可通过非同源末端连接(NHEJ)来进行。

[0071] 如本文所用,术语“双链断裂诱导剂”是指可在DNA分子中诱导双链断裂(DSB)的任何剂。在一些实施方案中,双链断裂诱导剂为位点特异性基因组修饰酶。

[0072] 如本文所用,术语“位点特异性基因组修饰酶”是指可以序列特异性方式对核苷酸序列进行修饰的任何酶。在一些实施方案中,位点特异性基因组修饰酶通过诱导单链断裂对基因组进行修饰。在一些实施方案中,位点特异性基因组修饰酶通过诱导双链断裂对基因组进行修饰。在一些实施方案中,位点特异性基因组修饰酶包含胞苷脱氨酶。在一些实施方案中,位点特异性基因组修饰酶包含腺嘌呤脱氨酶。在本公开中,位点特异性基因组修饰酶包括核酸内切酶、重组酶、转座酶、脱氨酶、解旋酶以及其任何组合。在一些实施方案中,位点特异性基因组修饰酶为序列特异性核酸酶。

[0073] 在一个方面中,核酸内切酶选自大范围核酸酶、锌指核酸酶(ZFN)、转录激活子样效应物核酸酶(TALEN)、Argonaute(Argonaute蛋白的非限制性实例包括嗜热栖热菌(Thermus thermophilus)Argonaute(TtAgo)、强烈炽热球菌(Pyrococcus furiosus)Argonaute(PfAgo)、格氏嗜盐碱杆菌(Natronobacterium gregoryi)Argonaute(NgAgo)、RNA引导的核酸酶(诸如CRISPR相关核酸酶,CRISPR相关核酸酶的非限制性实例包括Cas1、Cas1B、Cas2、Cas3、Cas4、Cas5、Cas6、Cas7、Cas8、Cas9(也称为Csn1和Csx12)、Cas10、Csy1、Csy2、Csy3、Cse1、Cse2、Csc1、Csc2、Csa5、Csn2、Csm2、Csm3、Csm4、Csm5、Csm6、Cmr1、Cmr3、Cmr4、Cmr5、Cmr6、Csb1、Csb2、Csb3、Csx17、Csx14、Csx10、Csx16、CsaX、Csx3、Csx1、Csx15、Csf1、Csf2、Csf3、Csf4、Cpf1、CasX、CasY、其同源物或其经修饰型式)。

[0074] 在一些实施方案中,位点特异性基因组修饰酶为重组酶。重组酶的非限制性实例包括与DNA识别基序连接的酪氨酸重组酶,本文所提供的选自由Cre重组酶、Gin重组酶、Flp重组酶以及Tnp1重组酶组成的组。在一个方面中,本文所提供的Cre重组酶或Gin重组酶拴系至锌指DNA结合结构域或TALE DNA结合结构域或Cas9核酸酶。在另一方面中,本文所提供的与DNA识别基序连接的丝氨酸重组酶选自由PhiC31整合酶、R4整合酶以及TP-901整合酶

组成的组。在另一方面中,本文所提供的与DNA结合结构域连接的DNA转座酶选自由TALE-piggyBac和TALE-突变者(Mutator)组成的组。

[0075] 可通过引入所关注的DNA和所提供的位点特异性基因组修饰酶将本文所提供的所关注的DNA中的任一者整合至染色体序列的目标位点中。本文所提供的任何方法可使用本文所提供的任何位点特异性基因组修饰酶。

[0076] 在一个方面中,本发明提供了对PPO抑制剂除草剂耐受的细胞、植物以及种子。此类细胞、植物以及种子可用于诸如杂草控制和作物生产等农业方法中。

[0077] 如本文所用,“除草剂”为用于控制、阻止或妨碍一种或多种植物生长的任何分子。示例性除草剂包括乙酰辅酶A羧化酶(ACC酶)抑制剂(例如芳氧基苯氧基丙酸酯和环己二酮);乙酰乳酸合酶(ALS)抑制剂(例如磺酰脲、咪唑啉酮、三唑并嘧啶以及三唑啉酮);5-烯醇丙酮酰莽草酸(enolpyruvylshikimate)-3-磷酸合酶(EPSPS)抑制剂(例如草甘膦)、合成植物生长素(例如苯氧基、苯甲酸、羧酸、缩氨基脲)、光合作用(光合系统II)抑制剂(例如三嗪、三嗪酮、腈、苯并噻二唑以及脲)、谷氨酰胺合成酶(GS)抑制剂(例如草铵膦和双丙氨膦(bialaphos))、4-羟苯丙酮酸双加氧酶(HPPD)抑制剂(例如异噁唑、吡唑啉酮以及三酮)、原卟啉原氧化酶(PPO)抑制剂(例如二苯醚、N-苯基邻苯二甲酰亚胺、芳基三嗪酮以及嘧啶二酮)、极长链脂肪酸抑制剂(例如氯乙酰胺、氧乙酰胺以及吡唑)、纤维素生物合成抑制剂(例如茚嗪氟草胺(indaziflam))、光合系统I抑制剂(例如百草枯(paraquat))、微管组装抑制剂(例如二甲戊乐灵(pendimethalin))以及八氢番茄红素去饱和酶(PDS)抑制剂(例如达草灭(norflurazone))等。

[0078] 如本文所用,“PPO除草剂”为靶向原卟啉原氧化酶(PPO)并且抑制其酶活性的化学品,原卟啉原氧化酶催化原卟啉原IX脱氢以形成原卟啉IX,原卟啉IX为血红素和叶绿素的前体。原卟啉原氧化酶的抑制使得形成反应性氧物质,从而引起细胞膜破裂并且最终引起易感细胞死亡。PPO除草剂为本领域中熟知的并且可商购获得。PPO除草剂的实例包括但不限于二苯醚(诸如三氟羧草醚、其盐和酯、苯草醚(aclonifen)、治草醚(bifenox)、其盐和酯、氟乳醚(ethoxyfen)、其盐和酯、氟草醚(fluoronitrofen)、呋氧草醚(furyloxyfen)、氟硝磺酰胺(halosafen)、氯硝醚(chlomethoxyfen)、乙羧氟草醚(fluoroglycofen)、其盐和酯、乳氟禾草灵、其盐和酯、乙氧氟草醚以及氟磺胺草醚、其盐和酯);噻二唑(诸如氟噻甲草酯和噻二唑草胺(thidiazimin));嘧啶二酮或苯基尿嘧啶(诸如双苯嘧草酮(benzfendizone)、氟丙嘧草酯(butafenacil)、[3-2-氯-4-氟-5-(1-甲基-6-三氟甲基-2,4-二氧代-1,2,3,4-四氢嘧啶-3-基)苯氧基]-2-吡啶氧基]乙酸乙酯(CAS登记号353292-31-6并且在本文中称为S-3100)、氟嘧苯甲酸(flupropacil)、苯嘧磺草胺以及氟嘧硫草酯(tiafenacil));苯基吡唑(诸如异丙吡草酯(fluazolate)、吡草醚以及吡草醚乙酯);噁二唑(诸如丙炔噁草酮和噁草酮);三唑啉酮(诸如唑啶草酮、酰苯草酮(bencarbazone)、唑草酮(carfentrazone)、其盐和酯以及甲磺草胺);噁唑烷二酮(诸如环戊噁草酮);N-苯基邻苯二甲酰亚胺(诸如吲哚酮草酯(cinidon-ethyl)、氟烯草酸(flumiclorac)、氟烯草酸戊酯以及丙炔氟草胺);苯并噁嗪酮衍生物(诸如1,5-二甲基-6-硫代-3-(2,2,7-三氟-3,4-二氢-3-氧代-4-丙-2-炔基-2H-1,4-苯并噁嗪-6-基)-1,3,5-三嗪烷-2,4-二酮);氟哒嗪草酯(flufenpyr)和氟哒嗪草乙酯(flufenpyr-ethyl);双唑草腈(pyraclonil);以及氟唑草胺(profluazol)。由本发明提供的原卟啉原氧化酶和细胞、种子、植物以及植物部分对一种或

多种PPO除草剂展现除草剂耐受性。

[0079] 如本文所用,“除草剂耐受性的”或“除草剂耐受性”意指完全或部分不受存在或施用一种或多种除草剂影响(例如在施用时抵抗除草剂的毒性作用)的能力。如果在存在一种或多种除草剂的情况下细胞或有机体能够维持至少一些正常生长或表型,那么所述细胞或有机体为“除草剂耐受性的”。如果性状的存在可使得细胞、植物或种子对除草剂的耐受性与野生型或对照细胞、植物或种子相比有所改善,那么所述性状为除草剂耐受性性状。包含除草剂耐受性性状的作物可持续生长并且极少因除草剂的存在而受影响。如果目标酶在存在除草剂的情况下相对于野生型或对照酶展现改善的酶活性,那么目标酶为“除草剂耐受性的”。除草剂耐受性可为对特定除草剂完全或部分不敏感,并且可以对特定除草剂的耐受性或不敏感性百分比(%)表示。

[0080] 所涵盖的可产生的具有本发明的除草剂耐受性性状的植物可包括例如任何植物,包括作物植物,诸如大豆(橹豆(Glycine max))、玉米(玉蜀黍(Zea mays))、棉花(棉属(Gossypium sp.))以及芸苔属(Brassica)植物等。

[0081] 可将除草剂施用于包含由本发明提供的植物和种子的植物生长区域作为控制杂草的方法。由本发明提供的植物和种子包含除草剂耐受性性状并且因而对一种或多种PPO除草剂的施用具耐受性。除草剂施用可为所建议的商业比率(1X)或其任何分数或倍数,诸如两倍于所建议的商业比率(2X)。除草剂比率可根据除草剂和配分表示为每英亩每磅酸当量(lb ae/英亩)或每公顷每克酸当量(g ae/ha)或表示为每英亩活性成分磅数(lb ai/英亩)或每公顷活性成分克数(g ai/ha)。除草剂施用包含至少一种PPO除草剂。在施用除草剂时植物生长区域可能包含或可能不包含杂草植物。在一个区域中用于控制杂草的一种或多种PPO除草剂的除草有效剂量可由一个生长季节中约0.1X至约30X标记比率的范围组成。表3中提供了一些示例性PPO除草剂的1X标记比率。一(1)英亩等于2.47105公顷并且一(1)磅等于453.592克。除草剂比率可如下在英制与公制之间转换:(lb ai/ac)乘以1.12＝(kg ai/ha)和(kg ai/ha)乘以0.89＝(lb ai/ac)。

[0082] 表3.示例性PPO除草剂

[0083]

| PPO 除草剂 | 化学品家族 | 1X 比率 |
|---|---|---|
| 三氟羧草醚 | 二苯醚 | 420 g ai/ha |
| 氟磺胺草醚 | 二苯醚 | 420 g ai/ha |
| 乳氟禾草灵 | 二苯醚 | 70-220 g ai/ha |
| 乙羧氟草醚 | 二苯醚 | 15-40 g ai/ha |
| 乙氧氟草醚 | 二苯醚 | 0.28-2.24 kg ai/ha |
| 丙炔氟草胺 | N-苯基邻苯二甲酰亚胺 | 70-105 g ai/ha |
| 唑啶草酮 | 三唑啉酮 | 240 g ai/ha |
| 唑酮草酯 | 三唑啉酮 | 4-36 g ai/ha |

[0084]

| | | |
|---|---|---|
| 甲磺草胺 | 三唑啉酮 | 0.1-0.42 kg ai/ha |
| 氟噻甲草酯 | 噻二唑 | 3-15 g ai/ha |
| 丙炔噁草酮 | 噁二唑 | 50-150 g ai/ha |
| 噁草酮 | 噁二唑 | 2.24-4.48 kg ai/ha |
| 吡草醚 | 苯基吡唑 | 6-12 g ai/ha |
| 苯嘧磺草胺 | 嘧啶二酮 | 25-50 g/ha |
| S-3100 | 嘧啶二酮 | 5-80 g/ha |

[0085] 除草剂施用可为依序进行的或与若干PPO除草剂中的一种、两种或组合或任何其他相容除草剂桶混。在生长季节中可将一种除草剂或两种或更多种除草剂组合或单独多次施用用于包含本发明的转基因植物的区域以控制广谱的双子叶杂草、单子叶杂草或两者，例如两次施用(诸如种植前施用和出土后施用或出土前施用和出土后施用)或三次施用(诸如种植前施用、出土前施用以及出土后施用或出土前施用和两次出土后施用)。

[0086] 如本文所用，“杂草”为任何不希望的植物。植物可对于农业或园艺目的通常被视为不希望的(例如苋属(Amaranthus)物种)或可在特定情况下被视为不希望的(例如不同物种领域内的一个物种的作物植物，也称为自生植物)。

[0087] 本发明的转基因植物、子代、种子、植物细胞以及植物部分还可含有一种或多种额外的性状。可通过使含有包含由本发明提供的重组DNA分子的转基因的植物与含有一种或多种额外的性状的另一植物杂交来引入额外的性状。如本文所用，“杂交”意指培育两种个别植物以产生子代植物。因此可使两种植物杂交以从每个母体产生含有所需性状的子代。如本文所用，“子代”意指亲本植物的任一代后代，并且转基因子代包含由本发明提供并且从至少一种亲本植物继承的DNA构建体。

[0088] 还可通过用包含由本发明提供的重组DNA分子的DNA构建体(例如用作为用于植物转化的相同载体的一部分存在的所有DNA构建体)针对所述一种或多种额外的转基因性状对DNA构建体进行共转化或通过将一种或多种额外的性状插入包含由本发明提供的DNA构建体的转基因植物中或反之亦然(例如通过对转基因植物或植物细胞使用植物转化或基因组编辑的方法中的任一者)来引入一种或多种额外的性状。此类额外性状包括但不限于增加的抗虫性、增加的水分利用效率、增加的产量表现、增加的抗旱性、增加的种子质量、改善的营养质量、杂交种子产量以及除草剂耐受性，其中所述性状是相对于野生型植物测量的。示例性额外除草剂耐受性性状可包括对诸如以下的一种或多种除草剂的转基因或非转基因耐受性：ACC酶抑制剂(例如芳氧基苯氧基丙酸酯和环己二酮)、ALS抑制剂(例如磺酰脲、咪唑啉酮、三唑并嘧啶以及三唑啉酮)EPSPS抑制剂(例如草甘膦)、合成植物生长素(例如苯氧基、苯甲酸、羧酸、缩氨基脲)、光合作用抑制剂(例如三嗪、三嗪酮、腈、苯并噻二唑以及脲)、谷氨酰胺合成抑制剂(例如草铵膦)、HPPD抑制剂(例如异噁唑、吡唑啉酮以及三酮)、PPO抑制剂(例如二苯醚、N-苯基邻苯二甲酰亚胺、芳基三嗪酮以及嘧啶二酮)以及长链脂肪酸抑制剂(例如氯乙酰胺、氧乙酰胺以及吡唑)等。可用于产生额外除草剂耐受性性状的除草剂耐受性蛋白质的实例为本领域中熟知的并且包括但不限于草甘膦耐性5-烯醇丙酮酰

莽草酸3-磷酸合酶(例如CP4EPSPS,2mEPSPS)、草甘膦氧化还原酶(GOX)、草甘膦N-乙酰转移酶(GAT)、除草剂耐受性乙酰乳酸合酶(ALS)/乙酰羟基酸合酶(AHAS)、除草剂耐受性4-羟苯丙酮酸双加氧酶(HPPD)、麦草畏单加氧酶(DMO)、草丁膦乙酰转移酶(PAT)、除草剂耐受性谷氨酰胺合成酶(GS)、2,4-二氯苯氧基丙酸双加氧酶(TfdA)、R-2,4-二氯苯氧基丙酸双加氧酶(RdpA)、S-2,4-二氯苯氧基丙酸双加氧酶(SdpA)、除草剂耐受性原卟啉原氧化酶(PPO)以及细胞色素P450单加氧酶。示例性抗虫性性状可包括对鳞翅目、鞘翅目、半翅目、缨翅目、双翅目、膜翅目以及直翅目等目中的一者或多者内的一个或多个昆虫成员的抗性。此类额外性状为本领域技术人员熟知的;例如美国农业部(USDA)动植物健康检查服务部门(APHIS)提供了此类转基因性状的列表。

[0089] 可在本领域中已知的任何育种方法情况下使用对PPO除草剂耐受的转基因植物和子代。在包含两个或更多个性状的植物株系中,所述性状在包含三个或更多个转基因性状的植物株系中可为独立分隔的、相关联的或两者的组合。正如营养繁殖一般,还涵盖与亲本植物回交和与非转基因植物异交。常用于不同性状和作物的育种方法的描述为本领域技术人员熟知的。为确认特定植物或种子中存在所述一个或多个转基因,可进行多种分析。此类分析包括例如分子生物学分析,诸如南方和北方墨点分析、PCR以及DNA测序;生物化学分析,诸如检测蛋白质产物的存在,例如通过免疫手段(ELISA和西方墨点法)或通过酶功能;植物部分分析,诸如叶或根分析;以及通过分析整个植物的表型。

[0090] 因回交转化过程实现转基因性状种质渗入植物基因型中。转基因性状已种质渗入其中之植物基因型可被称为回交转化的基因型、系、近交种或杂交种。类似地,缺乏所需转基因性状的植物基因型可被称为未转化的基因型、系、近交种或杂交种。

[0091] 如本文所用,术语“包含”意指“包括但不限于”。

[0092] 在已详细描述本发明的情况下,将清楚的是,在不背离随附权利要求书中所确定的本发明范围的情况下,修改、变化以及等效实施方案为可能的。此外,应了解,本公开中的实施例是作为非限制性实施例而被提供。

[0093] 实施例

[0094] 实施例1:微生物HemG蛋白质的长链环内的序列多样性

[0095] 针对蛋白质的长链插入环的多样性对不同的HemG PPO酶集合进行检验。长链插入环为微生物HemG PPO酶的定义特征并且在存在主要保守残基的情况下长约25个残基(Boynton等,Biochemistry(2009)48:6705-6711)。

[0096] 使用来自各种微生物的1,013个HemG PPO序列的起始集合进行基因组分析。设计算法以捕获蛋白质的总体序列多样性与长链插入环内的多样性。然后基于起始集合内的总体序列相似性将序列分选至多个组中。

[0097] 为形成第一组,鉴定了起始集合中与具有除草剂耐受性原卟啉原氧化酶活性的HemG PPO H_N90(SEQ ID NO:1)具有≥70%序列同一性的所有序列。然后,重复所述分析以鉴定与第一次分析中所鉴定的任何序列具有≥70%序列同一性的序列。最后,第三次重复检索以鉴定与第二次分析中所鉴定的任何序列具有≥70%序列同一性的序列。将三次分析的结果汇总在一起以形成第一组,所述第一组代表来自≥70%序列同一性分析的三次迭代的序列,总共273个HemG PPO序列。

[0098] 通过集中于来自起始集合的剩余未分组序列来形成第二组。鉴定了与HemG PPO

H_N90具有50％-70％序列同一性的所有序列。然后,重复所述分析以鉴定与第一次分析中所鉴定的任何序列具有≥70％序列同一性的序列。最后,第三次重复检索以鉴定与第二次分析中所鉴定的任何序列具有≥70％序列同一性的序列。将三次分析的结果汇总在一起以形成第二组,所述第二组代表来自所有三次迭代的序列,总共278个HemG PPO序列。

[0099] 通过集中于来自起始集合的仍剩余的未分组序列来形成第三组。鉴定了与HemG PPO H_N90具有40％-50％序列同一性的所有序列。然后,重复所述分析以鉴定与第一次分析中所鉴定的任何序列具有≥70％序列同一性的序列。进行第三次检索以鉴定与第二次分析中所鉴定的任何序列具有≥70％序列同一性的序列,但这最后一次迭代未捕获来自起始集合的任何额外序列。将两次分析的结果汇总在一起以形成第三组,所述第三组代表来自两次迭代的序列,总共66个HemG PPO序列。

[0100] 然后使用三组序列来分析长链插入环中的25个氨基酸处存在的变化。对各PPO的长链插入环序列进行鉴定和编译。意外地,发现对于第一组和第二组,此结构域中的序列变化为类似的,尽管这两个组的序列在组合时具有高达50％的总序列变化并且代表551个不同的序列。图3提供在来自三个组的617个序列中在长链插入环中所发现的变化的综述。在长链插入环的25个氨基酸位置中,从617个HemG PPO序列鉴定了211个不同氨基酸。图1A和图1B示出了23个微生物HemG PPO序列的子集的长链插入环(黑色突出显示)的序列比对。

[0101] 选择一组17个HemG PPO序列来代表在长链插入环中发现的变化。当使用成对序列比对比较时,17种不同的HemG PPO酶的蛋白质序列在全长序列上具有在约15％至98％同一性范围内的同一性百分比。针对原卟啉原氧化酶活性和除草剂耐受性对这17种不同的HemG PPO酶进行了测试。

[0102] 使用原卟啉原氧化酶细菌筛选系统来测试蛋白质的原卟啉原氧化酶活性并且因此证实它们为功能性PPO酶。此筛选系统使用大肠杆菌菌株中的功能拯救分析,所述大肠杆菌菌株含有关于大肠杆菌HemG PPO酶(在本文中称为H_N10并且对应于SEQ ID NO:2)的基因敲除。将hemG敲除大肠杆菌菌株用各自含有用于PPO酶中的一者的表达盒的细菌表达载体转化并且在LB培养基上培养。hemG敲除大肠杆菌菌株在经典细菌培养基(例如LB培养基)上显示极少的生长,但当细菌培养基补充有游离血红素时或当功能性原卟啉原氧化酶在细胞中表达时可恢复正常生长。使用两种对照用于比较:绿色荧光蛋白(GFP)和未转化的细胞。HemG PPO酶中的两种(HemG014和HemG015)不能拯救hemG敲除大肠杆菌菌株(无原卟啉原氧化酶活性),两种以较慢的生长显示部分拯救(中间),并且剩余的13种显示完全拯救表型(功能性)。表4中示出了结果。

[0103] 设计原生质体除草剂耐受性分析以测试17种不同的HemG PPO酶在植物细胞中的除草剂耐受性。合成编码17种不同的HemG PPO酶的重组DNA分子(针对双子叶植物表达进行密码子优化)并且克隆至植物转化载体中。表达构建体含有可操作地连接至植物启动子、叶绿体转运肽以及3'未翻译区的编码17种不同的HemG PPO酶中的一者的重组DNA分子。用植物转化载体使用标准方法对大豆原生质体进行转化。使转化的原生质体在存在1.0μM浓度的PPO除草剂S-3100或模拟处理(阴性对照)的情况下生长。然后针对PPO除草剂耐受性对原生质体进行分析,相对于设定为100的HemG PPO酶H_N90的得分进行标准化。分两批重复四次进行分析。对每一者的相对耐受性得分取平均值并且计算标准误差(SE)。GFP对照分析的耐受性得分为0,证实在不存在除草剂耐受性蛋白质的情况下大豆原生质体对PPO除草剂不

耐受。各种HemG PPO酶(HemG014和HemG015)中的两种未提供耐受性,而另外14种相对于H_N90提供24至89范围内的耐受性得分。表4中示出了结果。

[0104] 然后使各种HemG PPO酶中的十五种在转基因植物中表达,并且分析转基因植物的PPO除草剂耐受性。合成编码15种不同的HemG PPO酶的重组DNA分子(针对双子叶植物或单子叶植物表达进行密码子优化)并且克隆至植物转化载体中。表达构建体含有可操作地连接至植物启动子、叶绿体转运肽以及3'未翻译区的编码15种不同的HemG PPO酶中的一者的重组DNA分子。

[0105] 使用根癌土壤杆菌(Agrobacterium tumefaciens)和本领域中已知的标准方法用这些载体对玉米细胞进行转化。使再生的$R_0$转基因幼苗在温室中生长。在约$V_2$至$V_4$生长期用PPO除草剂S3100按80g/ha的比率对植物进行喷洒以评估耐受性。在处理之后1-14天针对损伤对植物进行评估并且记录损伤得分。针对所有植物对于各种HemG PPO酶中的每一者,计算目视损伤得分为20%或更低的植物的百分比。将25%或更多的个别植物显示良好耐受性(目视损伤得分为20%或更低)的任何构建体视为有效赋予除草剂耐受性。各种HemG PPO酶中的八种(HemG001、HemG002、HemG003、HemG004、HemG005、HemG006、HemG011以及HemG012)提供了大量对PPO除草剂展现耐受性(在处理之后具有20%或更少损伤)的玉米植物。表4中示出了结果。

[0106] 使用根癌土壤杆菌和本领域中已知的标准方法用这些载体对大豆细胞进行转化。使再生的$R_0$转基因幼苗在温室中生长。在约$V_2$至$V_4$生长期用PPO除草剂S3100按20g/ha的比率对植物进行喷洒以评估耐受性。在处理之后1-14天针对损伤对植物进行评估并且记录损伤得分。针对所有植物对于各种HemG PPO酶中的每一者,计算目视损伤得分为20%或更低的植物的百分比。将25%或更多的个别植物显示良好耐受性(目视损伤得分为20%或更低)的任何构建体视为有效赋予除草剂耐受性。各种HemG PPO酶中的十种(HemG001、HemG002、HemG003、HemG004、HemG005、HemG006、HemG007、HemG009、HemG011以及HemG013)提供了大量对PPO除草剂展现耐受性(在处理之后具有20%或更少损伤)的大豆植物。表4中示出了结果。

[0107] 表4.各种HemG PPO酶的测试

[0108]

| 基因/蛋白质 | 大肠杆菌中的 PPO 补充性分析 | 原生质体耐受性得分 (H_N90-CTP 的百分比) | 玉米 合格率 | 大豆 合格率 |
|---|---|---|---|---|
| 对照-GFP | 无 | 0 | 没有数据 | 没有数据 |
| 对照-空白 | 无 | 7 | 没有数据 | 没有数据 |
| H_N90 | 功能性 | 100 | 没有数据 | 没有数据 |
| H_N10 | 功能性 | 61 | 没有数据 | 没有数据 |
| HemG001 | 功能性 | 85 | 58 | 66 |
| HemG002 | 功能性 | 77 | 43 | 80 |
| HemG003 | 功能性 | 87 | 44 | 66 |
| HemG004 | 功能性 | 87 | 47 | 50 |
| HemG005 | 功能性 | 85 | 29 | 50 |
| HemG006 | 功能性 | 84 | 36 | 100 |

[0109]

| | | | | |
|---|---|---|---|---|
| HemG007 | 功能性 | 81 | 没有数据 | 50 |
| HemG008 | 功能性 | 51 | 4 | 0 |
| HemG009 | 功能性 | 82 | 没有数据 | 100 |
| HemG010 | 中间 | 24 | 2 | 0 |
| HemG011 | 功能性 | 86 | 52 | 75 |
| HemG012 | 中间 | 45 | 0 | 0 |
| HemG013 | 功能性 | 89 | 30 | 90 |
| HemG014 | 无 | -9 | 0 | 0 |
| HemG015 | 无 | -15 | 0 | 0 |

[0110] 在稳定转化的玉米和大豆(或两者)中所测试的15种不同的HemG PPO酶中,10种被发现有效赋予除草剂耐受性(产生多于25%的目视损伤得分为20%或更低的植物)。这些有效赋予植物除草剂耐受性的HemG PPO酶的序列提供如下:HemG001(SEQ ID NO:11)、HemG002(SEQ ID NO:12)、HemG003(SEQ ID NO:13)、HemG004(SEQ ID NO:14)、HemG005(SEQ ID NO:15)、HemG006(SEQ ID NO:16)、HemG007(SEQ ID NO:17)、HemG009(SEQ ID NO:19)、HemG011(SEQ ID NO:21)以及HemG013(SEQ ID NO:23)。

[0111] 实施例2:长链插入环变体的功能表征

[0112] HemG蛋白质的长链插入环已被描述为PPO酶功能所必需的并且许多残基被报道为高度保守的(Boynton等,Biochemistry(2009)48:6705-6711)。形成在长链插入环内引入氨基酸变化的重组HemG PPO酶,然后在细菌分析中分析酶功能的变化。

[0113] 使用实施例2中所描述的原卟啉原氧化酶细菌筛选系统来测试变体蛋白质的原卟啉原氧化酶活性。此分析提供了快速并且容易地分析变体蛋白质的原卟啉原氧化酶活性的手段。

[0114] 如下设计将突变合并至长链插入环中的重组HemG PPO酶。独立地考虑长链插入环

的每个氨基酸并且基于在所述位置所鉴定的变化的量以及所述变化中有多少是在序列组中的哪一个中被发现按优先级进行排列。基于此评估,选择长链插入环中的25个氨基酸中的21个用于诱变。在H_N90序列中形成突变以代表在这21个位置中的每一者处所观测的变化,从而产生109个单氨基酸变体。此外,使用H_N90序列进行丙氨酸扫描诱变以产生在长链插入环中在H_N90中并非已为丙氨酸的每个位置具有丙氨酸的突变体,从而产生10种额外变体。然后将总的119种单氨基酸变异体用于筛选。

[0115] 然后合成编码119种变体的重组DNA分子并且克隆至细菌转化载体中的表达构建体中。对于每种变体,整个核苷酸序列保持与H_N90核苷酸序列相同,除了用于突变体氨基酸的密码子。表达构建体含有可操作地连接至植物启动子、APG6叶绿体转运肽以及3'未翻译区的编码119种变体的重组DNA分子中的每一者。阳性对照由含有可操作地连接至植物启动子、APG6叶绿体转运肽以及3'未翻译区的H_N90编码序列的表达构建体组成。将每个载体个别地转化至hemG敲除大肠杆菌菌株中。作为阴性对照,将模拟转化(不存在载体)和用于表达绿色荧光蛋白(GFP)的载体个别地转化至hemG敲除大肠杆菌菌株中。

[0116] 针对在LB板上恢复hemG敲除大肠杆菌菌株的正常生长的能力对119种变体中的每一者进行筛选。由三个个体以设盲方式并且独立地对所有板进行评分:无生长(变体未补充)、缓慢生长(变体具有降低的酶功能)或正常生长(变体具有完全酶功能并且提供完全补充性)。基于板上的菌落尺寸而非菌落数目来测量生长,并且三个个体同意所有评级。表5示出了分析的结果。在此分析中,119种变体中的105种恢复正常生长,表明这些变体具有完全PPO功能;119种变体中的6种展现显著较慢生长速率的菌落生长,表明这些变体具有降低的PPO功能;并且119种变体中的8种未展现菌落生长,表明这些变体没有PPO功能。正如所料,阳性对照全部显示补充性,不过H_N10构建体生长得比H_N90构建体慢。图4示出了此分析的结果的图解表示。

[0117] 表5.HemG变体补充性分析

[0118]

| HemG 构建体 | WT AA | AA 变化 | AA 位置 | NT 位置 | 生长速率 |
|---|---|---|---|---|---|
| GFP 对照 | | | | | 无生长 |
| 模拟对照 | | | | | 无生长 |
| H_N10 | | | | | 缓慢生长 |
| H_N90-无 CTP | | | | | 正常 |
| H_N90-CTP | | | | | 正常 |
| H_N90_G123A | Gly | Ala | 123 | 367 | 无生长 |
| H_N90_L125A | Leu | Ala | 125 | 373 | 正常 |
| H_N90_L125F | Leu | Phe | 125 | 373 | 无生长 |
| H_N90_L125I | Leu | Ile | 125 | 373 | 正常 |
| H_N90_L125V | Leu | Val | 125 | 373 | 正常 |
| H_N90_R126A | Arg | Ala | 126 | 376 | 正常 |
| H_N90_Y127A | Tyr | Ala | 127 | 379 | 缓慢生长 |
| H_N90_Y127H | Tyr | His | 127 | 379 | 缓慢生长 |
| H_N90_Y127M | Tyr | Met | 127 | 379 | 正常 |
| H_N90_Y127W | Tyr | Trp | 127 | 379 | 正常 |
| H_N90_P128A | Pro | Ala | 128 | 382 | 正常 |
| H_N90_P128D | Pro | Asp | 128 | 382 | 正常 |
| H_N90_P128E | Pro | Glu | 128 | 382 | 正常 |
| H_N90_P128K | Pro | Lys | 128 | 382 | 正常 |
| H_N90_P128L | Pro | Leu | 128 | 382 | 正常 |
| H_N90_P128Q | Pro | Gln | 128 | 382 | 正常 |
| H_N90_P128R | Pro | Arg | 128 | 382 | 正常 |
| H_N90_P128S | Pro | Ser | 128 | 382 | 正常 |
| H_N90_P128T | Pro | Thr | 128 | 382 | 正常 |
| H_N90_R129A | Arg | Ala | 129 | 385 | 正常 |
| H_N90_R129E | Arg | Glu | 129 | 385 | 正常 |
| H_N90_R129G | Arg | Gly | 129 | 385 | 正常 |
| H_N90_R129H | Arg | His | 129 | 385 | 正常 |
| H_N90_R129I | Arg | Ile | 129 | 385 | 正常 |
| H_N90_R129K | Arg | Lys | 129 | 385 | 正常 |
| H_N90_R129L | Arg | Leu | 129 | 385 | 正常 |
| H_N90_R129N | Arg | Asn | 129 | 385 | 正常 |
| H_N90_R129Q | Arg | Gln | 129 | 385 | 正常 |
| H_N90_R129S | Arg | Ser | 129 | 385 | 正常 |
| H_N90_Y130A | Tyr | Ala | 130 | 388 | 正常 |

[0119]

| | | | | | |
|---|---|---|---|---|---|
| H_N90_Y130C | Tyr | Cys | 130 | 388 | 正常 |
| H_N90_Y130L | Tyr | Leu | 130 | 388 | 正常 |
| H_N90_Y130W | Tyr | Trp | 130 | 388 | 正常 |
| H_N90_R131A | Arg | Ala | 131 | 391 | 正常 |
| H_N90_W132A | Trp | Ala | 132 | 394 | 正常 |
| H_N90_W132F | Trp | Phe | 132 | 394 | 正常 |
| H_N90_W132I | Trp | Ile | 132 | 394 | 正常 |
| H_N90_W132K | Trp | Lys | 132 | 394 | 正常 |
| H_N90_W132L | Trp | Leu | 132 | 394 | 正常 |
| H_N90_W132P | Trp | Pro | 132 | 394 | 正常 |
| H_N90_W132R | Trp | Arg | 132 | 394 | 正常 |
| H_N90_W132S | Trp | Ser | 132 | 394 | 正常 |
| H_N90_W132T | Trp | Thr | 132 | 394 | 正常 |
| H_N90_W132V | Trp | Val | 132 | 394 | 正常 |
| H_N90_W132Y | Trp | Tyr | 132 | 394 | 正常 |
| H_N90_I133A | Ile | Ala | 133 | 397 | 正常 |
| H_N90_D134A | Asp | Ala | 134 | 400 | 正常 |
| H_N90_D134K | Asp | Lys | 134 | 400 | 正常 |
| H_N90_D134N | Asp | Asn | 134 | 400 | 正常 |
| H_N90_D134Q | Asp | Gln | 134 | 400 | 正常 |
| H_N90_D134T | Asp | Thr | 134 | 400 | 正常 |
| H_N90_K135A | Lys | Ala | 135 | 403 | 正常 |
| H_N90_K135Q | Lys | Gln | 135 | 403 | 正常 |
| H_N90_K135R | Lys | Arg | 135 | 403 | 正常 |
| H_N90_K135S | Lys | Ser | 135 | 403 | 正常 |
| H_N90_K135T | Lys | Thr | 135 | 403 | 正常 |
| H_N90_K135V | Lys | Val | 135 | 403 | 正常 |
| H_N90_V136A | Val | Ala | 136 | 406 | 正常 |
| H_N90_M137A | Met | Ala | 137 | 409 | 正常 |
| H_N90_M137C | Met | Cys | 137 | 409 | 正常 |
| H_N90_M137I | Met | Ile | 137 | 409 | 正常 |
| H_N90_M137L | Met | Leu | 137 | 409 | 正常 |
| H_N90_M137S | Met | Ser | 137 | 409 | 正常 |
| H_N90_M137V | Met | Val | 137 | 409 | 正常 |
| H_N90_I138A | Ile | Ala | 138 | 412 | 缓慢生长 |
| H_N90_I138L | Ile | Leu | 138 | 412 | 正常 |
| H_N90_I138M | Ile | Met | 138 | 412 | 正常 |

[0120]

| | | | | | |
|---|---|---|---|---|---|
| H_N90_I138V | Ile | Val | 138 | 412 | 正常 |
| H_N90_Q139A | Gln | Ala | 139 | 415 | 正常 |
| H_N90_Q139C | Gln | Cys | 139 | 415 | 正常 |
| H_N90_Q139E | Gln | Glu | 139 | 415 | 正常 |
| H_N90_Q139G | Gln | Gly | 139 | 415 | 正常 |
| H_N90_Q139H | Gln | His | 139 | 415 | 正常 |
| H_N90_Q139K | Gln | Lys | 139 | 415 | 正常 |
| H_N90_Q139L | Gln | Leu | 139 | 415 | 正常 |
| H_N90_Q139M | Gln | Met | 139 | 415 | 正常 |
| H_N90_Q139R | Gln | Arg | 139 | 415 | 正常 |
| H_N90_Q139S | Gln | Ser | 139 | 415 | 正常 |
| H_N90_L140A | Leu | Ala | 140 | 418 | 正常 |
| H_N90_L140C | Leu | Cys | 140 | 418 | 正常 |
| H_N90_L140D | Leu | Asp | 140 | 418 | 无生长 |
| H_N90_L140E | Leu | Glu | 140 | 418 | 缓慢生长 |
| H_N90_L140F | Leu | Phe | 140 | 418 | 正常 |
| H_N90_L140G | Leu | Gly | 140 | 418 | 正常 |
| H_N90_L140H | Leu | His | 140 | 418 | 正常 |
| H_N90_L140I | Leu | Ile | 140 | 418 | 正常 |
| H_N90_L140K | Leu | Lys | 140 | 418 | 正常 |
| H_N90_L140M | Leu | Met | 140 | 418 | 正常 |
| H_N90_L140N | Leu | Asn | 140 | 418 | 正常 |
| H_N90_L140P | Leu | Pro | 140 | 418 | 无生长 |
| H_N90_L140Q | Leu | Gln | 140 | 418 | 正常 |
| H_N90_L140R | Leu | Arg | 140 | 418 | 正常 |
| H_N90_L140S | Leu | Ser | 140 | 418 | 正常 |
| H_N90_L140T | Leu | Thr | 140 | 418 | 正常 |
| H_N90_L140V | Leu | Val | 140 | 418 | 正常 |
| H_N90_L140W | Leu | Trp | 140 | 418 | 正常 |
| H_N90_L140Y | Leu | Tyr | 140 | 418 | 正常 |
| H_N90_I141A | Ile | Ala | 141 | 421 | 无生长 |
| H_N90_I141L | Ile | Leu | 141 | 421 | 正常 |
| H_N90_I141M | Ile | Met | 141 | 421 | 缓慢生长 |
| H_N90_I141V | Ile | Val | 141 | 421 | 正常 |
| H_N90_M142A | Met | Ala | 142 | 424 | 正常 |
| H_N90_M142D | Met | Asp | 142 | 424 | 无生长 |
| H_N90_M142L | Met | Leu | 142 | 424 | 正常 |

[0121]

| | | | | | |
|---|---|---|---|---|---|
| H_N90_M142S | Met | Ser | 142 | 424 | 正常 |
| H_N90_M142V | Met | Val | 142 | 424 | 正常 |
| H_N90_R143A | Arg | Ala | 143 | 427 | 正常 |
| H_N90_M144A | Met | Ala | 144 | 430 | 正常 |
| H_N90_T145A | Thr | Ala | 145 | 433 | 正常 |
| H_N90_G146A | Gly | Ala | 146 | 436 | 正常 |
| H_N90_G146D | Gly | Asp | 146 | 436 | 正常 |
| H_N90_G146H | Gly | His | 146 | 436 | 正常 |
| H_N90_G146K | Gly | Lys | 146 | 436 | 正常 |
| H_N90_G146N | Gly | Asn | 146 | 436 | 正常 |
| H_N90_G147A | Gly | Ala | 147 | 439 | 正常 |
| H_N90_G147K | Gly | Lys | 147 | 439 | 无生长 |
| H_N90_G147M | Gly | Met | 147 | 439 | 缓慢生长 |
| H_N90_G147R | Gly | Arg | 147 | 439 | 无生长 |
| H_N90_G147S | Gly | Ser | 147 | 439 | 正常 |

[0122] 此分析的结果表明,虽然在HemG PPO蛋白质中长链插入环为高度保守的,但在环内的许多残基处在维持酶功能方面存在灵活性。基于说明长链插入环中的残基中的变化引起酶功能损失的公开报告,这是出乎意料的(Zwerschke,D.,Karrie,S.,Jahn,D.以及Jahn,M.(2014)Biosci.Rep.34(4),art:e00124.doi:10.1042/BSR20140081)。在此分析中,特别是具有在位置G123、L125、Y127、I138、L140、I141、M142以及G147处形成的突变的情况下,发现改变的酶功能,表明这些位置中的变化对于改变酶功能为重要的。

[0123] 实施例3:长链插入环变体的除草剂耐受性表征

[0124] 形成在长链插入环内引入氨基酸变化的重组HemG PPO酶并且分析在植物中的除草剂灵敏度的变化。设计原生质体除草剂耐受性分析以确定变体是否可赋予在植物细胞中对PPO除草剂的耐受性。

[0125] 用实施例2中所描述的相同表达构建体但使用植物转化载体使用标准方法对大豆原生质体进行转化。使转化的原生质体在存在1.0μM浓度的PPO除草剂S-3100或模拟处理(阴性对照)的情况下生长。然后针对PPO除草剂耐受性对原生质体进行分析,相对于GFP对照和H_N90来表示(允许得到相对耐受性得分以实现实验之间的比较)。分两批重复四次进行分析。对每一者的相对耐受性得分取平均值并且计算标准误差(SE)。GFP对照分析的耐受性得分为0,证实在不存在除草剂耐受性蛋白质的情况下大豆原生质体对PPO除草剂不耐受。N-N90分析的耐受性得分为100。表6示出了分析的结果。13种变体几乎未赋予耐受性(类似于未转化的对照或GFP对照),6种变体赋予弱耐受性(类似于不含CTP的H_N90对照),9种变体赋予边际耐受性(类似于H_N10对照),并且79种变体赋予良好耐受性(类似于含CTP的H_N90对照)。12种变体具有大于100的相对耐受性得分(优于含CTP的H_N90对照)。这12种变体中的氨基酸变化位于7个残基位置,所述位置中的4个具有超过1种倾向于高于100的变体。这表明这7个氨基酸位点就改善的除草剂耐受性来说特别受关注。图5示出了此分析的结果的图解表示。

[0126] 表6.HemG变体原生质体分析结果-S3100

| HemG 构建体 | WT AA | AA 变化 | AA 位置 | NT 位置 | 耐受性得分 (H_N90-CTP 的百分比) |
|---|---|---|---|---|---|
| GFP 对照 | | | | | 0 |
| 模拟处理 | | | | | 20 |
| H_N10 | | | | | 62 |
| H_N90 - No CTP | | | | | 39 |
| H_N90 - CTP | | | | | 100 |
| H_N90_G123A | Gly | Ala | 123 | 367 | 19 |
| H_N90_L125A | Leu | Ala | 125 | 373 | 62 |
| H_N90_L125F | Leu | Phe | 125 | 373 | 24 |
| H_N90_L125I | Leu | Ile | 125 | 373 | 97 |
| H_N90_L125V | Leu | Val | 125 | 373 | 84 |
| H_N90_R126A | Arg | Ala | 126 | 376 | 75 |
| H_N90_Y127A | Tyr | Ala | 127 | 379 | 5 |
| H_N90_Y127H | Tyr | His | 127 | 379 | 3 |
| H_N90_Y127M | Tyr | Met | 127 | 379 | 34 |
| H_N90_Y127W | Tyr | Trp | 127 | 379 | 99 |

[0127]

[0128]

| | | | | | |
|---|---|---|---|---|---|
| H_N90_P128A | Pro | Ala | 128 | 382 | 97 |
| H_N90_P128D | Pro | Asp | 128 | 382 | 92 |
| H_N90_P128E | Pro | Glu | 128 | 382 | 88 |
| H_N90_P128K | Pro | Lys | 128 | 382 | 75 |
| H_N90_P128L | Pro | Leu | 128 | 382 | 79 |
| H_N90_P128Q | Pro | Gln | 128 | 382 | 92 |
| H_N90_P128R | Pro | Arg | 128 | 382 | 91 |
| H_N90_P128S | Pro | Ser | 128 | 382 | 100 |
| H_N90_P128T | Pro | Thr | 128 | 382 | 99 |
| H_N90_R129A | Arg | Ala | 129 | 385 | 97 |
| H_N90_R129E | Arg | Glu | 129 | 385 | 77 |
| H_N90_R129G | Arg | Gly | 129 | 385 | 81 |
| H_N90_R129H | Arg | His | 129 | 385 | 88 |
| H_N90_R129I | Arg | Ile | 129 | 385 | 82 |
| H_N90_R129K | Arg | Lys | 129 | 385 | 89 |
| H_N90_R129L | Arg | Leu | 129 | 385 | 96 |
| H_N90_R129N | Arg | Asn | 129 | 385 | 108 |
| H_N90_R129Q | Arg | Gln | 129 | 385 | 106 |
| H_N90_R129S | Arg | Ser | 129 | 385 | 87 |
| H_N90_Y130A | Tyr | Ala | 130 | 388 | 20 |
| H_N90_Y130C | Tyr | Cys | 130 | 388 | 14 |
| H_N90_Y130L | Tyr | Leu | 130 | 388 | 98 |
| H_N90_Y130W | Tyr | Trp | 130 | 388 | 61 |
| H_N90_R131A | Arg | Ala | 131 | 391 | 93 |
| H_N90_W132A | Trp | Ala | 132 | 394 | 77 |
| H_N90_W132F | Trp | Phe | 132 | 394 | 85 |
| H_N90_W132I | Trp | Ile | 132 | 394 | 99 |
| H_N90_W132K | Trp | Lys | 132 | 394 | 78 |
| H_N90_W132L | Trp | Leu | 132 | 394 | 76 |
| H_N90_W132P | Trp | Pro | 132 | 394 | 75 |
| H_N90_W132R | Trp | Arg | 132 | 394 | 84 |
| H_N90_W132S | Trp | Ser | 132 | 394 | 85 |
| H_N90_W132T | Trp | Thr | 132 | 394 | 85 |
| H_N90_W132V | Trp | Val | 132 | 394 | 83 |
| H_N90_W132Y | Trp | Tyr | 132 | 394 | 95 |
| H_N90_I133A | Ile | Ala | 133 | 397 | 91 |
| H_N90_D134A | Asp | Ala | 134 | 400 | 80 |
| H_N90_D134K | Asp | Lys | 134 | 400 | 38 |
| H_N90_D134N | Asp | Asn | 134 | 400 | 87 |
| H_N90_D134Q | Asp | Gln | 134 | 400 | 93 |
| H_N90_D134T | Asp | Thr | 134 | 400 | 94 |
| H_N90_K135A | Lys | Ala | 135 | 403 | 94 |

[0129]

| | | | | | |
|---|---|---|---|---|---|
| H_N90_K135Q | Lys | Gln | 135 | 403 | 95 |
| H_N90_K135R | Lys | Arg | 135 | 403 | 105 |
| H_N90_K135S | Lys | Ser | 135 | 403 | 79 |
| H_N90_K135T | Lys | Thr | 135 | 403 | 93 |
| H_N90_K135V | Lys | Val | 135 | 403 | 90 |
| H_N90_V136A | Val | Ala | 136 | 406 | 98 |
| H_N90_M137A | Met | Ala | 137 | 409 | 105 |
| H_N90_M137C | Met | Cys | 137 | 409 | 106 |
| H_N90_M137I | Met | Ile | 137 | 409 | 109 |
| H_N90_M137L | Met | Leu | 137 | 409 | 100 |
| H_N90_M137S | Met | Ser | 137 | 409 | 89 |
| H_N90_M137V | Met | Val | 137 | 409 | 89 |
| H_N90_I138A | Ile | Ala | 138 | 412 | 31 |
| H_N90_I138L | Ile | Leu | 138 | 412 | 97 |
| H_N90_I138M | Ile | Met | 138 | 412 | 93 |
| H_N90_I138V | Ile | Val | 138 | 412 | 85 |
| H_N90_Q139A | Gln | Ala | 139 | 415 | 90 |
| H_N90_Q139C | Gln | Cys | 139 | 415 | 90 |
| H_N90_Q139E | Gln | Glu | 139 | 415 | 85 |
| H_N90_Q139G | Gln | Gly | 139 | 415 | 94 |
| H_N90_Q139H | Gln | His | 139 | 415 | 89 |
| H_N90_Q139K | Gln | Lys | 139 | 415 | 99 |
| H_N90_Q139L | Gln | Leu | 139 | 415 | 87 |
| H_N90_Q139M | Gln | Met | 139 | 415 | 96 |
| H_N90_Q139R | Gln | Arg | 139 | 415 | 96 |
| H_N90_Q139S | Gln | Ser | 139 | 415 | 101 |
| H_N90_L140A | Leu | Ala | 140 | 418 | 88 |
| H_N90_L140C | Leu | Cys | 140 | 418 | 100 |
| H_N90_L140D | Leu | Asp | 140 | 418 | -5 |
| H_N90_L140E | Leu | Glu | 140 | 418 | 49 |
| H_N90_L140F | Leu | Phe | 140 | 418 | 99 |
| H_N90_L140G | Leu | Gly | 140 | 418 | 95 |
| H_N90_L140H | Leu | His | 140 | 418 | 66 |
| H_N90_L140I | Leu | Ile | 140 | 418 | 97 |
| H_N90_L140K | Leu | Lys | 140 | 418 | 30 |
| H_N90_L140M | Leu | Met | 140 | 418 | 109 |
| H_N90_L140N | Leu | Asn | 140 | 418 | 85 |
| H_N90_L140P | Leu | Pro | 140 | 418 | 6 |
| H_N90_L140Q | Leu | Gln | 140 | 418 | 89 |
| H_N90_L140R | Leu | Arg | 140 | 418 | 46 |
| H_N90_L140S | Leu | Ser | 140 | 418 | 78 |
| H_N90_L140T | Leu | Thr | 140 | 418 | 102 |

[0130]

| | | | | | |
|---|---|---|---|---|---|
| H_N90_L140V | Leu | Val | 140 | 418 | 80 |
| H_N90_L140W | Leu | Trp | 140 | 418 | 80 |
| H_N90_L140Y | Leu | Tyr | 140 | 418 | 77 |
| H_N90_I141A | Ile | Ala | 141 | 421 | 20 |
| H_N90_I141L | Ile | Leu | 141 | 421 | 64 |
| H_N90_I141M | Ile | Met | 141 | 421 | 61 |
| H_N90_I141V | Ile | Val | 141 | 421 | 94 |
| H_N90_M142A | Met | Ala | 142 | 424 | 58 |
| H_N90_M142D | Met | Asp | 142 | 424 | 13 |
| H_N90_M142L | Met | Leu | 142 | 424 | 89 |
| H_N90_M142S | Met | Ser | 142 | 424 | 80 |
| H_N90_M142V | Met | Val | 142 | 424 | 50 |
| H_N90_R143A | Arg | Ala | 143 | 427 | 112 |
| H_N90_M144A | Met | Ala | 144 | 430 | 91 |
| H_N90_T145A | Thr | Ala | 145 | 433 | 90 |
| H_N90_G146A | Gly | Ala | 146 | 436 | 104 |
| H_N90_G146D | Gly | Asp | 146 | 436 | 101 |
| H_N90_G146H | Gly | His | 146 | 436 | 93 |
| H_N90_G146K | Gly | Lys | 146 | 436 | 85 |
| H_N90_G146N | Gly | Asn | 146 | 436 | 85 |
| H_N90_G147A | Gly | Ala | 147 | 439 | 50 |
| H_N90_G147K | Gly | Lys | 147 | 439 | 9 |
| H_N90_G147M | Gly | Met | 147 | 439 | 17 |
| H_N90_G147R | Gly | Arg | 147 | 439 | 23 |
| H_N90_G147S | Gly | Ser | 147 | 439 | 54 |

[0131] 选择39种变体(加上对照)的子集用于进一步分析。在类似于上文所描述的S-3100耐受性分析的分析中,针对对三种额外PPO除草剂丙炔氟草胺、甲磺草胺以及乳氟禾草灵的耐受性对这些变体进行测试。将转化的原生质体用丙炔氟草胺(5nM)、甲磺草胺(1μM)以及乳氟禾草灵(1μM)处理。表7示出了分析的结果。在所测试的39种变体中,30种对丙炔氟草胺、甲磺草胺或乳氟禾草灵展现良好耐受性并且9种具有不良耐受性(耐受性得分低于50,指示为“PT”)。在展现良好耐受性的30种变体中,8种对一种或多种除草剂展现的耐受性变化大于相对于S-3100的实验变化。在这8种变体中,4种变体赋予对除草剂中的一者或多者的更高耐受性,这在下表7中指示为“更高”,同时4种变体赋予对除草剂中的一者或多者的更低耐受性,这在下表7中指示为“更低”。指示为“NSD”的变体具有耐受性得分差异小于已知数据点的标准误差的耐受性得分。

[0132] 表7.HemG变体原生质体分析结果-丙炔氟草胺、甲磺草胺以及乳氟禾草灵

[0133]

| HemG 构建体 | WT AA | AA 变化 | AA 位置 | NT 位置 | 相对于 S-3100 的耐受性 | | |
|---|---|---|---|---|---|---|---|
| | | | | | 丙炔氟草胺 | 甲磺草胺 | 乳氟禾草灵 |
| GFP 对照 | | | | | 0 | 0 | 0 |
| H_N10 | | | | | NSD | NSD | 更高 |
| H_N90 - No CTP | | | | | 更高 | 更高 | 更高 |
| H_N90 - CTP | | | | | 100 | 100 | 100 |
| H_N90_Y127A | Tyr | Ala | 127 | 379 | PT | PT | PT |
| H_N90_Y127H | Tyr | His | 127 | 379 | PT | PT | PT |
| H_N90_Y127M | Tyr | Met | 127 | 379 | PT | PT | PT |
| H_N90_Y127W | Tyr | Trp | 127 | 379 | NSD | 更低 | NSD |
| H_N90_R129N | Arg | Asn | 129 | 385 | NSD | NSD | NSD |
| H_N90_R129Q | Arg | Gln | 129 | 385 | NSD | NSD | NSD |
| H_N90_Y130A | Tyr | Ala | 130 | 388 | PT | PT | PT |
| H_N90_Y130C | Tyr | Cys | 130 | 388 | PT | PT | PT |
| H_N90_Y130L | Tyr | Leu | 130 | 388 | NSD | NSD | NSD |
| H_N90_Y130W | Tyr | Trp | 130 | 388 | NSD | NSD | NSD |
| H_N90_K135R | Lys | Arg | 135 | 403 | NSD | NSD | NSD |
| H_N90_M137A | Met | Ala | 137 | 409 | NSD | NSD | NSD |
| H_N90_M13 | Met | Cys | 137 | 409 | NSD | NSD | NSD |

[0134]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7C | | | | | | | |
| H_N90_M137I | Met | Ile | 137 | 409 | NSD | 更低 | NSD |
| H_N90_M137L | Met | Leu | 137 | 409 | NSD | NSD | NSD |
| H_N90_M137S | Met | Ser | 137 | 409 | NSD | NSD | NSD |
| H_N90_M137V | Met | Val | 137 | 409 | NSD | NSD | NSD |
| H_N90_L140A | Leu | Ala | 140 | 418 | NSD | NSD | NSD |
| H_N90_L140C | Leu | Cys | 140 | 418 | NSD | NSD | NSD |
| H_N90_L140F | Leu | Phe | 140 | 418 | NSD | NSD | NSD |
| H_N90_L140G | Leu | Gly | 140 | 418 | NSD | NSD | NSD |
| H_N90_L140H | Leu | His | 140 | 418 | NSD | NSD | 更高 |
| H_N90_L140I | Leu | Ile | 140 | 418 | NSD | NSD | NSD |
| H_N90_L140K | Leu | Lys | 140 | 418 | PT | PT | PT |
| H_N90_L140M | Leu | Met | 140 | 418 | NSD | 更低 | NSD |
| H_N90_L140R | Leu | Arg | 140 | 418 | PT | PT | PT |
| H_N90_L140T | Leu | Thr | 140 | 418 | NSD | NSD | NSD |
| H_N90_I141A | Ile | Ala | 141 | 421 | PT | PT | PT |
| H_N90_I141L | Ile | Leu | 141 | 421 | NSD | NSD | NSD |
| H_N90_I141M | Ile | Met | 141 | 421 | NSD | NSD | NSD |
| H_N90_I141V | Ile | Val | 141 | 421 | NSD | NSD | NSD |
| H_N90_M142A | Met | Ala | 142 | 424 | NSD | NSD | NSD |
| H_N90_M142D | Met | Asp | 142 | 424 | PT | PT | PT |
| H_N90_M14 | Met | Leu | 142 | 424 | NSD | NSD | 更高 |

[0135]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2L | | | | | | | |
| H_N90_M142S | Met | Ser | 142 | 424 | NSD | NSD | 更高 |
| H_N90_M142V | Met | Val | 142 | 424 | 更高 | 更高 | NSD |
| H_N90_R143A | Arg | Ala | 143 | 427 | NSD | NSD | NSD |
| H_N90_G146A | Gly | Ala | 146 | 436 | NSD | 更低 | NSD |
| H_N90_G146D | Gly | Asp | 146 | 436 | NSD | NSD | NSD |

[0136] 在对丙炔氟草胺、甲磺草胺或乳氟禾草灵的耐受性得分与对S-3100的耐受性得分相比展现显著差异的8种变体中,6种变体位于疏水性残基M137、L140以及M142处。跨残基M137至M142的区域含有大量疏水性残基(尤其是I、L、V、M、A)。此疏水性区域的分析表明这些残基在调节酶变体的功能性方面为唯一重要的。此外,这些残基在调节对不同PPO抑制剂除草剂的耐受性方面为唯一重要的。

[0137] 可用其他PPO除草剂对转化的原生质体进行攻击,诸如二苯醚(诸如三氟羧草醚、其盐和酯、苯草醚、治草醚、其盐和酯、氟乳醚、其盐和酯、氟草醚、呋氧草醚、氟硝磺酰胺、氯硝醚、乙羧氟草醚、其盐和酯、乳氟禾草灵的盐和酯、乙氧氟草醚以及氟磺胺草醚、其盐和酯);噻二唑(诸如氟噻甲草酯和噻二唑草胺);嘧啶二酮或苯基尿嘧啶(诸如双苯嘧草酮、氟丙嘧草酯、[3-2-氯-4-氟-5-(1-甲基-6-三氟甲基-2,4-二氧代-1,2,3,4-四氢嘧啶-3-基)苯氧基]-2-吡啶氧基]乙酸乙酯(CAS登记号353292-31-6并且在本文中称为S-3100)、氟嘧苯甲酸、苯嘧磺草胺以及氟嘧硫草酯);苯基吡唑(诸如异丙吡草酯、吡草醚以及吡草醚乙酯);噁二唑(诸如丙炔噁草酮和噁草酮);三唑啉酮(诸如唑啶草酮、酰苯草酮以及唑草酮、其盐和酯);噁唑烷二酮(诸如环戊噁草酮);N-苯基邻苯二甲酰亚胺(诸如吲哚酮草酯、氟烯草酸以及氟烯草酸戊酯);苯并噁嗪酮衍生物(诸如1,5-二甲基-6-硫代-3-(2,2,7-三氟-3,4-二氢-3-氧代-4-丙-2-炔基-2H-1,4-苯并噁嗪-6-基)-1,3,5-三嗪烷-2,4-二酮);氟哒嗪草酯和氟哒嗪草乙酯;双唑草腈;以及氟唑草胺。可使用模拟处理作为阴性对照。

[0138] 实施例4:组合变体的功能和除草剂耐受性表征

[0139] 将变体设计成在HemG PPO序列中的长链插入环内包含两个或更多个氨基酸修饰。然后分析这些组合变体HemG PPO酶以确定PPO活性。合成组合变体HemG PPO DNA序列并且克隆至表达盒中。可将包含表达盒的细菌转化载体转化至hemG敲除大肠杆菌菌株中用于如实施例2中所描述的初始高通量细菌拯救筛选。针对恢复hemG敲除大肠杆菌菌株的正常生长的能力对组合变体进行筛选。

[0140] 还针对赋予植物细胞对PPO除草剂的耐受性的能力对组合变体HemG PPO酶进行了分析。将含有组合变体HemG PPO DNA序列的表达盒与植物转化载体一起用于转化大豆原生质体。如实施例3中所描述进行原生质体耐受性分析,并且针对赋予植物细胞除草剂耐受性的能力对组合变体进行筛选。

[0141] 实施例5:变体HemG PPO酶在植物中的表达和测试

[0142] 可使以上实施例中所描述的微生物HemG PPO变体在稳定转化的植物中表达,并且可分析这些植物的PPO除草剂耐受性。

[0143] 在稳定转化的玉米或大豆(或两者)中针对除草剂耐受性对微生物HemG PPO变体中的二十五种进行了测试。构建包含可操作地连接至植物启动子、转运序列以及3'UTR的编码变体HemG PPO酶的重组DNA分子(其中蛋白质编码序列针对单子叶或双子叶植物表达进行优化)的植物转化载体。

[0144] 在玉米中,使用根癌土壤杆菌和本领域中已知的标准方法用植物转化载体对玉米细胞进行转化。使再生的$R_0$转基因幼苗在温室中生长。在约$V_2$至$V_4$生长期用S3100按80g/ha的比率对$R_0$植物进行喷洒。然后在处理之后1-14天针对损伤对植物进行评估并且记录损伤得分。鉴定了具有单一转基因DNA插入物拷贝的转基因植物(即单事件植物),并且使仅含有单一拷贝并且通过除草剂喷洒测试的$R_0$植物自交以产生$R_1$种子。

[0145] 在大豆中,使用根癌土壤杆菌和本领域中已知的标准方法用植物转化载体对切除的胚进行转化。使再生的$R_0$转基因幼苗在温室中生长。在约$V_2$至$V_4$生长期用S3100按20g/ha的比率对$R_0$植物进行喷洒。然后在处理之后1-14天针对损伤对植物进行评估并且记录损伤得分。鉴定了具有单一转基因DNA插入物拷贝的转基因植物(即单事件植物),并且使仅含有单一拷贝并且通过除草剂喷洒测试的$R_0$植物自交以产生$R_1$种子。对于一些变体HemG PPO酶,使$R_1$植物在温室中生长并且在约$V_2$至$V_4$生长期用S3100按60g/ha的比率喷洒。然后在处理之后1-14天针对损伤对植物进行评估并且记录损伤得分。

[0146] 将目视损伤得分为20%或更低的转基因大豆和玉米植物评分为通过除草剂耐受性筛选,因此对PPO除草剂展现耐受性。计算对于每种变体HemG PPO酶来说通过除草剂耐受性筛选的全部植物的百分比。将25%或更多的个别植物显示良好耐受性(目视损伤得分为20%或更低)的任何构建体视为有效赋予除草剂耐受性。

[0147] 测试证实从原生质体分析(如上文所描述进行)获得的结果与在整个植物中获得的结果一致,从而验证了原生质体分析为筛选工具的用途。在稳定转化的玉米或大豆(或两者)中所测试的25种微生物HemGPPO变体中,20种被发现有效赋予除草剂耐受性(产生多于25%的目视损伤得分为20%或更低的植物)。在这二十种中,14种具有高于阳性对照H_N90的功效结果。表8中提供了结果。

[0148] 表8.HemG变体在大豆和玉米植物中的测试结果.

[0149]

| HemG 构建体 | 原生质体耐受性得分 | 大豆通过百分比 | 玉米通过百分比 |
|---|---|---|---|
| H_N90 | 100 | 50% | 58% |
| H_N90_Y127H | 3 | 0% | |

[0150]

| | | | |
|---|---|---|---|
| H_N90_R129A | 97 | 94% | |
| H_N90_R129E | 77 | 57% | |
| H_N90_R129L | 96 | 62% | |
| H_N90_R129N | 108 | 83% | 53% |
| H_N90_R129Q | 106 | 91% | 52% |
| H_N90_R129K | 89 | 100% | |
| H_N90_Y130C | 14 | 0% | |
| H_N90_Y130L | 98 | 32% | |
| H_N90_Y130W | 61 | 0% | |
| H_N90_K135R | 105 | | 62% |
| H_N90_M137A | 105 | | 67% |
| H_N90_M137C | 106 | | 72% |
| H_N90_M137I | 109 | | 66% |
| H_N90_M137L | 100 | 37% | |
| H_N90_M137S | 89 | 35% | |
| H_N90_M137V | 89 | 28% | |
| H_N90_L140F | 99 | 64% | |
| H_N90_L140H | 66 | 4% | |
| H_N90_L140K | 30 | 0% | |
| H_N90_L140M | 109 | 46% | 51% |
| H_N90_L140T | 102 | | 64% |
| H_N90_R143A | 112 | 94% | 69% |
| H_N90_G146A | 104 | 41% | |
| H_N90_G146D | 101 | 50% | |

[0151] 在棉花中,可使用根癌土壤杆菌和本领域中已知的标准方法用这些载体对切除的胚(Coker 130)进行转化。使再生的$R_0$转基因幼苗在温室中生长并且如上文所描述进行测试。

[0152] 可在转基因植物情况下针对耐受性对其他除草剂进行测试。这可例如通过使用于每种HemG PPO的多个转基因植物生长并且将植物分成组来进行。将各组用一种或多种PPO除草剂喷洒(每组一种PPO除草剂)以评估耐受性。举例来说,在约2-4真叶生长期用约220g ai/ha或440g ai/ha的乳氟禾草灵或约210g/ha或420g/ha的丙炔氟草胺对转基因植物进行喷洒。然后在处理之后1-14天针对损伤对植物进行评估并且记录损伤得分。将未喷洒的转基因植物用于与未喷洒的非转基因植物的表型比较。

序列表

<110> 孟山都技术有限责任公司(Monsanto Technology LLC)

<120> 用于PPO除草剂耐受性的方法和组合物

<130> MONS:429WO

<150> US 62/599,386
<151> 2017-12-15

<160> 278

<170> PatentIn version 3.5

<210> 1
<211> 179
<212> PRT
<213> 阴沟肠杆菌(Enterobacter cloacae)

<400> 1

[0001]

```
Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1               5                  10                  15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
            20                  25                  30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
        35                  40                  45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
    50                  55                  60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65                  70                  75                  80

Ser Ala Phe Phe Cys Val Asn Leu Thr Ala Arg Lys Pro Glu Lys Arg
                85                  90                  95
```

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

[0002] Lys Ala Leu

<210> 2
<211> 181
<212> PRT
<213> 大肠杆菌(Escherichia Coli)

<400> 2

Met Lys Thr Leu Ile Leu Phe Ser Thr Arg Asp Gly Gln Thr Arg Glu
1 5 10 15

Ile Ala Ser Tyr Leu Ala Ser Glu Leu Lys Glu Leu Gly Ile Gln Ala
20 25 30

Asp Val Ala Asn Val His Arg Ile Glu Glu Pro Gln Trp Glu Asn Tyr
35 40 45

Asp Arg Val Val Ile Gly Ala Ser Ile Arg Tyr Gly His Tyr His Ser
50 55 60

Ala Phe Gln Glu Phe Val Lys Lys His Ala Thr Arg Leu Asn Ser Met
65 70 75 80

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

Arg Thr Pro Gln Thr Asn Ser Tyr Ala Arg Lys Phe Leu Met Asn Ser
100 105 110

Gln Trp Arg Pro Asp Arg Cys Ala Val Ile Ala Gly Ala Leu Arg Tyr
115 120 125

[0003]

Pro Arg Tyr Arg Trp Tyr Asp Arg Phe Met Ile Lys Leu Ile Met Lys
130 135 140

Met Ser Gly Gly Glu Thr Asp Thr Arg Lys Glu Val Val Tyr Thr Asp
145 150 155 160

Trp Glu Gln Val Ala Asn Phe Ala Arg Glu Ile Ala His Leu Thr Asp
165 170 175

Lys Pro Thr Leu Lys
180

<210> 3
<211> 178
<212> PRT
<213> 菠萝泛菌(Pantoea ananatis)

<400> 3

Met Lys Ala Leu Ile Leu Phe Ser Thr Arg Asp Gly Gln Thr Gln Lys
1 5 10 15

Ile Ala Ser Ala Ile Ala Asp Glu Ile Lys Gly Gln Gln Ser Cys Asp
20 25 30

Val Ile Asn Ile Gln Asp Ala Lys Thr Leu Asp Trp Gln Gln Tyr Asp
35 40 45

Arg Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Gln Pro Val
50 55 60

Val Asn Glu Phe Val Lys His Asn Leu Leu Ala Leu Gln Gln Arg Val
65 70 75 80

[0004]

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

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

Trp Gln Pro Asp Cys Cys Ala Val Phe Ala Gly Ala Leu Tyr Tyr Pro
115 120 125

Arg Tyr Arg Trp Phe Asp Arg Val Met Ile Gln Phe Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Ala Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Gln Gln Val Gln Arg Phe Ala Arg Asp Phe Ala Gln Leu Pro Gly Lys
165 170 175

Ser Tyr

<210> 4
<211> 178
<212> PRT
<213> 托莱多欧文氏菌(Erwinia toletana)

<400> 4

Met Lys Ala Leu Ile Leu Phe Ser Ser Arg Glu Gly Gln Thr Arg Glu
1 5 10 15

Ile Ala Ser Tyr Ile Ala Asn Ser Ile Lys Glu Glu Met Glu Cys Asp
20 25 30

Val Phe Asn Ile Leu Arg Val Glu Gln Ile Asp Trp Ser Gln Tyr Asp
35 40 45

[0005]

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

Val Ala Lys Phe Val Lys Arg His Leu His Glu Leu Gln Gln Arg Ser
65 70 75 80

Ser Gly Phe Phe Cys Val Asn Leu Thr Ala Arg Lys Ala Asp Lys Arg
85 90 95

Thr Pro Gln Thr Asn Ala Tyr Met Arg Lys Phe Leu Leu Gln Ser Pro
100 105 110

Trp Gln Pro Asp Cys Cys Ala Val Phe Ala Gly Ala Leu Arg Tyr Thr
115 120 125

Arg Tyr Arg Trp Phe Asp Arg Val Met Ile Gln Leu Ile Met Arg Met

130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Thr Gln Val Ala Arg Phe Ala Gln Glu Phe Ala His Leu Pro Gly Lys
165 170 175

Thr Gln

<210> 5
<211> 179
<212> PRT
<213> 胡萝卜软腐病果胶杆菌(Pectobacterium carotovorum)

<400> 5

[0006]

Met Lys Ala Leu Ile Val Phe Ser Ser Arg Asp Gly Gln Thr Arg Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Asn Thr Leu Lys Gly Thr Leu Glu Cys Asp
20 25 30

Val Val Asn Val Leu Asn Ala Asn Asp Ile Asp Leu Ser Gln Tyr Asp
35 40 45

Arg Val Ala Ile Gly Ala Ser Ile Arg Tyr Gly Arg Phe His Pro Ala
50 55 60

Val Asn Gln Phe Ile Arg Lys His Leu Thr Ser Leu Gln Gln Leu Pro
65 70 75 80

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

Thr Ile Gln Thr Asn Ala Tyr Thr Arg Lys Phe Leu Leu Asn Ser Pro
100 105 110

Trp Gln Pro Asp Leu Cys Cys Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Phe Asp Arg Val Met Ile Gln Leu Ile Met Arg Ile
130 135 140

Thr Gly Gly Glu Thr Asp Ser Thr Lys Glu Ile Glu Tyr Thr Asp Trp
145 150 155 160

Gln Gln Val Ala Arg Phe Ala Gln Asp Phe Ala Gln Leu Ala Ala Lys
165 170 175

[0007] Asn Pro Ala

<210> 6
<211> 179
<212> PRT
<213> 布拉特西姆惠菌(Shimwellia blattae)

<400> 6

Met Lys Thr Leu Ile Leu Phe Ser Thr Arg Asp Gly Gln Thr His Lys
1 5 10 15

Ile Ala Arg His Ile Ala Gly Val Leu Glu Glu Gln Gly Lys Ala Cys
20 25 30

Glu Leu Val Asp Leu Leu Gln Pro Gly Glu Pro Asp Trp Ser Thr Val
35 40 45

Glu Cys Val Val Leu Gly Ala Ser Ile Arg Tyr Gly His Phe His Lys
50 55 60

Ser Phe Ile Arg Phe Val Asn Thr His Ala Gln Arg Leu Asn Asn Met
65 70 75 80

Pro Gly Ala Leu Phe Thr Val Asn Leu Val Ala Arg Lys Pro Glu Lys
85 90 95

Gln Ser Pro Gln Thr Asn Ser Tyr Thr Arg Lys Phe Leu Ala Ala Ser
100 105 110

Pro Trp Gln Pro Gln Arg Cys Gln Val Phe Ala Gly Ala Leu Arg Tyr
115 120 125

[0008]

Pro Arg Tyr Ser Trp Tyr Asp Arg Met Met Ile Arg Leu Ile Met Lys
130 135 140

Met Ala Gly Gly Glu Thr Asp Thr Arg Lys Glu Val Glu Tyr Thr Asp
145 150 155 160

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

Glu Thr Arg

<210> 7
<211> 177
<212> PRT
<213> 斯氏泛菌(Pantoea stewardii)

<400> 7

Met Lys Ala Leu Ile Leu Tyr Ser Thr Arg Asp Gly Gln Thr Arg Lys
1 5 10 15

Ile Ala Ser Ser Ile Ala Asp Val Ile Arg Gln Gln Gln Gln Cys Asp
20 25 30

Val Leu Asn Ile Lys Asp Ala Ser Leu Pro Asp Trp Ala Gln Tyr Asp
35 40 45

Arg Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Gln Pro Val
50 55 60

Val Asp Lys Phe Val Lys Gln His Leu His Glu Leu Gln Gln Arg Thr
65 70 75 80

[0009]

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

Ser Pro Glu Thr Asn Ala Tyr Thr Gln Lys Phe Leu Ala His Ser Pro
100 105 110

Trp Gln Pro Asp Cys Cys Ala Val Phe Ala Gly Ala Leu Tyr Tyr Pro
115 120 125

Arg Tyr Arg Trp Phe Asp Arg Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Ser Thr Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Gln Gln Val Ser Thr Phe Ala Asn Asp Phe Ala Gln Leu Pro Gly Lys
165 170 175

Ser

<210> 8
<211> 178
<212> PRT
<213> 斯氏泛菌(Pantoea stewardii)

<400> 8

Met Lys Ala Leu Ile Leu Phe Ser Ser Arg Asp Gly Gln Thr Gln Leu
1 5 10 15

Ile Ala Ser Ser Ile Ala Lys Glu Leu Glu Gly Lys Gln Ala Cys Asp
20 25 30

Val Leu Asn Ile Leu Asp Thr Thr Asn Val Glu Trp Thr Gln Tyr Asp
35 40 45

[0010]

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

Val Ala Glu Phe Val Lys Arg His Gln Arg Glu Leu Gln Gln Arg Ser
65 70 75 80

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

Ser Pro Glu Thr Asn Ala Tyr Thr Ala Lys Phe Leu Asn Gln Ser Pro
100 105 110

Trp Gln Pro Asp Cys Cys Ala Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Phe Asp Arg Ile Met Ile Gln Leu Ile Met Arg Met

130 135 140

Thr Gly Gly Glu Thr Asp Ser Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

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

Thr Ser

<210> 9
<211> 180
<212> PRT
<213> 阴沟肠杆菌(Enterobacter cloacae)

<400> 9

[0011]

Met Lys Thr Leu Ile Leu Phe Ser Thr Arg Asp Gly Gln Thr Arg Glu
1 5 10 15

Ile Ala Ala Phe Leu Ala Ser Glu Leu Lys Glu Gln Gly Ile Tyr Ala
20 25 30

Asp Val Ile Asn Leu Asn Arg Thr Glu Glu Ile Ala Trp Gln Glu Tyr
35 40 45

Asp Arg Val Val Ile Gly Ala Ser Ile Arg Tyr Gly His Phe His Pro
50 55 60

Ala Val Asp Arg Phe Val Lys Lys His Thr Glu Thr Leu Asn Ser Leu
65 70 75 80

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

Arg Thr Pro Gln Thr Asn Ser Tyr Thr Arg Lys Phe Leu Leu Asn Ser
100 105 110

Pro Trp Lys Pro Ala Ala Cys Ala Val Phe Ala Gly Ala Leu Arg Tyr
115 120 125

Pro Arg Tyr Arg Trp Tyr Asp Arg Phe Met Ile Arg Leu Ile Met Lys
130 135 140

Met Thr Gly Gly Glu Thr Asp Thr Arg Lys Glu Val Val Tyr Thr Asp
145 150 155 160

Trp Ser Gln Val Ala Ser Phe Ala Arg Glu Ile Val Gln Leu Thr Arg
165 170 175

[0012] Ser Ser Arg Leu
180

<210> 10
<211> 177
<212> PRT
<213> 桑肠杆菌(Enterobacter mori)

<400> 10

Met Lys Ile Leu Ile Leu Phe Ser Thr Arg Asp Gly Gln Thr Arg Glu
1 5 10 15

Ile Ala Ala Ser Leu Ala Ser Glu Leu Lys Glu Gln Ala Phe Asp Val
20 25 30

Asp Val Val Asn Leu His Arg Ala Glu Asn Ile Ala Trp Glu Glu Tyr
35 40 45

Asp Gly Val Val Ile Gly Ala Ser Ile Arg Tyr Gly His Phe His Ser
50 55 60

Thr Leu Asn Ser Phe Val Lys Lys His Gln Gln Ala Leu Lys Lys Leu
65 70 75 80

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

Arg Thr Pro Gln Thr Asn Ser Tyr Thr Arg Lys Phe Leu Leu Asp Ser
100 105 110

Pro Trp Gln Pro Asp Leu Ser Ala Val Phe Ala Gly Ala Leu Arg Tyr
115 120 125

[0013]

Pro Arg Tyr Asn Trp Tyr Asp Arg Ile Met Ile Arg Leu Ile Met Lys
130 135 140

Ile Thr Gly Gly Glu Thr Asp Thr Arg Lys Glu Val Val Tyr Thr Asp
145 150 155 160

Trp Gln Gln Val Thr His Phe Ala His Glu Ile Val Gln Leu Val Arg
165 170 175

Lys

<210> 11
<211> 179
<212> PRT
<213> 水生拉恩氏菌(Rahnella aquatilis)

<400> 11

Met Lys Ala Leu Ile Leu Tyr Ser Ser Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Asn Glu Leu Lys Glu Lys Cys Ser Cys Asp
20 25 30

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

Gln Val Met Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Pro Val
50 55 60

Leu Asp Lys Phe Val Lys Lys His Ala Gly Ile Leu Asn His Met Pro
65 70 75 80

[0014]

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

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

Trp Glu Pro Ala Met Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Phe Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Arg Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Gln Gln Val Ala Lys Phe Ala Glu Asp Phe Gly Gln Ile Ser Tyr Lys
165 170 175

Lys Ser His

<210> 12
<211> 181
<212> PRT
<213> 肠道沙门氏菌肠道亚种血清型(Salmonella enterica subsp enterica serovar)

<400> 12

Met Lys Thr Leu Ile Leu Phe Ser Thr Arg Asp Gly Gln Thr Arg Glu
1 5 10 15

Ile Ala Ser Tyr Leu Ala Ser Glu Leu Lys Glu Met Gly Ile Trp Ala
20 25 30

Asp Val Val Asn Leu His Arg Ala Glu Glu Pro Asp Trp Asp Ser Tyr
35 40 45

[0015]

Asp Arg Val Val Ile Gly Ala Ser Ile Arg Tyr Gly His Tyr His Ser
50 55 60

Ala Phe Gln Glu Phe Val Lys Lys Tyr Ala Thr Arg Leu Asn Gly Met
65 70 75 80

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

Arg Thr Pro Gln Thr Asn Ser Tyr Ala Arg Lys Phe Leu Met Ser Ser
100 105 110

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

Pro Arg Tyr Arg Trp Tyr Asp Arg Leu Met Ile Lys Leu Ile Met Lys

130 135 140

Met Ser Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Val Tyr Thr Asp
145 150 155 160

Trp Glu Gln Val Ala His Phe Ala Arg Glu Ile Ala His Leu Thr Asn
165 170 175

Lys Ser Ser Ala Lys
180

<210> 13
<211> 179
<212> PRT
<213> 水生拉恩氏菌(Rahnella aquatilis)

<400> 13

[0016]

Met Lys Ala Leu Ile Leu Tyr Ser Ser Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Asn Glu Leu Lys Glu Lys Cys Ser Cys Asp
20 25 30

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

Gln Val Met Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Pro Val
50 55 60

Leu Asp Lys Phe Val Lys Lys His Ala Glu Thr Leu Asn Arg Met Pro
65 70 75 80

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

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

Trp Glu Pro Ala Met Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Phe Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Arg Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Gln Gln Val Ala Lys Phe Ala Glu Asp Phe Gly Gln Ile Ser Tyr Lys
165 170 175

[0017] Lys Ser His

<210> 14
<211> 175
<212> PRT
<213> 帕西尼氏弧菌(Vibrio pacinii)

<400> 14

Met Ala Lys Ala Leu Phe Leu Tyr Ser Thr Arg Glu Gly Gln Thr Lys
1 5 10 15

Lys Ile Phe Gln His Ile Ser Glu Gln Met Lys Glu Phe Asp Cys Glu
20 25 30

Met Ile Asp Leu His Ser Val Glu Ser Val Asp Phe Ser Gln Tyr Gln
35 40 45

Arg Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Leu Asn Lys Lys
50 55 60

Leu Tyr Gln Phe Ile Glu His Asn Leu Ser Gln Leu Gln Thr Ala Lys
65 70 75 80

Ser Ala Phe Phe Cys Val Asn Leu Thr Ala Arg Lys Glu Asp Gln Ala
85 90 95

Lys Asp Thr Pro Glu Gly Ser Ala Tyr Ile Lys Thr Phe Leu Ser Lys
100 105 110

Ser Pro Trp Gln Pro Glu Leu Ile Gly Val Phe Ala Gly Ala Leu Tyr
115 120 125

[0018] Tyr Pro Arg Tyr Asn Trp Phe Asp Lys Thr Met Ile Lys Phe Ile Met
130 135 140

Ser Met Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr
145 150 155 160

Asn Trp Gly Lys Val Thr Leu Phe Ala Asp Lys Phe Gln Asn Leu
165 170 175

<210> 15
<211> 174
<212> PRT
<213> 嗜线虫致病杆菌(Xenorhabdus nematophila)

<400> 15

Met Ser Tyr Leu Leu Leu Tyr Ser Thr Gln Asp Gly Gln Thr Lys Lys
1 5 10 15

Ile Ile Met Arg Ile Ala Glu Asn Leu Arg Arg Ser Gly Val Ser Cys
20 25 30

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

Gln Lys Val Met Val Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ser
50 55 60

Val Leu His Lys Phe Val Thr His His Gln Lys Gln Leu Asn Gln Lys
65 70 75 80

Pro Thr Ala Phe Phe Gly Val Asn Leu Thr Ala Arg Lys Pro Glu Lys
85 90 95

Arg Thr Pro Glu Thr Asn Ala Tyr Val Arg Lys Phe Leu Met Lys Ser
100 105 110

[0019]

Pro Trp Gln Pro Asp Leu Cys Glu Val Phe Ala Gly Ala Leu Leu Tyr
115 120 125

Pro Arg Tyr Lys Trp Leu Asp Arg Val Met Ile Gln Ile Ile Met Arg
130 135 140

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

Trp Ala Gln Val Asp Arg Phe Ser Glu Met Phe Leu Gln Ile
165 170

<210> 16
<211> 174
<212> PRT
<213> 重氮养弧菌(Vibrio diazotrophicus)

<400> 16

Met Lys Ala Leu Leu Leu Tyr Ser Thr Arg Glu Gly Gln Thr Lys Lys
1 5 10 15

Ile Met His His Ile Ala Gln Gln Leu Gln Gly Tyr Glu Cys Gln Phe
20 25 30

Val Asp Leu His Glu Cys His Thr Met Asp Leu Thr Gln Tyr Asp Lys
35 40 45

Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly Lys Leu Asn Ala Lys Leu
50 55 60

Tyr Gln Phe Ile Asp Ala His Ile Lys Gln Leu Glu Gln Val Lys Ala
65 70 75 80

[0020]

Ala Phe Tyr Cys Val Asn Leu Thr Ala Arg Lys Val Glu Gln Gly Lys
85 90 95

Asp Thr Pro Glu Gly Ser Val Tyr Ile Lys Thr Phe Leu Lys Lys Ser
100 105 110

Pro Trp Gln Pro Ser Leu Ile Gly Val Phe Ala Gly Ala Leu Tyr Tyr
115 120 125

Pro Arg Tyr Arg Pro Ile Asp Arg Met Met Ile Arg Phe Ile Met Lys
130 135 140

Leu Thr Gly Gly Glu Thr Asp Thr Thr Lys Glu Val Glu Tyr Thr Asp
145 150 155 160

Trp Glu Lys Val Ser Leu Phe Ala Lys Lys Phe Glu Gln Leu

165 170

<210> 17
<211> 174
<212> PRT
<213> 霍利斯格里蒙菌(Grimontia hollisae)

<400> 17

Met Lys Lys Ala Leu Leu Leu His Ser Ser Arg Glu Gly Gln Thr Leu
1 5 10 15

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

Glu Leu Val Asp Leu His Glu Met Pro Glu Val Asn Trp Glu Asp Tyr
35 40 45

[0021]

Asp Lys Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Leu Asn Lys
50 55 60

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

Lys Ala Ala Phe Phe Cys Val Asn Leu Thr Ala Arg Lys Pro Gly Lys
85 90 95

Asp Thr Pro Glu Gly Ser Val Tyr Met Lys Lys Phe Leu Lys Arg Ser
100 105 110

Pro Trp Gln Pro Gln Leu Leu Asp Val Phe Ala Gly Ala Leu Tyr Tyr
115 120 125

Pro Arg Tyr Arg Phe Phe Asp Arg Val Met Ile Gln Phe Ile Met Lys
130 135 140

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

Trp Asp Arg Val Lys Val Phe Ser Gly Gln Phe Arg Ser Leu
165 170

<210> 18
<211> 177
<212> PRT
<213> 蜜蜂吉利氏菌(Gilliamella apicola)

<400> 18

Met Lys Val Leu Leu Leu Tyr Thr Thr His Glu Lys Gln Thr Phe Lys
1 5 10 15

Ile Met Gln Arg Ile Glu Asn Gln Leu Ala Gly Lys Cys Asp Cys Asp
[0022] 20 25 30

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

Ala Val Leu Leu Gly Cys Ser Ile Arg Tyr Gly Phe Tyr Ser Lys Val
50 55 60

Met Lys Lys Phe Ile Asp Asn Asn Tyr Gln Gln Leu Asn Lys Met Arg
65 70 75 80

Ser Gly Phe Phe Gly Val Asn Val Val Ala Arg Lys Pro His Lys Asn
85 90 95

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

Trp Gln Pro Thr Ile Lys Ala Val Phe Ala Gly Ala Leu Tyr Tyr Pro
115 120 125

Lys Tyr Asn Trp Phe Asp Arg Asn Met Val Arg Phe Ile Met Trp Leu
130 135 140

Gly Lys Gly Asp Thr Asp Val Thr Lys Pro Ile Ile Glu Tyr Thr Asp
145 150 155 160

Trp Ala Lys Val Asp Gln Phe Ala Glu Leu Phe Tyr Thr Gln Thr Tyr
165 170 175

Ser

[0023] <210> 19
<211> 174
<212> PRT
<213> 奥奈达希瓦氏菌(Shewanella oneidensis)

<400> 19

Met Gln Thr Leu Ile Ile Tyr Ser Thr Ile Asp Gly Gln Thr Leu Glu
1 5 10 15

Ile Cys Arg Lys Ile Lys Ala Phe Ala Glu Arg Ala Gly Glu Lys Val
20 25 30

Ser Leu Phe Ser Leu Glu Gln Ala Glu Ala Ile Asn Leu Ala Asp Val
35 40 45

Asp Lys Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly Lys His Arg Pro
50 55 60

Glu Leu Tyr Gln Phe Val Asn Arg Asn His Ala Val Leu Ser Ala Lys
65 70 75 80

Val Asn Gly Phe Phe Thr Val Asn Val Val Ala Arg Lys Pro Leu Lys
85 90 95

Asn Thr Pro Glu Thr Asn Pro Tyr Met Gln Lys Phe Leu Lys Leu Ser
100 105 110

Leu Trp Gln Pro Gln His Leu Ala Val Phe Ala Gly Lys Ile Asp Tyr
115 120 125

Pro Lys Tyr Gly Leu Phe Asp Arg Thr Met Ile Cys Phe Ile Met Trp
130 135 140

Met Thr Lys Gly Pro Thr Asp Leu Lys Gly Thr Phe Glu Phe Thr Asp
145 150 155 160

[0024]

Trp Ala Lys Val Glu Ala Phe Gly Thr His Phe Ser Lys Leu
165 170

<210> 20
<211> 175
<212> PRT
<213> 海洋希瓦氏菌(Shewanella benthica)

<400> 20

Met Asn Lys Ile Leu Ile Ile Tyr Ser Ser Val His Gly Gln Thr Arg
1 5 10 15

Lys Ile Cys Glu Tyr Ile Ala Ser Gln Leu Arg Ala Ser Asp Tyr Gly
20 25 30

Cys Glu Val Arg Leu Ala Ser Leu Glu Glu Gln Phe Asp Leu Asp Ser

35 40 45

Phe Asp Lys Ile Ile Ile Gly Ala Ser Ile Arg His Gly Lys His Asn
50 55 60

Pro Glu Val Tyr His Phe Ile Asp Thr His Leu Val Ala Leu Glu Thr
65 70 75 80

Lys Ser Ser Ser Phe Phe Ser Val Ser Leu Val Ala Arg Lys Ala Ser
85 90 95

Arg Asn Thr Pro Glu Ser Asn Pro Tyr Met Gln Ala Phe Leu Ser Lys
100 105 110

Thr Leu Trp Arg Pro Asn Leu Val Lys Val Phe Ala Gly Lys Leu Asp
115 120 125

[0025]

Tyr Gln Gly Tyr Asn Trp Leu Asp Arg Ser Ile Ile Arg Phe Ile Met
130 135 140

Trp Ile Thr Lys Gly Pro Thr Ala Val Asn Thr Lys Ile Glu Tyr Thr
145 150 155 160

Asp Trp Gln Leu Val Asp Val Phe Val Lys Glu Leu Glu Leu Leu
165 170 175

<210> 21
<211> 176
<212> PRT
<213> 乌斯怀亚海单胞菌(Marinomonas ushuaiensis)

<400> 21

Met Ser Thr Thr Leu Leu Ile Tyr Ser Thr Thr Asp Gly His Thr Lys
1 5 10 15

Lys Ile Ser Gln Lys Ile Gln Glu Ile Ile Glu Ala Lys Gly Gln Lys
20 25 30

Val Thr Leu Leu Pro Ile Glu Glu Ile Thr Ala Ala Ala Leu Asp Ser
35 40 45

His Asp Lys Ile Val Ile Gly Ala Ser Ile Arg Tyr Gly Lys His Gln
50 55 60

Lys Val Val Ala Asp Phe Ile Glu Gln Asn Lys Thr Thr Leu Glu Ser
65 70 75 80

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

[0026]

Lys Cys Gln Pro Asp Thr Asn Pro Tyr Ile Ile Lys Phe Leu Ser Gln
100 105 110

Leu Asp Trp Gln Pro Ser Leu Gln Gly Val Phe Ala Gly Lys Leu Asp
115 120 125

Tyr Gln Lys Tyr Gly Phe Ile Asp Arg Asn Met Ile Arg Phe Ile Met
130 135 140

Trp Met Thr Lys Gly Pro Thr Asp Pro Lys Thr Asn Ile Glu Phe Thr
145 150 155 160

Asn Trp Glu Ala Val Asp Gln Phe Ala Asn Gly Val Val Glu Leu Ser
165 170 175

<210> 22
<211> 173

<212> PRT
<213> 武氏希瓦氏菌(Shewanella woodyi)

<400> 22

Met Ser Asn Ile Leu Ile Ile Tyr Ser Ser Val His Gly Gln Thr Arg
1 5 10 15

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

Val Thr Met Ser Ser Leu Asp Gln Val Pro Asp Leu Asn Asp Phe Asp
35 40 45

Lys Val Val Leu Gly Ala Ser Ile Arg His Gly Lys His Asn Pro Asn
50 55 60

[0027] Val Tyr Asp Phe Ile Ser Gln Asn Arg Gly Ile Leu Glu Lys Lys Thr
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Met Leu Ala Phe Ile Glu Lys Ser Glu
100 105 110

Trp Lys Pro Asn Leu Leu Gln Val Phe Ala Gly Ser Leu Asn Tyr Gln
115 120 125

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

Thr Lys Gly Pro Thr Asp Ala Gln Thr Asn Ile Glu Tyr Thr Asp Trp
145 150 155 160

Ala Lys Val Asp Leu Phe Ser Ser Glu Phe His Ala Leu
165 170

<210> 23
<211> 176
<212> PRT
<213> 白色噬琼胶菌(Agarivorans albus)

<400> 23

Met Lys Leu Leu Val Leu Tyr Ser Ser Cys Glu Gly Gln Thr Leu Lys
1 5 10 15

Ile Ala Lys His Ile Val Ser Gln Gln Ala Gly Glu Val Ala Ala Asp
20 25 30

Tyr Ile Gln Ile Asp Ser Asn Gln Gln Ser Leu Asp Leu Thr Ala Tyr
[0028] 35 40 45

Asp Lys Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly Lys Phe Arg Pro
50 55 60

Gln Leu Tyr Ser Leu Leu Ala Glu Tyr Gln Asn Gln Leu Ala Asn Val
65 70 75 80

Pro Val Ala Phe Phe Gly Val Cys Leu Thr Ala Arg Lys Pro Glu Lys
85 90 95

Asn Thr Pro Glu Thr Ser Val Tyr Met Lys Lys Leu Asn Leu Asn Ala
100 105 110

Ala Trp Met Pro Lys Leu Gln Ala Val Phe Ala Gly Ala Leu Leu Tyr
115 120 125

Ser Lys Tyr Thr Trp Trp Gln Ala Leu Leu Ile Gln Phe Ile Met Lys
130 135 140

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

Trp Ala Lys Val Asp Glu Phe Ala Thr Gln Phe Ala Lys Leu Asp Lys
165 170 175

<210> 24
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 24

[0029]

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Ala Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

[0030]

Lys Ala Leu

<210> 25
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 25

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Ala Arg Tyr Pro
115 120 125

[0031]

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 26
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 26

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0032] Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Phe Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 27
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 27

[0033]

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Ile Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0034]

<210> 28
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 28

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Val Arg Tyr Pro
115 120 125

[0035]

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 29
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>

〈223〉 重组

〈400〉 29

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0036]

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Ala Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 30
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 30

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

[0037]

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Ala Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0038]

<210> 31
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 31

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg His Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
[0039] 130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 32
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

〈400〉 32

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0040]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Met Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 33
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 33

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0041]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Trp Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0042]

<210> 34
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 34

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Ala
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

[0043] Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 35
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 35

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0044]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Asp
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 36
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 36

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0045]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Glu
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 37
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

[0046]

<220>
<223> 重组

<400> 37

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Lys
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

[0047]

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 38
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 38

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

[0048] Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Leu
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 39
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 39

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0049]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Gln
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 40
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

[0050]
<220>
<223> 重组

<400> 40

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Arg
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

[0051]

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 41
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 41

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

[0052] Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Ser
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 42
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 42

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0053]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Thr
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 43
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0054]
<400> 43

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Ala Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

[0055]

Lys Ala Leu

<210> 44
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 44

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

[0056]

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Glu Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 45
<211> 179

<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 45

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0057]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Gly Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 46
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 46

[0058]

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

His Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

[0059]

Lys Ala Leu

<210> 47
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 47

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

[0060]

Ile Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 48
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 48

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0061] Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Lys Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 49
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 49

[0062]

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Leu Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0063]

<210> 50
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 50

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

[0064]

Asn Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 51
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>

〈223〉 重组

〈400〉 51

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0065]

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Gln Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 52
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 52

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

[0066]

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Ser Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0067]

<210> 53
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 53

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Ala Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
[0068] 130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 54
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

〈400〉 54

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0069]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Cys Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 55
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 55

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0070]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Leu Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0071]

<210> 56
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 56

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Trp Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

[0072] Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 57
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 57

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0073]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Ala Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 58
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 58

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0074]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Ala Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0075]

<210> 59
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 59

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Phe Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

[0076]

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 60
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 60

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

[0077] Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Ile Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 61
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 61

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0078]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Lys Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 62
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

[0079]
<220>
<223> 重组

<400> 62

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Leu Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

[0080]

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 63
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 63

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

[0081] Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Pro Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 64
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 64

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0082]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Arg Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 65
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0083]
<400> 65

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Ser Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

[0084]

Lys Ala Leu

<210> 66
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 66

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

[0085] Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Thr Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 67
<211> 179

<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 67

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0086]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Val Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 68
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 68

[0087]

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Tyr Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

[0088]

Lys Ala Leu

<210> 69
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 69

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

[0089]

Arg Tyr Arg Trp Ala Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 70
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 70

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0090] Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Ala Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 71
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 71

[0091]

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Lys Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0092]

<210> 72
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 72

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

[0093]

Arg Tyr Arg Trp Ile Asn Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 73
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>

〈223〉 重组

〈400〉 73

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0094]

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Gln Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 74
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 74

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

[0095]

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Thr Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0096]

<210> 75
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 75

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Ala Val Met Ile Gln Leu Ile Met Arg Met
[0097] 130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 76
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

〈400〉 76

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0098]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Gln Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 77
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 77

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0099]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Arg Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0100]

<210> 78
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 78

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Ser Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

[0101] Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 79
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 79

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0102]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Thr Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 80
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 80

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0103]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Val Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0104]

<210> 81
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 81

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Ala Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

[0105]

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 82
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 82

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

[0106] Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Ala Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 83
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 83

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0107]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Cys Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 84
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

[0108]
<220>
<223> 重组

<400> 84

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Ile Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

[0109]

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 85
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 85

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

[0110] Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Leu Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 86
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 86

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0111]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Ser Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 87
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0112]

<400> 87

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Val Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

[0113]

Lys Ala Leu

<210> 88
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 88

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

[0114]

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ala Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 89
<211> 179

<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 89

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0115]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Leu Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 90
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 90

[0116]

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Met Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

[0117]

Lys Ala Leu

<210> 91
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 91

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

[0118]

Arg Tyr Arg Trp Ile Asp Lys Val Met Val Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 92
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 92

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0119] Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Ala Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 93
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 93

[0120]

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Cys Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0121]

<210> 94
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 94

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

[0122]

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Phe Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 95
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>

〈223〉 重组

〈400〉 95

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0123]

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Gly Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 96
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 96

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

[0124]

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln His Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0125]

<210> 97
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 97

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Ile Ile Met Arg Met
[0126] 130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 98
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 98

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0127]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Lys Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 99
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 99

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0128]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Met Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0129]

<210> 100
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 100

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Arg Ile Met Arg Met
130 135 140

[0130] Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 101
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 101

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0131]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Thr Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 102
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 102

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0132]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ala Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0133]

<210> 103
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 103

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Leu Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

[0134]

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 104
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 104

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

[0135] Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Met Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 105
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 105

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0136]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Val Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 106
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

[0137]
<220>
<223> 重组

<400> 106

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Ala Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

[0138]

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 107
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 107

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

[0139] Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Asp Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 108
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 108

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0140]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Leu Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 109
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0141]
<400> 109

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Ser Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

[0142]

Lys Ala Leu

<210> 110
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 110

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

[0143]

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Val Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 111
<211> 179

<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 111

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0144]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Ala Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 112
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 112

[0145]

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Ala
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

[0146]

Lys Ala Leu

<210> 113
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 113

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

[0147]

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Ala Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 114
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 114

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0148] Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Ala Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 115
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 115

[0149]

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Asp Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0150]

<210> 116
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 116

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

[0151]

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr His Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 117
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>

〈223〉 重组

〈400〉 117

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0152]

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Lys Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 118
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 118

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

[0153]

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Asn Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0154]

<210> 119
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 119

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
[0155] 130 135 140

Thr Gly Ala Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 120
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 120

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0156]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Lys Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 121
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 121

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0157]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Met Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0158]

<210> 122
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 122

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

[0159] Thr Gly Arg Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 123
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 123

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0160]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Leu Ile Met Arg Met
130 135 140

Thr Gly Ser Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 124
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 124

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0161]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Ala Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 125
<211> 540
<212> DNA
<213> 阴沟肠杆菌(Enterobacter cloacae)

[0162]

<400> 125
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 126

<211> 546
<212> DNA
<213> 大肠杆菌(Escherichia Coli)

<400> 126
atgaagacct tgattctatt ctccacaagg gacggccaga ctagggagat cgcttcctac 60

ctggccagcg agctaaagga gcttggcatt caggcagacg tggctaacgt gcaccgaatt 120

gaggagccgc agtgggagaa ctacgatcgg gtcgtgatcg gcgccagcat ccggtatgga 180

cactaccaca gcgcgttcca ggagttcgtg aaaaagcacg cgacccgtct gaatagcatg 240

ccatcagcgt tctactcggt caacctcgtg gctcgtaagc ccgagaagcg gacaccccag 300

accaactcgt atgccaggaa gttccttatg aactcgcagt ggcgaccgga ccgctgcgcg 360

gtgatcgccg gtgcgctcag gtaccctcgt tataggtggt acgacaggtt tatgattaaa 420

cttataatga aaatgagcgg cggagagacc gacaccagaa aagaggtggt ttacacagac 480

[0163] tgggagcagg tagcaaactt cgctagggag attgctcacc tcaccgacaa gccgaccttg 540

aagtaa 546

<210> 127
<211> 537
<212> DNA
<213> 菠萝泛菌(Pantoea ananatis)

<400> 127
atgaaggcct tgatcctgtt ctctacacgc gacggacaga cacagaagat cgcatctgcc 60

atcgctgatg agataaaggg gcagcaatcg tgcgacgtga ttaacataca ggatgccaaa 120

accctcgact ggcagcagta cgaccgggta ctcatcggcg cctccattcg ttacgggcat 180

ttccagcccg ttgtgaatga gtttgtcaag cacaacctct tggccctaca gcagagagtt 240

tccggattct tctccgtgaa cttgacagcc cgaaagccag agaagcggag ccccgagact 300

aacgcttata cagtcaaatt cttggcgcag tcaccctggc aaccggactg ctgcgctgtt 360

tttgcggggg ccctgtacta cccacggtac cggtggttcg atagggtgat gatacagttc 420

ataatgcgaa tgacgggggg agagaccgac gcatcgaaag aggtggagta cactgactgg 480

cagcaggtgc agcggttcgc gcgagacttc gcgcagttac cgggtaagtc ctactga 537

<210> 128
<211> 537
<212> DNA
<213> 托莱多欧文氏菌(Erwinia toletana)

<400> 128
atgaaggccc ttatactgtt cagttccaga gaaggccaga cgagggagat agcgagttac 60

attgccaact cgataaagga ggaaatggaa tgcgacgtgt tcaacatcct tcgtgtggag 120

cagatcgact ggtctcaata cgaccgcgtc ctgatcgggg gctcgataca ctacggccat 180

ttccacccag cggtggcaaa atttgtcaag aggcacctcc atgagttgca acagaggtct 240

[0164] tccggctttt tctgcgtcaa cctgacggcc aggaaggccg acaagcggac tccccagacc 300

aatgcctaca tgagaaagtt cttgttgcag tccccatggc aacccgattg ctgcgccgtg 360

tttgcggggg cccttaggta cacccgttac aggtggttcg acagggtaat gattcagctg 420

atcatgagga tgacgggcgg agagactgac acatcgaagg aggtggagta cacagactgg 480

acgcaggtcg cccgcttcgc gcaggagttc gcccatttgc ccggcaaaac tcagtga 537

<210> 129
<211> 540
<212> DNA
<213> 胡萝卜软腐病果胶杆菌(Pectobacterium carotovorum)

<400> 129
atgaaggctc ttatcgtatt ctcttcgagg gatggccaaa cccgagcgat cgcgtcttat 60

attgctaata ccctcaaagg gaccctagag tgcgacgtcg tcaacgtcct caatgctaac 120

gacattgatt tgagccagta cgaccgtgtg gccattggcg cctccattcg ctacgggagg 180

ttccacccag ctgttaacca gtttatccgg aagcacctta cgagcctcca gcagctacca 240

tctgcgttct tctccgtgaa cctcacagct cggaagcccg agaagaggac tatacaaacc 300

aacgcgtaca ctaggaagtt tctactgaac tcgccgtggc agccggacct gtgctgcgtg 360

ttcgcgggag cccttcgcta tccccgttac aggtggtttg accgagtgat gattcaactc 420

ataatgcgca taacgggggg cgagacagac tccaccaagg agatcgagta caccgactgg 480

cagcaggtcg cgcgattcgc ccaggatttt gcacagcttg ccgcaaagaa cccggcatga 540

<210> 130
<211> 540
<212> DNA
<213> 布拉特西姆惠菌(Shimwellia blattae)

<400> 130
atgaagacct tgatcctatt ctccaccagg gacggccaaa cacacaagat cgcaaggcac 60

[0165] atcgcaggag tcctcgaaga gcaggggaag gcctgcgagt tggtcgatct gttacagccc 120

ggcgaaccag actggagtac cgttgaatgc gtcgttctag gggccagcat tagatatggt 180

cacttccata agtctttcat caggttcgta aacactcacg cgcagcgctt gaataatatg 240

ccaggcgccc ttttcacagt taacttagtc gcccgaaagc ccgagaagca gagtccacag 300

acgaactctt acacccgcaa gtttctcgcc gcctcccctt ggcagccaca gcgatgccaa 360

gttttcgcgg gcgctttgag gtaccctagg tactcgtggt acgacagaat gatgatacgt 420

ttgataatga agatggccgg gggcgagact gacacaagga aggaggttga gtacactgac 480

tggcagtcgg tgactcggtt cgcgagggag atcgctcagc tgccgggaga gacgcggtag 540

<210> 131
<211> 534
<212> DNA
<213> 斯氏泛菌(Pantoea stewardii)

<400> 131

atgaaggcgc tgatcttgta ctcaaccagg gacggtcaga ctcgcaagat tgcaagtagc 60

attgcggacg tcatcaggca gcagcagcag tgcgacgtct taaacattaa agacgcatca 120

cttcctgact gggcccaata tgaccgagtg ctcatcggag ctagcatccg ttacgggcat 180

ttccagcccg ttgtagacaa gttcgtgaag cagcacttgc acgagcttca gcagcggacc 240

tccggcttct tctccgtgaa cctgacggcg aggaagcctg aaaaaaggag ccctgagacc 300

aatgcctaca cccagaaatt cttggcgcac tccccttggc agcccgattg ctgtgccgtt 360

ttcgcggggg ccctttacta ccccaggtac cgttggttcg accgggtgat gatccagttg 420

attatgcgca tgactggtgg agagaccgac tctaccaagg aagtggagta cactgactgg 480

cagcaggtga gtaccttcgc caacgatttt gcccagcttc caggcaagag ctaa 534

[0166]

<210> 132
<211> 537
<212> DNA
<213> 斯氏泛菌(Pantoea stewardii)

<400> 132
atgaaggccc taattttatt cagtagtagg gacggccaga cccagcttat agcatcgtct 60

atcgccaagg agctcgaagg gaagcaggcg tgcgacgtgt tgaatatcct cgacacgact 120

aatgtggagt ggacccagta cgaccgcgtg ctgattggag catccatccg gtacgggcac 180

tttcaccctg cggtcgccga gttcgtaaag cgtcaccagc gagagctaca gcagagaagt 240

agtggctttt tctctgtgaa cttgacggcc cgtaagccgg aaaagaggtc ccccgagact 300

aacgcctata ccgccaagtt ccttaaccaa agtccatggc agcctgactg ttgcgctgtg 360

ttcgctgggg ctttgcgata ccctcggtac cgctggttcg acagaattat gatccagcta 420

atcatgcgga tgactggggg tgagacagat tcttcaaagg aggtcgagta caccgactgg 480

cagcaggtga cccgcttcgc gcaagagttc gccaggcttc cgggaaagac cagttga 537

<210> 133
<211> 543
<212> DNA
<213> 阴沟肠杆菌(Enterobacter cloacae)

<400> 133
atgaagaccc taatactgtt ctctacccgc gacgggcaga caagggagat cgccgcgttc 60

cttgcctcgg agctgaagga gcaggggatt tacgctgacg tcataaacct taaccggacg 120

gaggagatag cttggcagga gtatgataga gtcgtaatcg gggcgtcgat ccgatacggg 180

catttccacc ctgctgtcga ccgcttcgtg aagaagcaca cagagacact caactcactg 240

cccggcgcct ttttctctgt aaaccttgtt gcccggaaag ccgagaagag aacgccgcag 300

acgaactcat acaccaggaa gttcctatta aacagcccgt ggaagccagc ggcctgcgcg 360

gtctttgctg gggccctccg ctaccctaga taccgctggt acgacaggtt catgatacga 420

ctgattatga aaatgacagg cggggagacg gatacccgaa aggaggtagt ctacactgac 480

[0167]

tggtcgcagg tcgcgtcgtt tgccagagag atagtccagt tgaccaggtc atcgcgcttg 540

tga 543

<210> 134
<211> 534
<212> DNA
<213> 桑肠杆菌(Enterobacter mori)

<400> 134
atgaagatat taatcctttt ctccacccgt gacggccaaa cccgtgagat tgcggcgtcc 60

ttggcgtccg aactcaagga gcaggcattc gacgtggacg tcgtcaacct tcaccgggcc 120

gagaacatcg catgggagga gtacgacggt gttgtcatcg gagcgtccat caggtacggc 180

cactttcata gtaccctgaa ctcatttgtc aagaagcatc agcaggctct taagaagctt 240

cccggggctt tctacagcgt gaacctcgtc gcccggaagc ctgagaagcg cacaccgcag 300

accaatagct acacccgcaa gttcctcttg gattccccgt ggcagcccga cctttcagcc 360

gtgttcgccg gggcactcag gtaccctcgg tacaattggt acgaccgtat catgattaga 420

cttatcatga agattacagg cggcgagact gataccagga aggaagtagt ctacacagac 480

tggcagcagg tcactcactt tgctcacgag atcgtccagc tcgtgcggaa gtag 534

<210> 135
<211> 540
<212> DNA
<213> 水生拉恩氏菌(Rahnella aquatilis)

<400> 135
atgaaggctc ttatcctcta ctctagcaga gacggacaga cacacgccat tgcctcctac 60

atcgcaaatg aactcaagga gaagtgctcc tgcgatgtcg tggacctggc gcacgctgag 120

cgggttgatc tgaagtcata cgaccaggtc atgattggcg cttccatacg ctacggacac 180

ttcaatcccg ttctcgacaa gtttgtgaag aagcacgccg ggatcttaaa ccacatgcca 240

[0168] tctgccttct tcggcgtgaa cttaacagcc cggaagcccg agaagcgtac accacagacg 300

aacgcctacg tccgcaagtt cttgctcgca tcaccctggg agcccgcaat gtgcggcgtg 360

ttcgctggtg ccctgcgata cccgcgctac cgctggttcg acaaggtcat gattcagctc 420

atcatgcgga tgacaggagg cgaaacggac actaggaagg aagtagagta caccgactgg 480

caacaagtgg ccaaattcgc agaggacttc gggcagatta gctacaagaa gtctcattag 540

<210> 136
<211> 546
<212> DNA
<213> 肠道沙门氏菌肠道亚种血清型(Salmonella enterica subsp enterica serovar)

<400> 136
atgaagacgc tcattctctt ctcgacgcgg gacgggcaaa ctcgggaaat cgcgtcatac 60

ctggcgtccg agctcaagga gatgggcatc tgggccgatg tcgtgaacct ccacagagcg 120

gaggagcccg attgggactc ctacgacagg gttgtcatag gtgcctcgat ccgctacgga 180

cattatcact ccgctttcca ggagttcgtt aagaagtacg ccacgcgatt gaacggtatg 240

ccaagtgcct tctactcggt gaatcttgtt gcacggaagg ccgagaagcg aactccacag 300

accaacagct acgcacggaa attcctcatg tcaagtcctt ggagacctga ttattgcgcc 360

gtgattgcgg gtgccttgcg ttaccctcgc tatcgctggt acgaccgact catgatcaaa 420

cttatcatga agatgtctgg cggcgagacc gacacgagca aggaggtggt gtacactgat 480

tgggaacaag tggcgcactt cgcacgagag attgcacacc ttacgaacaa gtcctcggcc 540

aaatag 546

<210> 137
<211> 540
<212> DNA
<213> 水生拉恩氏菌(Rahnella aquatilis)

<400> 137

[0169] atgaaggccc tcatcttgta ctccagccgc gacgggcaaa cccatgctat cgcctcttac 60

attgcgaacg agcttaagga gaagtgttcc tgcgatgtcg tggacctcgc ccacgcggaa 120

agagtggacc tcaagtcgta tgaccaagtg atgatcggcg cttccatccg atacggccac 180

ttcaatccag tgctcgacaa gttcgttaag aagcacgcgg agactcttaa ccgtatgccc 240

tcagccttct tcggagtcaa cttgaccgct aggaaacctg agaagcgcac gccgcagacc 300

aatgcttacg tgaggaagtt cctccttgca agcccttggg agccagccat gtgcggtgtg 360

ttcgctggtg ccctccgcta cccacgctac cgttggtttg acaaggtcat gattcagttg 420

attatgagaa tgacaggcgg tgagacagac acacgcaagg aagtcgagta caccgattgg 480

cagcaagtgg ctaagttcgc agaggacttc ggtcagatca gctacaagaa atctcattga 540

<210> 138
<211> 528
<212> DNA

<213> 帕西尼氏弧菌(Vibrio pacinii)

<400> 138

atggcaaagg cactcttcct ctactctacc cgcgagggcc agaccaagaa gatcttccag 60

cacatctccg agcagatgaa ggagttcgat tgcgagatga tcgacctgca ctccgtcgag 120

tccgtggact tctcccagta ccaacgggta ctcatcggcg catccatccg atacggccac 180

cttaacaaga aactctatca attcatcgag cacaatctga gccagttgca gaccgctaag 240

tcggcgttct tctgcgtgaa cctcactgct cgaaaggagg accaggcgaa ggatactcct 300

gagggctcgg cctacatcaa gacgttctta tccaagtcgc cttggcagcc ggaactaata 360

ggcgtgttcg ctggtgccct gtactaccct cgctacaact ggttcgacaa gacgatgatt 420

aagttcatca tgtccatgac gggcggcgag accgacacct ccaaggaggt ggagtacact 480

aactggggca aggtgacctt gttcgcagac aagttccaga acctctag 528

[0170]

<210> 139
<211> 525
<212> DNA
<213> 嗜线虫致病杆菌(Xenorhabdus nematophila)

<400> 139

atgtcctacc tgctcttgta cagcacccag gatggtcaga ccaagaagat catcatgcgt 60

attgccgaga acctccgccg ctctggtgtt tcgtgcgacc tgagagactt ggccgcagtg 120

aagcaagtga acttagcgag ctaccagaag gtgatggtcg gtgcctcgat ccggtacggc 180

cacttcaact ccgttctgca caagttcgtg acccaccacc agaagcagct gaaccagaag 240

ccgacggcct tcttcggagt caacctcaca gcaaggaagc cggagaagcg cactccggag 300

actaacgcct acgttcgcaa gttcctcatg aagtcgccct ggcagcctga cctttgtgag 360

gtcttcgctg gcgctctcct gtacccgcgt tacaagtggc tcgaccgtgt gatgatccag 420

attattatgc ggatgactgg tggcgagacc gataccacca aggagatcga gtacaccgat 480

tgggcacaag tcgatcggtt cagtgagatg ttccttcaga tttga 525

<210> 140
<211> 525
<212> DNA
<213> 重氮养弧菌(Vibrio diazotrophicus)

<400> 140
atgaaggcac tcctcttgta ctccacccgc gagggccaga ccaagaagat tatgcaccac 60

atcgcccagc agctccaggg ctatgaatgc cagttcgtgg acctccacga gtgccacact 120

atggacttga ctcaatacga taaggtctta attggtgcct ccattcgtta cgggaagctc 180

aacgcaaagc tgtaccaatt catcgacgcc cacatcaagc agctcgaaca agttaaggcc 240

gccttctatt gcgtcaacct caccgcacgc aaggtggaac agggcaagga tactcccgaa 300

gggtcagtgt acatcaagac gttcctcaag aagtcgccct ggcagccgag cctgatcggc 360

[0171] gtgttcgccg gtgcattgta ctatccgcgc taccgtccaa tcgaccgcat gatgataagg 420

ttcatcatga agctcacagg cggcgaaact gataccacca aggaggtcga gtacaccgac 480

tgggagaagg tctcactgtt cgcaaagaag ttcgagcagt tgtga 525

<210> 141
<211> 525
<212> DNA
<213> 霍利斯格里蒙菌(Grimontia hollisae)

<400> 141
atgaagaagg ccctcctcct gcattcttcg cgcgagggcc agacacttaa gatcctcagg 60

gccatcgagt cagaactaag cgagtcatac cagtgcgagc ttgtggacct gcacgagatg 120

ccagaggtga actgggaaga ttacgataag gtgcttatcg gtgcctccat cagatacggc 180

cacttgaaca agaagctgta ccgtttcatc gagactaacc tctcgtccct caagaacaag 240

aaggccgcgt tcttctgcgt gaacttgacc gcgaggaagc ccggcaagga cacgccggag 300

ggctcggtgt acatgaagaa attcctcaag cgttcgccgt ggcagccgca gctccttgat 360

gtgttcgctg gcgctctgta ctacccacgc taccgattct tcgaccgtgt gatgatccag 420

ttcattatga agatgactgg tggagagacc gacccaacta aggaaatcga gtacaccaac 480

tgggacaggg tgaaggtctt ctcaggccaa tttcggtcgt tgtga 525

<210> 142
<211> 534
<212> DNA
<213> 蜜蜂吉利氏菌(Gilliamella apicola)

<400> 142
atgaaggtgc tcttgcttta caccactcac gagaagcaga cctttaagat catgcagcgc 60

atcgagaacc agctcgccgg gaagtgcgac tgcgacgtca ttgaactcct tccctctacg 120

aacatcgacc ttacgaagta ccaggccgtc ctcctcgggt gctccattcg ctacggcttc 180

[0172] tactctaagg tgatgaagaa gttcatcgac aacaactacc agcagttgaa caagatgagg 240

tccggcttct tcggcgtaaa cgtggtggca cgcaagccgc acaagaacac gccggagacc 300

aacagttaca cgcgcaagtt cctggccaag atcgcgtggc agcctaccat caaggcggtg 360

ttcgcgggcg ctctttacta cccaaagtac aactggttcg accggaacat ggtgaggttc 420

atcatgtggc ttgggaaggg cgacaccgac gtcaccaagc caattattga gtacacggac 480

tgggccaagg tggaccagtt cgcagaactg ttctacacgc agacgtactc gtga 534

<210> 143
<211> 525
<212> DNA
<213> 奥奈达希瓦氏菌(Shewanella oneidensis)

<400> 143
atgcagaccc tcatcatcta ctccacaata gacggtcaga cacttgaaat ctgccgtaag 60

atcaaagcgt tcgccgagcg cgctggcgag aaggtgtccc tgttctcact ggaacaggct 120

gaggccatca acctggcgga cgttgataag gttctcatcg gcgcatccat ccgctatggc 180

aagcaccgtc ccgagctgta ccaattcgtc aaccgcaacc acgccgtact atcagccaaa 240

gtcaacggct tcttcaccgt gaatgtggtg gcgaggaagc cattgaagaa cactccggag 300

accaaccctt acatgcagaa gttcctcaag ttgtcgctct ggcagcctca acaccttgca 360

gtgttcgccg ggaagataga ctacccgaag tacgggctat tcgaccgaac catgatctgc 420

ttcatcatgt ggatgaccaa agggccgacg gacctgaaag gcaccttcga gttcacagac 480

tgggccaagg tcgaggcttt cgggacacac ttctccaagt tgtga 525

<210> 144
<211> 528
<212> DNA
<213> 海洋希瓦氏菌(Shewanella benthica)

<400> 144
[0173] atgaacaaga ttctcatcat ctactctagc gtccacgggc agaccaggaa gatttgcgag 60

tacatcgcca gtcagctcag ggcgtccgat tatgggtgcg aggtccgact ggcctcgctg 120

gaggaacagt tcgatctgga ctcattcgac aagatcatca tcggtgcctc catccgccac 180

ggcaagcaca acccggaggt gtaccacttc atcgacactc accttgtggc acttgagacg 240

aagtccagct cgttcttctc cgtgtcccta gtcgcccgca aggcaagtcg caacacgccg 300

gagtcaaacc cgtacatgca agcgtttctg tccaagactc tgtggagacc aaacctggtc 360

aaggtgttcg ccggaaagct cgactaccag ggctacaact ggcttgatcg cagcatcata 420

aggtttatca tgtggatcac gaagggccct acggccgtga acactaagat cgagtacacc 480

gactggcaac ttgtggatgt gttcgtgaag gaattggagc tgctttag 528

<210> 145
<211> 531
<212> DNA
<213> 乌斯怀亚海单胞菌(Marinomonas ushuaiensis)

<400> 145
atgtccacca ccctcctgat ctactcgact acagacgggc atacgaagaa gatttcccag 60

aagatccagg agatcatcga ggcgaagggc cagaaggtca cccttcttcc catcgaggag 120

attacggcgg cggccctaga ctcccacgat aagatcgtga tcggcgcgtc catccgctac 180

ggcaagcacc agaaggtcgt ggcggacttc attgagcaga acaagactac tctggagtca 240

aagccgtccg ccttctacac cgtcaacctg gtggcccgca agcctgagaa gtgccagccc 300

gacacgaacc cttacatcat caaattcttg tcacagctcg actggcagcc ctcccttcaa 360

ggagtcttcg ctggcaaact cgactaccag aagtacggct tcattgacag aaacatgata 420

cggttcatca tgtggatgac caaaggccct accgacccaa agacgaacat cgagttcact 480

aactgggagg cggttgacca gttcgccaac ggcgttgtgg agcttagctg a 531

<210> 146
[0174] <211> 522
<212> DNA
<213> 武氏希瓦氏菌(Shewanella woodyi)

<400> 146
atgagcaaca tccttattat ctactccagt gtgcacggcc agacgcggaa gatttgcgct 60

tacttggagg acaagttcgt tgcccttggc gacaaggtga ccatgtcgtc cctcgaccaa 120

gtgcccgacc tcaacgactt cgacaaggtg gtactcggtg ccagcatccg acacgggaag 180

cacaacccga acgtttacga cttcatcagt cagaatcgtg gcatcctcga gaagaagacc 240

agctcattct tcagcgtcaa cctcgtggca aggaagcctg caaagaacac tccacagacg 300

aatccctaca tgcttgcctt catcgagaag tccgagtgga agcccaactt gcttcaagtg 360

ttcgcgggct cgctaaacta ccagggttac ggcatagtgg accgtaacat tatccggttc 420

atcatgtgga tgactaaggg accgacggac gcccagacca acattgagta cactgattgg 480

gctaaagttg atctgtttag ttccgagttc cacgcgctgt ag 522

<210> 147
<211> 531
<212> DNA
<213> 白色噬琼胶菌(Agarivorans albus)

<400> 147
atgaagttgc tcgtgcttta ctcatcctgt gagggacaga ctctcaagat cgctaagcac 60

atcgtctctc aacaggccgg agaagtggcg gccgactaca ttcagatcga ctccaaccag 120

cagtcactgg acctcaccgc ttacgacaag gtcttaatcg gcgcgtccat cagatacggg 180

aagttccgac cgcagctcta ctccctactg gctgagtacc agaaccagct cgcaaacgtc 240

cctgtggcct tcttcggcgt ttgcctcaca gcgcgaaagc ccgagaagaa tacgccggag 300

actagcgtgt acatgaagaa gctgaacttg aacgccgctt ggatgcctaa gctccaggct 360

gtgttcgctg gagccctctt gtacagtaag tacacctggt ggcaagccct gctcatacag 420

[0175] ttcatcatga agatgacggg cgggagcact gaccgctcac aagacctgga actcacagat 480

tgggccaagg tggatgagtt cgccactcag ttcgccaagt tggacaagta g 531

<210> 148
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 148
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagctg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 149
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 149
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

[0176]

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg ccgctcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 150
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 150
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg ccttccggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

[0177]

<210> 151
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 151
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg ccatacggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 152
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 152
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

[0178]

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg ccgtccggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 153
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 153

atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttgctta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 154
<211> 540
[0179] <212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 154
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcgggc tccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 155
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 155
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

[0180]

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggca tccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 156
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 156
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggat gccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 157
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0181]

<400> 157
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggtg gccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 158

<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 158
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cgctcgatac cggtggatcg acaaggtgat gatccagcta 420

[0182]

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 159
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 159
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cgatcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 160
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 160
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

[0183]

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cgaacgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 161
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 161
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta caaacgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

[0184]

<210> 162
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 162
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cctacgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 163
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 163
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

[0185]

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta ccaacgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 164
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 164

atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta ccggcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 165
<211> 540
[0186] <212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 165
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta ctctcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 166
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 166
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

[0187]

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cactcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 167
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 167
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccggcttac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 168
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0188]

<400> 168
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccggaatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 169

<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 169
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgggctac cggtggatcg acaaggtgat gatccagcta 420

[0189]

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 170
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 170
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcattac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 171
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 171
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

[0190]

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgatatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 172
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 172
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgaaatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

[0191]

<210> 173
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 173
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgctatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 174
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 174
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

[0192]

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgaattac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 175
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 175

atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcaatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 176
<211> 540
[0193] <212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 176
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgtcttac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 177
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 177
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

[0194]

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgagct cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 178
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 178
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatgc cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 179
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0195]

<400> 179
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgacta cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 180

<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 180
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatgg cggtggatcg acaaggtgat gatccagcta 420

[0196]

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 181
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 181
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac gcttggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 182
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 182
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

[0197]

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cgggctatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 183
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 183
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggttcatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

[0198]

<210> 184
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 184
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggataatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 185
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 185
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

[0199]

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggaaaatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 186
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 186

atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggctaatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 187
<211> 540
[0200] <212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 187
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggcctatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 188
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 188
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

[0201]

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggcggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 189
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 189
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtctatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 190
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0202]

<400> 190
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggactatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 191

<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 191
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cgggtcatcg acaaggtgat gatccagcta 420

[0203]

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 192
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 192
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtatatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 193
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 193
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

[0204]

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtgggctg acaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 194
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 194
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg ctaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

[0205]

<210> 195
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 195
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatca aaaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 196
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 196
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

[0206]

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatca ataaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 197
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 197

atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcc aaaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 198
<211> 540
[0207] <212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 198
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatca ctaaggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 199
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 199
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

[0208]

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acgctgtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 200
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 200
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg accaagtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 201
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0209]

<400> 201
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtgggatcg accgggtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 202

<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 202
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg actctgtgat gatccagcta 420

[0210]

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 203
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 203
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acactgtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 204
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 204
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

[0211]

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acgtcgtgat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 205
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 205
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggctat gatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

[0212]

<210> 206
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 206
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtggc tatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 207
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 207
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

[0213]

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgtg catccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 208
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 208

atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat aatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 209
<211> 540
[0214] <212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 209
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgct aatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 210
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 210
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

[0215]

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgtc tatccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 211
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 211
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtggt catccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 212
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0216]

<400> 212
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat ggctcagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 213

<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 213
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gctacagcta 420

[0217]

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 214
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 214
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatgcagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 215
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 215
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

[0218]

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat ggtccagcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 216
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 216
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccaggct 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

[0219]

<210> 217
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 217
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagtgc 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 218
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 218
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

[0220]

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagttc 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 219
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 219

atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagggc 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 220
<211> 540
[0221] <212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 220
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcat 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 221
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 221
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

[0222]

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagata 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 222
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 222
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagaaa 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 223
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0223]

<400> 223
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagatg 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 224

<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 224
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcgg 420

[0224]

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 225
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 225
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagact 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 226
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 226
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

[0225]

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

gctatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 227
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 227
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ctaatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

[0226]

<210> 228
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 228
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

atgatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 229
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 229
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

[0227]

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

gtcatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 230
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 230

atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

atagctcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 231
<211> 540
[0228] <212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 231
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

atagatcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 232
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 232
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

[0229]

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

atactacgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 233
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 233
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

atatctcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 234
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0230]

<400> 234
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

atagtccgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 235

<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 235
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

[0231]

ataatggcta tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 236
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 236
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcggg ctactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 237
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 237
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

[0232]

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tggctggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 238
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 238
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactgctgg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

[0233]

<210> 239
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 239
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactgatgg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 240
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 240
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

[0234]

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactcatgg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 241
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 241

atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactaaagg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 242
<211> 540
[0235] <212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 242
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactaatgg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 243
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 243
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

[0236]

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactggggc tgagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 244
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 244
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactgggaa agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 245
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0237]

<400> 245
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactgggat ggagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 246

<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 246
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

[0238]

ataatgcgga tgactgggcg ggagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 247
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 247
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatccagcta 420

ataatgcgga tgactgggtc tgagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 248
<211> 540
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 248
atgaaggcct tggtactgta ctcgacgcgg gacggccaga cccacgcaat tgcttcatac 60

[0239]

atcgcctcct gcatgaagga gaaggccgaa tgcgacgtga tcgacctcac ccacggggag 120

cacgtgaacc tcacccaata cgatcaggtg ctaatcggtg cgagtattcg ttacggccac 180

ttcaacgccg tgcttgacaa gttcatcaag agaaacgtgg atcagctgaa caacatgcca 240

agcgcgttct tctgcgtaaa cctcacagca aggaagcccg agaagcgtac tccccagaca 300

aacccttatg tccgaaaatt cttgcttgct acccccctggc agcccgcgtt gtgcggagtg 360

ttcgcagggg cccttcggta cccgcgatac cggtggatcg acaaggtgat gatcgctcta 420

ataatgcgga tgactggggg agagacagac acgagcaagg aggtcgagta cacggattgg 480

gagcaggtta agaagttcgc ggaggatttt gcaaagctat cgtacaagaa ggccctctag 540

<210> 249
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 249

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

[0240] Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Cys Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 250
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 250

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

[0241]

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro

100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Glu Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

[0242]

<210> 251
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 251

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gly Leu Ile Met Arg Met
[0243] 130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 252
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 252

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0244]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile His Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys

165 170 175

Lys Ala Leu

<210> 253
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 253

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

[0245] Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Lys Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 254
[0246] <211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 254

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val

50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Leu Leu Ile Met Arg Met
130 135 140

[0247]

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 255
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 255

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

[0248]

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Met Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 256
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 256

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

[0249]

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro

115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Arg Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 257
<211> 179
[0250] <212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 257

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Ser Leu Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
[0251] 145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 258
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 258

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala

1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

[0252]

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Asn Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 259
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 259

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0253]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Gln Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 260
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

[0254] <220>
<223> 重组

<400> 260

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro

65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Ser Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

[0255]

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 261
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 261

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

[0256] Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Val Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 262
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 262

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

[0257]

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Trp Ile Met Arg Met

130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 263
<211> 179
<212> PRT
<213> 人工序列(Artificial Sequence)

<220>
[0258] <223> 重组

<400> 263

Met Lys Ala Leu Val Leu Tyr Ser Thr Arg Asp Gly Gln Thr His Ala
1 5 10 15

Ile Ala Ser Tyr Ile Ala Ser Cys Met Lys Glu Lys Ala Glu Cys Asp
20 25 30

Val Ile Asp Leu Thr His Gly Glu His Val Asn Leu Thr Gln Tyr Asp
35 40 45

Gln Val Leu Ile Gly Ala Ser Ile Arg Tyr Gly His Phe Asn Ala Val
50 55 60

Leu Asp Lys Phe Ile Lys Arg Asn Val Asp Gln Leu Asn Asn Met Pro
65 70 75 80

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

Thr Pro Gln Thr Asn Pro Tyr Val Arg Lys Phe Leu Leu Ala Thr Pro
100 105 110

Trp Gln Pro Ala Leu Cys Gly Val Phe Ala Gly Ala Leu Arg Tyr Pro
115 120 125

Arg Tyr Arg Trp Ile Asp Lys Val Met Ile Gln Tyr Ile Met Arg Met
130 135 140

Thr Gly Gly Glu Thr Asp Thr Ser Lys Glu Val Glu Tyr Thr Asp Trp
145 150 155 160

[0259]

Glu Gln Val Lys Lys Phe Ala Glu Asp Phe Ala Lys Leu Ser Tyr Lys
165 170 175

Lys Ala Leu

<210> 264
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 264
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gatttgcctg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 265
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0260]

<400> 265
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattgaactg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 266
<211> 537
<212> DNA

<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 266
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattggcctg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

[0261]

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 267
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 267
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattcatctg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 268
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 268
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

[0262]

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattaaactg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 269
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 269
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattctgctg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

[0263]

<210> 270
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 270
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattatgctg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 271
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 271
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

[0264]

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattcgcctg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 272
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 272
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattagcctg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 273
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

[0265]

<220>
<223> 重组

<400> 273
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattcagaac 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 274
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 274
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

[0266]
tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattcagcag 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 275
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 275
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattcagagc 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 276
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

[0267]

<400> 276
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattcaggtg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 277
<211> 537
<212> DNA

<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 277
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattcagtgg 420

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

[0268]

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

<210> 278
<211> 537
<212> DNA
<213> 人工序列(Artificial Sequence)

<220>
<223> 重组

<400> 278
atgaaagcgc tggtgctgta tagcacccgc gatggccaga cccatgcgat tgcgagctat 60

attgcgagct gcatgaaaga aaaagcggaa tgcgatgtga ttgatctgac ccatggcgaa 120

catgtgaacc tgacccagta tgatcaggtg ctgattggcg cgagcattcg ctatggccat 180

tttaacgcgg tgctggataa atttattaaa cgcaacgtgg atcagctgaa caacatgccg 240

agcgcgtttt tttgcgtgaa cctgaccgcg cgcaaaccgg aaaaacgcac cccgcagacc 300

aacccgtatg tgcgcaaatt tctgctggcg accccgtggc agccggcgct gtgcggcgtg 360

tttgcgggcg cgctgcgcta tccgcgctat cgctggattg ataaagtgat gattcagtat 420

[0269]

attatgcgca tgaccggcgg cgaaaccgat accagcaaag aagtggaata taccgattgg 480

gaacaggtga aaaaatttgc ggaagatttt gcgaaactga gctataaaaa agcgctg 537

```
H_N90       -MKALVLYSTRDGQTHAIASYIASCMKEK-AECDVIDL-THGEHVNLTQYDQVLIGASIR
HemG001     -MKALILYSSRDGQTHAIASYIANELKEK-CSCDVVDL-AHAERVDLKSYDQVMIGASIR
HemG003     -MKALILYSSRDGQTHAIASYIANELKEK-CSCDVVDL-AHAERVDLKSYDQVMIGASIR
H_N30       -MKALILFSSREGQTREIASYIANSIKEE-MECDVFNI-LRVEQIDWSQYDRVLIGGSIH
H_N40       -MKALIVFSSRDGQTRAIASYIANTLKGT-LECDVVNV-LNANDIDLSQYDRVAIGASIR
H_N60       -MKALILYSTRDGQTRKIASSIADVIRQQ-QQCDVLNI-KDASLPDWAQYDRVLIGASIR
H_N20       -MKALILFSTRDGQTQKIASAIADEIKGQ-QSCDVINI-QDAKTLDWQQYDRVLIGASIR
H_N70       -MKALILFSSRDGQTQLIASSIAKELEGK-QACDVLNI-LDTTNVEWTQYDRVLIGASIR
HemG005     -MSYLLLYSTQDGQTKKIIMRIAENLRRSGVSCDLRDL-AAVKQVNLASYQKVMVGASIR
H_N100      -MKTLILFSTRDGQTREIAAFLASELKEQGIYADVINL-NRTEEIAWQEYDRVVIGASIR
HemG002     -MKTLILFSTRDGQTREIASYLASELKEMGIWADVVNL-HRAEEPDWDSYDRVVIGASIR
HemG004     MAKALFLYSTREGQTKKIFQHISEQMKE--FDCEMIDL-HSVESVDFSQYQRVLIGASIR
H_N110      -MKILILFSTRDGQTREIAASLASELKEQAFDVDVVNL-HRAENIAWEEYDGVVIGASIR
H_N10       -MKTLILFSTRDGQTREIASYLASELKELGIQADVANV-HRIEEPQWENYDRVVIGASIR
HemG006     -MKALLLYSTREGQTKKIMHHIAQQLQG--YECQFVDL-HECHTMDLTQYDKVLIGASIR
HemG007     MKKALLLHSSREGQTLKILRAIESELSES-YQCELVDL-HEMPEVNWEDYDKVLIGASIR
H_N50       -MKTLILFSTRDGQTHKIARHIAGVLEEQGKACELVDL-LQPGEPDWSTVECVVLGASIR
HemG013     -MKLLVLYSSCEGQTLKIAKHIVSQQAGE-VAADYIQIDSNQQSLDLTAYDKVLIGASIR
HemG008     -MKVLLLYTTHEKQTFKIMQRIENQLAGK-CDCDVIEL-LPSTNIDLTKYQAVLLGCSIR
HemG009     -MQTLIIYSTIDGQTLEICRKIKAFAERAGEKVSLFSL-EQAEAINLADVDKVLIGASIR
HemG011     MSTTLLIYSTTDGHTKKISQKIQEIIEAKGQKVTLLPI-EEITAAALDSHDKIVIGASIR
HemG012     MSNILIIYSSVHGQTRKICAYLEDKFVALGDKVTMSSL---DQVPDLNDFDKVVLGASIR
HemG010     MNKILIIYSSVHGQTRKICEYIASQLRASDYGCEVRLA-SLEEQFDLDSFDKIIIGASIR

H_N90       YGHFNAVLDKFIKRNVDQLNNMPSAFFCVNLTARKPE--KRTPQTNPYVRKFLLATPWQP
HemG001     YGHFNPVLDKFVKKHAGILNHMPSAFFGVNLTARKPE--KRTPQTNAYVRKFLLASPWEP
HemG003     YGHFNPVLDKFVKKHAETLNRMPSAFFGVNLTARKPE--KRTPQTNAYVRKFLLASPWEP
H_N30       YGHFHPAVAKFVKRHLHELQQRSSGFFCVNLTARKAD--KRTPQTNAYMRKFLLQSPWQP
H_N40       YGRFHPAVNQFIRKHLTSLQQLPSAFFSVNLTARKPE--KRTIQTNAYTRKFLLNSPWQP
H_N60       YGHFQPVVDKFVKQHLHELQQRTSGFFSVNLTARKPE--KRSPETNAYTQKFLAHSPWQP
H_N20       YGHFQPVVNEFVKHNLLALQQRVSGFFSVNLTARKPE--KRSPETNAYTVKFLAQSPWQP
H_N70       YGHFHPAVAEFVKRHQRELQQRSSGFFSVNLTARKPE--KRSPETNAYTAKFLNQSPWQP
HemG005     YGHFNSVLHKFVTHHQKQLNQKPTAFFGVNLTARKPE--KRTPETNAYVRKFLMKSPWQP
H_N100      YGHFHPAVDRFVKKHTETLNSLPGAFFSVNLVARKAE--KRTPQTNSYTRKFLLNSPWKP
HemG002     YGHYHSAFQEFVKKYATRLNGMPSAFYSVNLVARKAE--KRTPQTNSYARKFLMSSPWRP
HemG004     YGHLNKKLYQFIEHNLSQLQTAKSAFFCVNLTARKEDQAKDTPEGSAYIKTFLSKSPWQP
H_N110      YGHFHSTLNSFVKKHQQALKKLPGAFYSVNLVARKPE--KRTPQTNSYTRKFLLDSPWQP
H_N10       YGHYHSAFQEFVKKHATRLNSMPSAFYSVNLVARKPE--KRTPQTNSYARKFLMNSQWRP
HemG006     YGKLNAKLYQFIDAHIKQLEQVKAAFYCVNLTARKVEQGKDTPEGSVYIKTFLKKSPWQP
HemG007     YGHLNKKLYRFIETNLSSLKNKKAAFFCVNLTARKPG--KDTPEGSVYMKKFLKRSPWQP
H_N50       YGHFHKSFIRFVNTHAQRLNNMPGALFTVNLVARKPE--KQSPQTNSYTRKFLAASPWQP
HemG013     YGKFRPQLYSLLAEYQNQLANVPVAFFGVCLTARKPE--KNTPETSVYMKKLNLNAAWMP
HemG008     YGFYSKVMKKFIDNNYQQLNKMRSGFFGVNVVARKPH--KNTPETNSYTRKFLAKIAWQP
HemG009     YGKHRPELYQFVNRNHAVLSAKVNGFFTVNVVARKPL--KNTPETNPYMQKFLKLSLWQP
HemG011     YGKHQKVVADFIEQNKTTLESKPSAFYTVNLVARKPE--KCQPDTNPYIIKFLSQLDWQP
HemG012     HGKHNPNVYDFISQNRGILEKKTSSFFSVNLVARKPA--KNTPQTNPYMLAFIEKSEWKP
HemG010     HGKHNPEVYHFIDTHLVALETKSSSFFSVSLVARKAS--RNTPESNPYMQAFLSKTLWRP
```

图1A

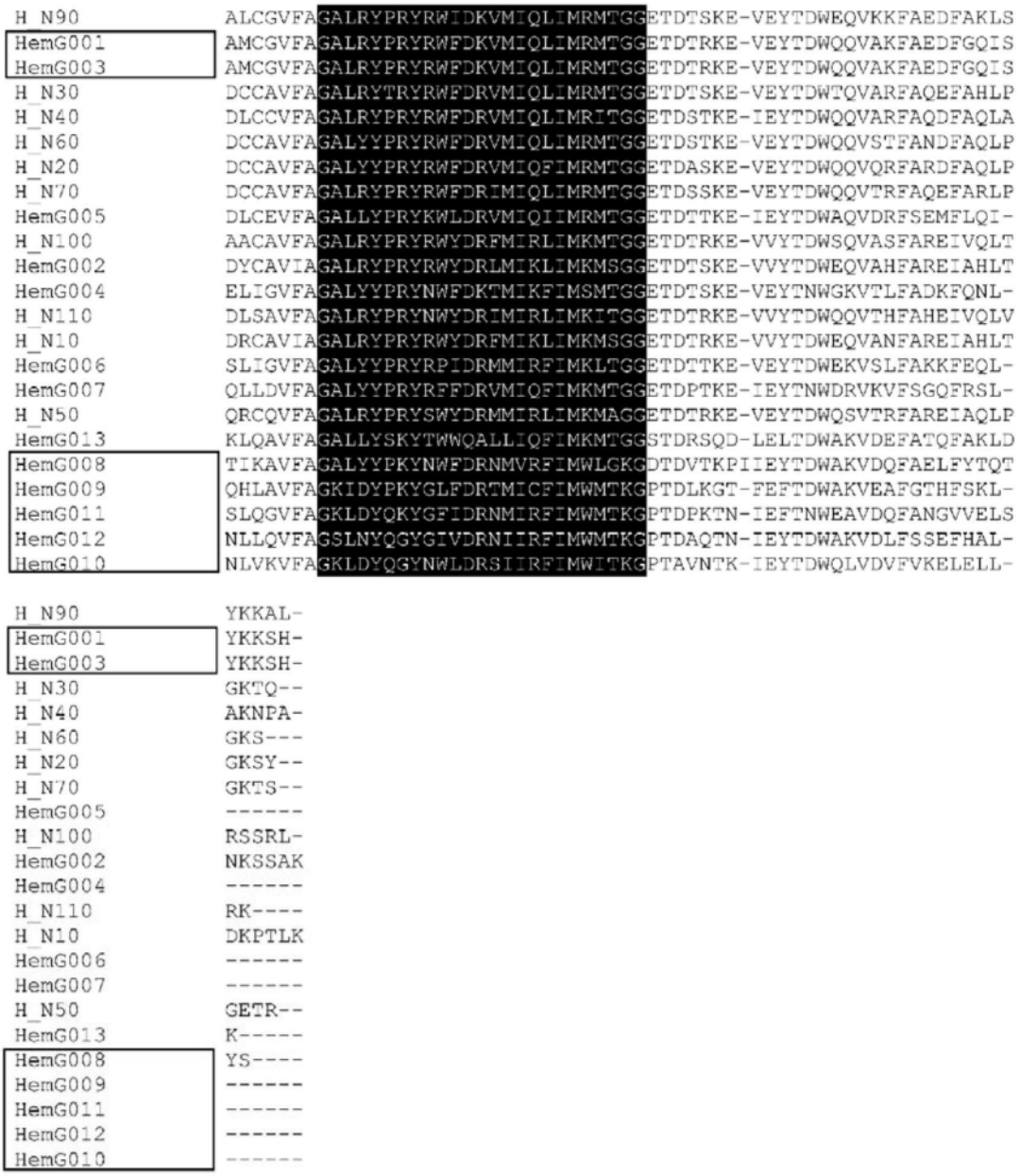

H_N90 ALCGVFAGALRYPRYRWIDKVMIQLIMRMTGGETDTSKE-VEYTDWEQVKKFAEDFAKLS
HemG001 AMCGVFAGALRYPRYRWFDKVMIQLIMRMTGGETDTRKE-VEYTDWQQVAKFAEDFGQIS
HemG003 AMCGVFAGALRYPRYRWFDKVMIQLIMRMTGGETDTRKE-VEYTDWQQVAKFAEDFGQIS
H_N30 DCCAVFAGALRYTRYRWFDRVMIQLIMRMTGGETDTSKE-VEYTDWTQVARFAQEFAHLP
H_N40 DLCCVFAGALRYPRYRWFDRVMIQLIMRITGGETDSTKE-IEYTDWQQVARFAQDFAQLA
H_N60 DCCAVFAGALYYPRYRWFDRVMIQLIMRMTGGETDSTKE-VEYTDWQQVSTFANDFAQLP
H_N20 DCCAVFAGALYYPRYRWFDRVMIQFIMRMTGGETDASKE-VEYTDWQQVQRFARDFAQLP
H_N70 DCCAVFAGALRYPRYRWFDRIMIQLIMRMTGGETDSSKE-VEYTDWQQVTRFAQEFARLP
HemG005 DLCEVFAGALLYPRYKWLDRVMIQIIMRMTGGETDTTKE-IEYTDWAQVDRFSEMFLQI-
H_N100 AACAVFAGALRYPRYRWYDRFMIRLIMKMTGGETDTRKE-VVYTDWSQVASFAREIVQLT
HemG002 DYCAVIAGALRYPRYRWYDRLMIKLIMKMSGGETDTSKE-VVYTDWEQVAHFAREIAHLT
HemG004 ELIGVFAGALYYPRYNWFDKTMIKFIMSMTGGETDTSKE-VEYTNWGKVTLFADKFQNL-
H_N110 DLSAVFAGALRYPRYNWYDRIMIRLIMKITGGETDTRKE-VVYTDWQQVTHFAHEIVQLV
H_N10 DRCAVIAGALRYPRYRWYDRFMIKLIMKMSGGETDTRKE-VVYTDWEQVANFAREIAHLT
HemG006 SLIGVFAGALYYPRYRPIDRMMIRFIMKLTGGETDTTKE-VEYTDWEKVSLFAKKFEQL-
HemG007 QLLDVFAGALYYPRYRFFDRVMIQFIMKMTGGETDPTKE-IEYTNWDRVKVFSGQFRSL-
H_N50 QRCQVFAGALRYPRYSWYDRMMIRLIMKMAGGETDTRKE-VEYTDWQSVTRFAREIAQLP
HemG013 KLQAVFAGALLYSKYTWWQALLIQFIMKMTGGSTDRSQD-LELTDWAKVDEFATQFAKLD
HemG008 TIKAVFAGALYYPKYNWFDRNMVRFIMWLGKGDTDVTKPIIEYTDWAKVDQFAELFYTQT
HemG009 QHLAVFAGKIDYPKYGLFDRTMICFIMWMTKGPTDLKGT-FEFTDWAKVEAFGTHFSKL-
HemG011 SLQGVFAGKLDYQKYGFIDRNMIRFIMWMTKGPTDPKTN-IEFTNWEAVDQFANGVVELS
HemG012 NLLQVFAGSLNYQGYGIVDRNIIRFIMWMTKGPTDAQTN-IEYTDWAKVDLFSSEFHAL-
HemG010 NLVKVFAGKLDYQGYNWLDRSIIRFIMWITKGPTAVNTK-IEYTDWQLVDVFVKELELL-
H_N90 YKKAL-
HemG001 YKKSH-
HemG003 YKKSH-
H_N30 GKTQ--
H_N40 AKNPA-
H_N60 GKS---
H_N20 GKSY--
H_N70 GKTS--
HemG005 ------
H_N100 RSSRL-
HemG002 NKSSAK
HemG004 ------
H_N110 RK----
H_N10 DKPTLK
HemG006 ------
HemG007 ------
H_N50 GETR--
HemG013 K-----
HemG008 YS----
HemG009 ------
HemG011 ------
HemG012 ------
HemG010 ------

图1B

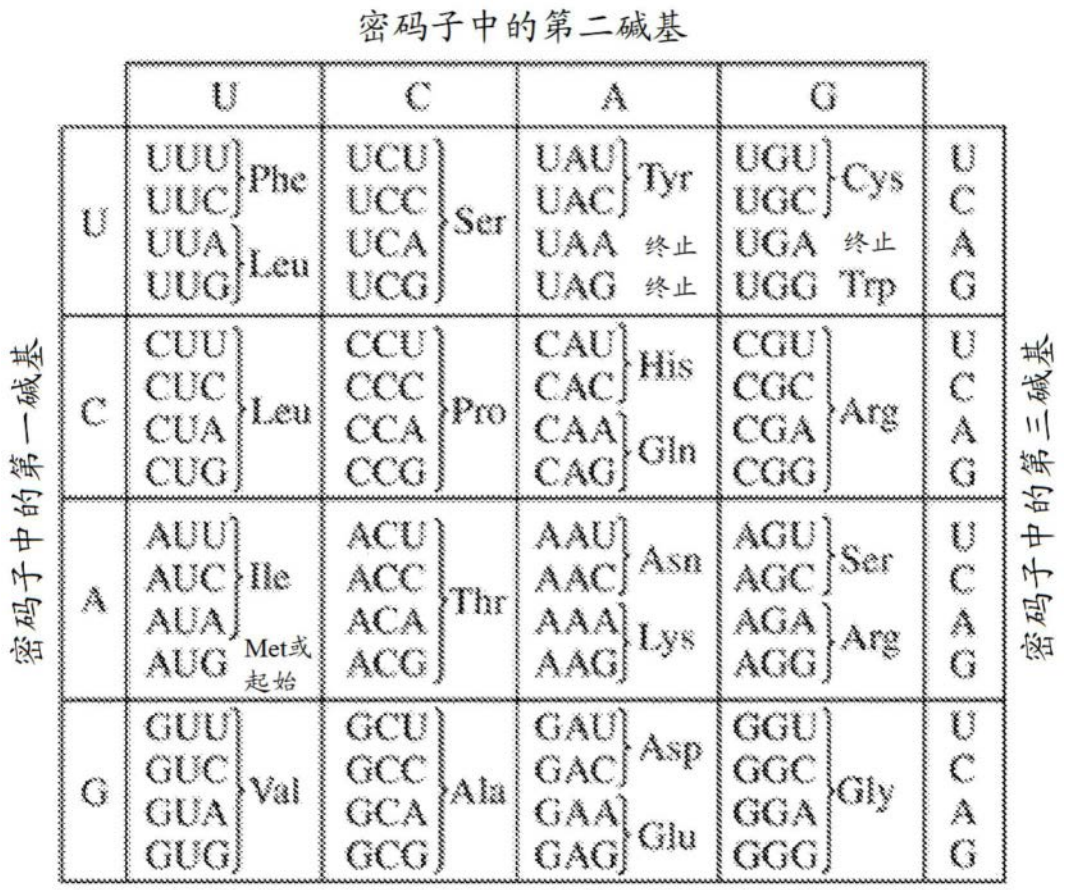

密码子中的第二碱基
U
C
A
G
密码子中的第一碱基
密码子中的第三碱基
UUU Phe
UUC
UUA Leu
UUG
UCU Ser
UCC
UCA
UCG
UAU Tyr
UAC
UAA 终止
UAG 终止
UGU Cys
UGC
UGA 终止
UGG Trp
CUU
CUC
CUA Leu
CUG
CCU Pro
CCC
CCA
CCG
CAU His
CAC
CAA Gln
CAG
CGU
CGC
CGA Arg
CGG
AUU
AUC Ile
AUA
AUG Met或起始
ACU Thr
ACC
ACA
ACG
AAU Asn
AAC
AAA Lys
AAG
AGU Ser
AGC
AGA Arg
AGG
GUU
GUC
GUA Val
GUG
GCU Ala
GCC
GCA
GCG
GAU Asp
GAC
GAA Glu
GAG
GGU
GGC
GGA Gly
GGG

图2

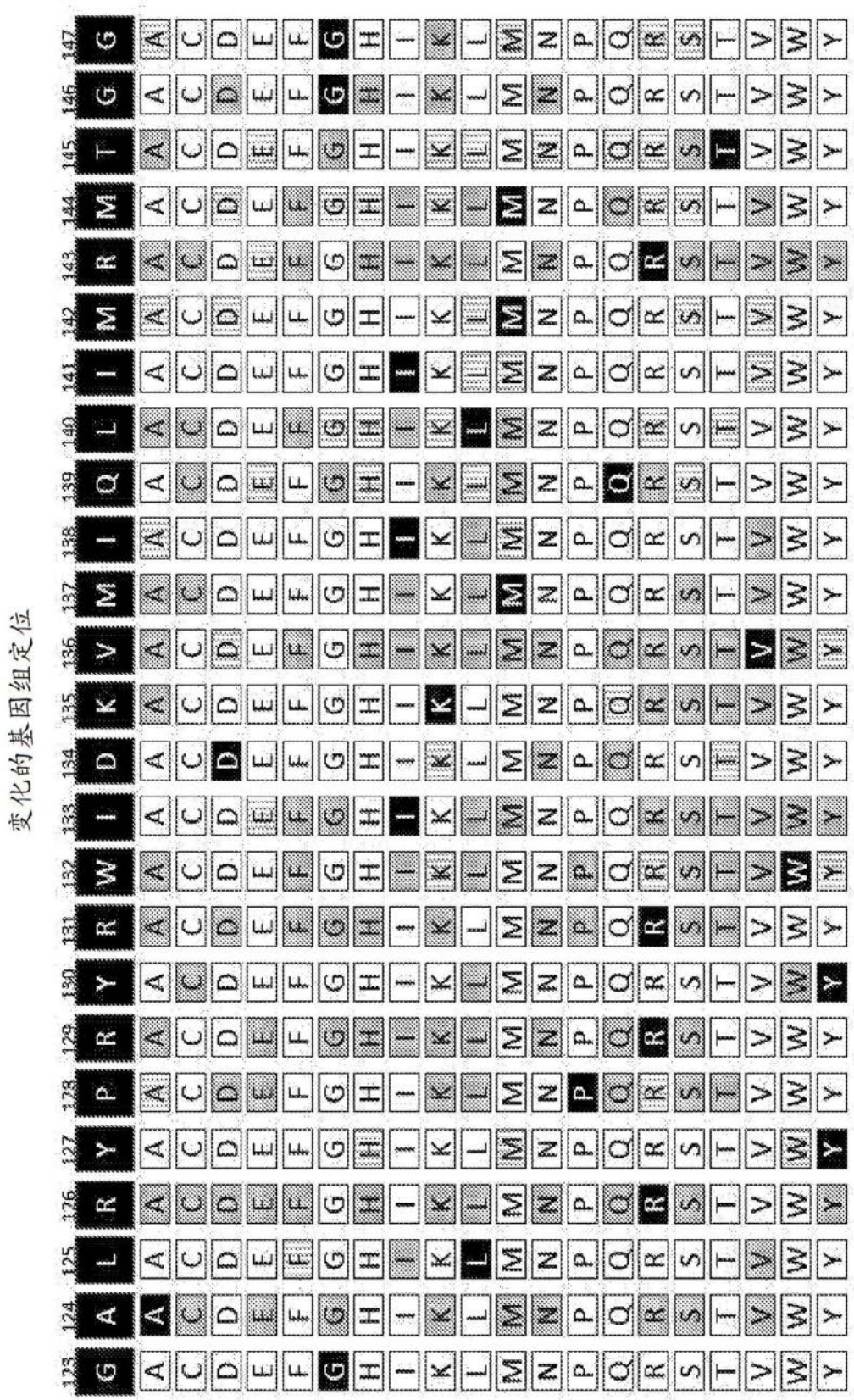

变化的基因组定位
133 124 125 126 127 128 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 145 146 147

图3

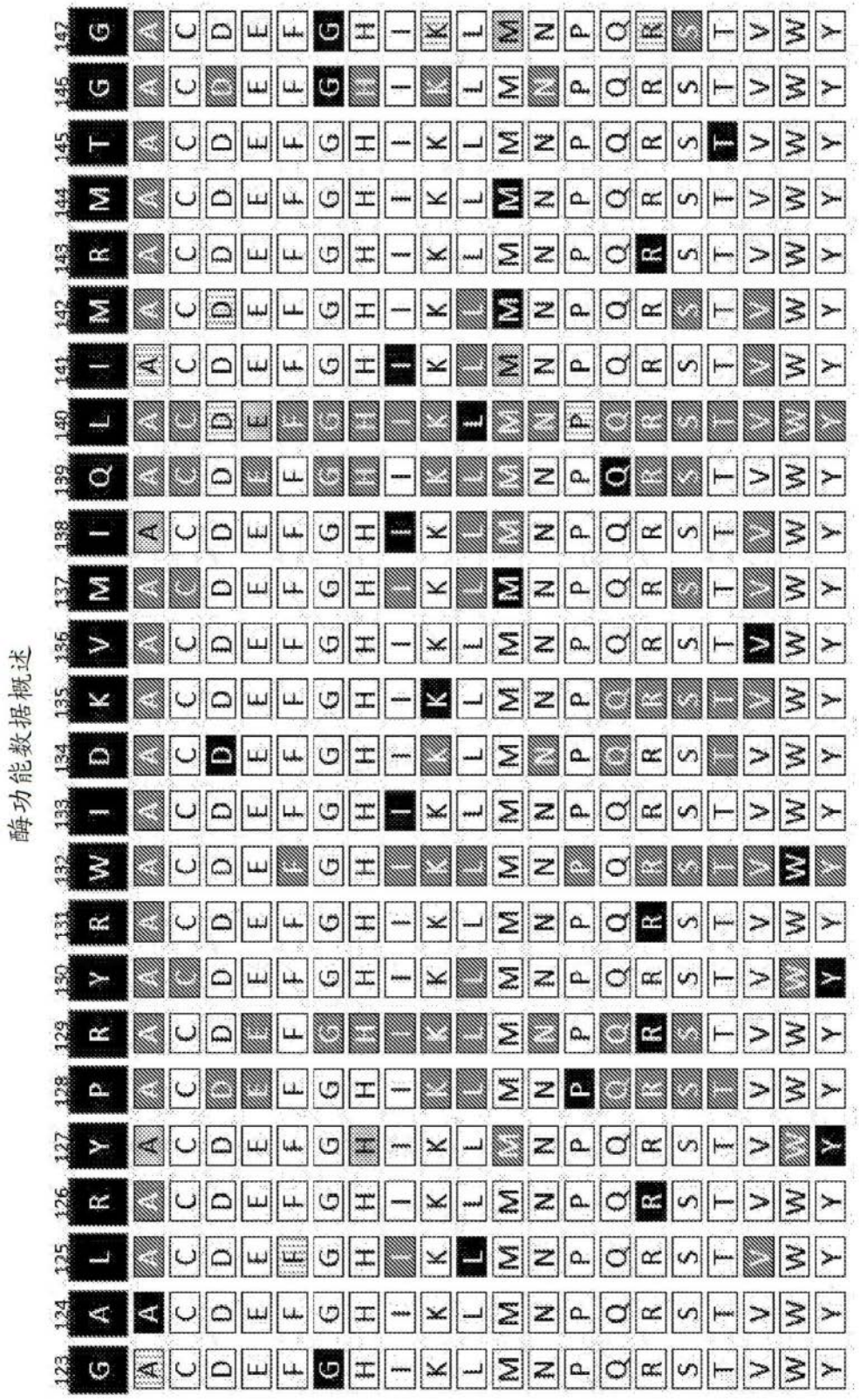



图4

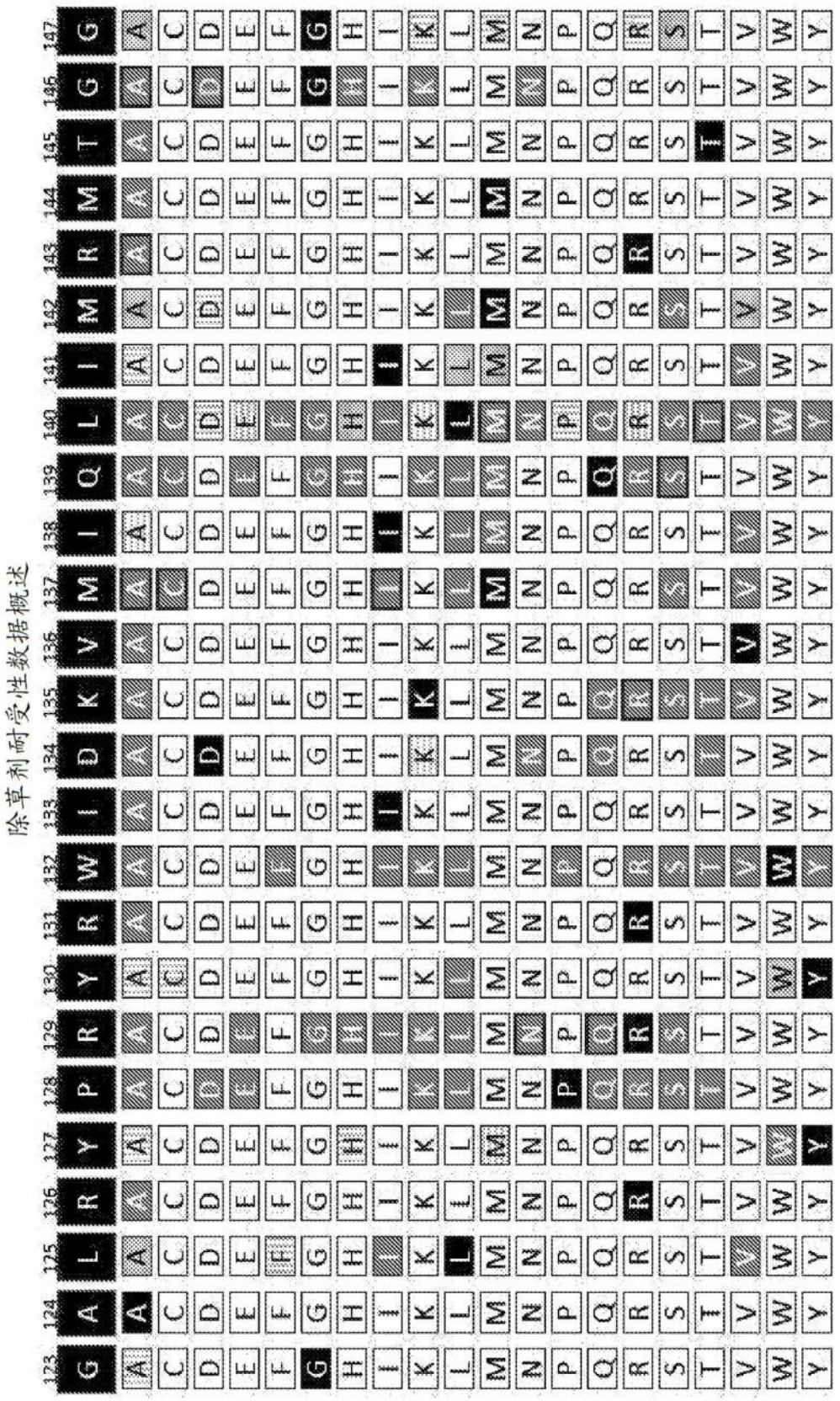



图5