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(54) **METHODS AND COMPOSITIONS FOR TESTING AND BREEDING CATTLE FOR IMPROVED FERTILITY AND EMBRYONIC SURVIVAL**

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(57) **ABSTRACT**

Disclosed are arrays of nucleic acid molecules, kits, methods of genotyping and marker assisted bovine breeding methods using SNPs on genes of the bovine interferon tau signaling pathway for improved bovine fertilization rate, or embryo survival, or both.

Figure 1

Coding sequence for Bovine Uterine milk protein (UTMP)

1 ggctggattg ccgcagaaat gtcccacggg agaatgaatc tggccctgtc tctggtcttc
61 atcctctgtg gcctgtttaa tagcatcttc tgtgaaaagc aacaacactc tcaaaagcac
121 atgaacctag tcttattaaa gaaaatttca gctctctccc agaagatgga agctcaccct
181 aaggattttg cccaagaatt gttcaaggct ttgataattg aggatcccag aaagaatatc
241 atcttctccc ccatggccat gaccaccacc ctggccaccc tctccctggg gatcaagtct
301 acaatgagaa cccaccaccc tgaggacctg aaacttgagc ccaaactgtt ggatgtgcac
361 aagtacttac agcctctggt ccacgtgggg cgtgagctag tgaagcagaa ggtactgaag
421 caccagcaca ttctctttat caacagaaaa atgatggtca accagatgct tctacagcag
481 ataagcaagc tgcagggaat ggacatccag atgattgact ttacagatat agaaaaagcc
541 aagaagacca tcagccacca tgtggctgaa aaaacacata cgaaaatcac aaacttaatc
601 accgacctga accctgagac catcctgtgt cttgttaacc acattttctt caaaggcatc
661 ttgaaaagag cttttcagcc caaactcacc cagaaggagg tcttctttgt gaatgaccaa
721 accaaagtgc aggtggacat gatgagaaag acagaacgga tgctttacag ccggtcagag
781 gagctacatg ctacgatggt taagatgcct tgcaaaggaa atgtgtccct aactctcatg
841 cttccagatg ccggacaatt tgacactgat cttaaaaaga tgactgctaa gcgagctaaa
901 cttcagaaaa tcagtgactt cagactggtg cgcttaattt tgcccaagtt gaagatctcc
961 ttcaagataa actttaagca tctgcttccc aagattgacc ccaaacatat actgactgcc
1021 acagcaatct cacaggccat cacatcgaag gctcccctgc ctaatttgga **ggccctacat**
1081 **caagctgaga** tagagctgag cgagcacgcc ttaaccgtgg acacagccat tcacacagat
1141 aatctgttga aagtcccagt gaaggcaaag gaggtcccgg cggtcgtgaa agtcccaatg
1201 aaggcaaagg aggtcccggc ggtcgtgaaa gtcccaatga acacaaagga ggtcccagtg
1261 gtcgtgaaag tcccaatgaa cacaaaggag gtccc(a/g)gtgg tcgtgaaggt caacagaccc
1321 ttcttgctgt ttgtggagga tgagaagact caaagagacc tctttgtggg caaagtcc**tc**
1381 **aacccccaag ttgagtag**ag ccagggccac actgtgcagc acaggaactt agcaggccat
1441 gaataaaaag agtacaattc acc

Notes: The SNP at position 1296 is A/G. A is the nucleotide reported by the original submitter. The SNP is in the coding sequence, but does not change the amino acid sequence of the encoded polypeptide. Primers are designed to be positioned at positions 1071-1090 and positions 1379-1398 (underlined).

Figure 2

Coding sequence for bovine signal transducer and activator of transcription (STAT1)

1 ctttaaatat **agcctcaagt ttgccagtgg c**ttgcctgtg aaatagtgca aagctgtcct
61 gtatctgggc agaggataaa agttatgtgt gttattatat tttccacact ggccattgaa
121 aactaaagat tctctttctt gggagaatta gcttttggta tggctttatg atgctggcta
181 atatcaatag aaggaagtaa actttacaaa tt(c/t)atgagta gtatcttcca tttcagcttt
241 aataccaaag ttgaatatat tctgccttca tcatgaaatt gaagttagta aatgaaactg
301 tcttc**acagt tctatcaagg gagcc**aaact attaacagct ctcttaaggc aaatcctatt
361 attttttcaa aaagttgaaa ttaattgtag atgtaaacaa actcagaaat ttaatgcatg
421 tttcataagt gggttcactt gtctttattg tttagtaaaa attttaaaat tgagaagaaa
481 aactagtaat tgacaaatca ttaggtggag attatgagaa tccaataatt tgaaaactca
541 tcctgtgtaa ctgccttgag aattgggtaa ttttcactgg caaatgtgta tctctcacaa
601 atacattaca gatggttcca ctaaaa

Notes: SNP is at position 213 (C/T), with C being the nucleotide reported by the original submitter. Primers are designed to be positioned at positions 11-31 and positions 306-325.

Figure 3

Partial genomic sequence of the region encoding bovine osteopontin (OPN/SPP1) position 8504

7561 taattaactc taaatattaa aattctcaca attaaagaac aaccactcca aaaaatagcc
7621 accaagcagg ccatttgggc tggttaaatg gatcttccct gcctgttggg cttccctgat
7681 agctcagttg gtaaagcatc tgcctgcaac ttggaagacc cgggttcagt ccctgggtcg
7741 ggaagactcc ctggagaagg aaatggcaac cccctctagt actcttgcct ggaaaatttc
7801 catggactga ggaccctggt aggctaagag tcagacagaa ctgagcaact tcacttcact
7861 ttcctgcctg tttgtaaaag tgagcttagg acaccaattg atctgtcagg ttgtcttccg
7921 gcttaatcct tccacaatga ggctagaaaa ataagacctg ctttggatgg aaacagctaa
7981 cttttgaata aaaaagttac gttgtatgat gtgcactgat ttgtgtcttt tcttcttcag
8041 aattctgtgt cctctgagga aactgatgac aacaaacaaa atgtgagtct ttgctttgat
8101 tctgatgtct gttgtgcctt agactcagga aggcactctt tctcctaatg acattgccca
8161 ggttcaaatt ccggcaaaat tccactagca aacccttcag gaactacttt ttattgggac
8221 tattaatagg gataagttaa atttgctttc cttaagattc tatttgaaga tgctgagaat
8281 ctataagaga agttagataa atgacccagg atattt**gcaa atcagaagtg tgatagac**at
8341 taactgagct atagtttcta cacatggata agagagtcac cttttgatta tccaggctaa
8401 tagggaggtg attttagttt tggggtgtg cattaataca tggattctct gatcccctga
8461 gaattttcat ttcaaataga aaaggtagtc tcacaattat gta(**t/c**)ctgtat ttattggatc
8521 attgaaattt ggtaaattag tgtttattat gaacaaggaa aaacagtgtc attgatacaa
8581 atattat**aac tcatacgttt ggcttg**[illegible]aaa tatctgtgaa aatcgttttt atgagaaacc
8641 aagaaaaatg ccttagaata ggattccatt tacccttgtg ttaaagggga aattggaata
8701 agctcatttt agcatttaaa agccattaag tgctttgttg tgaatacaaa gattctaaaa
8761 ctaaataaag atagtaaaat actaatgcac tgtaaagcct aagggacagt aaaaaccctg
8821 acacccattt ttctggccat cttgatttct agaccctccc aagtaagtcc aatgaaagcc
8881 ctgagcaaac agacgatcta gatgacgatg atgataacag ccaggacgtc aactctaatg
8941 actccgacga cgctgaaacc actgatgacc ctgaccattc cgacgagtct caccattctg
9001 atgaatctga tgaagttgat tttcccactg atattccaac aatcgcagtt ttcactccgt
9061 ttatccctac ggaaagcgca aatgatggcc gaggtgatag tgtggcttac ggactgaagt

Notes: SNP is at position 8504 (C/T), with T being the nucleotide reported by the original submitter. Primers are designed to be positioned at positions 8316-8338 and positions 8588-8606/7. Positions are numbered according to the GenBank.

Figure 4 Coding sequence for GHR gene (NC_007318)

```
154261 cagataatga aggataagga aggctggcat gctgcagttc atggggttgc aaagagtcag
154321 acatgactta gcaactgaac agcattctaa aatctgagag tcctagtact gatcttctgt
154381 caaacagtac tttttacgct gtaaaaatgt acaccctgca tatctaagaa gttttaataa
154441 tgattcaaaa atacaacttg gcccccatct ttttgatgga tcctcagtct agatcagatc
154501 tagatctaaa gatcacatta aaaaaaaaaa agaattggac attatttagg taaagtagta
154561 tattaacaag catcactttt ccctcaagct aaagcctttt aatgacacac cctgaacaca
154621 taagatgttt aaagcaggtt gtttatataa taaacatgga ttgtgcttaa attgtatgct
154681 gttactcttt tttttttggt atacaaaagg atctgaagaa gtggatagag gtgttcttag
154741 aaaatactaa gtaattgcat tctatttcag tggctatcaa gtgaaatcat tgactttact
154801 agatgaatac aaattaggaa gttttatgtg gaacaggaga atgagatata aacttcaact
154861 gttcatagtt ctgtgagata ttatttttgt gtttttcaga tttccagttt ccatggttct
154921 taattattat ctttggaata cttgggctag cagtgacatt at(t/a)tttactc atattttcta
154981 aacagcaaag gtaagtgtga tataacctac tctgatatgt tttgccagtt atttagcaaa
155041 tgtccatgtt tccatttttt gtttgatgtt ttcttttgtg aatcctgagt gaagtgtttc
155101 atcaacccag tgaaacgtta tcgctctaca tttacatctt tgttgtgtcc acagagagac
155161 aacacaggtc tcagttttat ctggaaagtt gcataggatg ttaagagggt gaggctagtg
155221 actacatacc atgtgacatg caccttaaag ttccgcactg atatttattc caggacccag
155281 aggtagcttt gagcaaaaat ttaagtggtg aactaaagct actagataat tcagtctaat
155341 aaaacctttc tttagacttc atatgatacc aatcttaagt aaatttgggt ttatttaaat
155401 tggttggcta cttacagttt ggtattttac cttcttttgt cagagataaa attctaagtt
155461 tgaggacacc atcctgcatc ctcttgcagc cagaaggcag gtttcagtta ttattctgcc
155521 actgttgttt gagttcattt gagtcccttt atctctagga ctccacgttc tcatgggtaa
155581 tttgagggtg gtggattgta tgatgtttaa gtttccctta agctgtaagg accattattc
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Notes: SNP is at position position 154,963 (exon 8), with A being the nucleotide reported by the original submitter. Positions are numbered according to the GenBank.

Figure 5 Nucleotide coding sequence of POU1F1

1 gcaaatactg tgatttgaag ctaaccaaat aaactaattt ctattttggc tggagaagag
61 aaaggaatga aagtagaaac actcgctatt acacatagga gagcctatct gaattcgaga
121 tgctccttag aaatagtaaa taaactctga ttcaggcttg tcttcacccg tttttctctc
181 tgcttcggtt acaaaaccaa accctcacca cttctttctc caggtttagt tcttcagcca
241 tccgcaggat ctcctgagag gaaggcttat tctgttctcc aaagtgtctc tccagggcgt
301 ctttagcagc aatactgatt gttgttctcc gtttctattc ttttgtggga atgagttgcc
361 aacctttac ttcgactgat acctttatac ctctgaattc tgagtcttct gcaactctgc
421 ctctgataat gcatcccagt gctgcggagt gcctaccggt ctccaaccac gccaccaacg
481 tgatgtccac agcaacagga cttcattatt ctgttccttt ctgtcattat ggaaaccagt
541 catcgaccta tggcgtgatg gcagggagct taaccc(**c/a**)ttg tctttataag tttcctgacc
601 acacgttgag tcatggtttt cctcccatgc atcagcctct cctttcagag gaccccactg
661 ccgctgattt caagcaggag ctcaggcgga aaagcaaatt ggttgaagag ccaatagaca
721 tggattctcc agaaatccga gaacttgaaa agtttgccaa tgagtttaaa gtgagaagaa
781 ttaagctagg atacacccag acaaatgttg gggaagctct ggcagctgtg catggctctg
841 aattcagtca aacaactatc tgccgatttg aaaacctgca gctcagcttc aaaaatgcat
901 gcaaactaaa agcaatatta tccaaatggc tggaggaagc cgagcaagta ggagctttat
961 acaatgagaa agttggtgca aatgaaagaa aaaggaaacg gagaacaaca atcagtattg
1021 ctgctaaaga cgcgctggag agacactttg gagaacagaa taagccttcc tctcaggaga
1081 tcctgcggat ggctgaagaa ctaaacctgg agaaagaagt ggtgagggtt tggttttgta
1141 accgaaggca gagagaaaaa cgggtgaaga caagcctaaa tcagagttta tttactattt
1201 ctaaggagca tctcgaatgc agataggctc tcctattgtg taatagcgat tctacttttc
1261 attcctttct cttctcagcc aaaatagaaa ttagttattt ggttagcnnn aaaaatcaca
1321 tcagtaattt ttgncagaag tgtttctttt ctactttaaa aataaataca atttaaatta
1381 tgttgatgaa ntattctcag aaggannnnn tcantgtaca ntttaagcca aagactaata
1441 ggattaaaac aatgattctg tccctttcac tatatctttc cctctatctc tcccnggaat
1501 tc

Notes: SNP is at position 577, with C being the nucleotide orginally reported.

Figure 6: Coding Seqeunce for FGF2

1 ccggggccgc gccgcggagc gc(G/T)tcggagg ccggggccgg ggcgcggcgg ctccccgcgc
61 ggctccaggg gctcggggac ccgccaggg ccttggtggg gccatggccg ccgggagcat
121 caccacgctg ccagtccctg ccggaggacg gcggcagcgg cgctttcccg ccgggccact
181 tcaaggaccc caagcggctg tactgcaaga acggggctt cttcctgcgc atccaccccg
241 acggccgagt ggacggggtc cgcgagaaga gcgacccaca cagtgagtgc tccccaggtc
301 ttccccggtg ccgtcttcgt cccctgcggt tctctccccc gcccctgcct tccagcctcc
361 gcgctccttc ttcctcttca ctgtgacccc ggtgggactt gtggtttctc tccgctcggc
421 cctcggcggt ttcgggctca ccactcgccc ccctcctgcc ccgagctgcg gtggcggtag
481 acgctcctcc aggctttgga gtgtgccggc tgctcagcaa agccagtccc ctgggccccg
541 agcccccggc gcccgggctt tgcgggcggc tccctgggcg cagacaacct gtcgcgtcgg
601 gggtgcccgg cggctgagca gaggtgagcg gctcagcgag gtgccgcccg cgccccgagc
661 ctgaagttcc gaccgcttct atgggatgcc cgttgtctcc ggggcaaagc caggagggac
721 cgcagaccaa ctaaaaggtc cttgttggaa agataccttg catcaggttt gaggatcaaa
781 tgagaatttg aagtgcgcag aggactcaat ttactagtct acagttgcat tttctgtaaa
841 aataataatg atgtatctgt ggtaatagca ataagattgg tctgaggcgt tggttgtcaa
901 actaagagtg cataagaatc acctggaagg tgtgtgtgtt gtgtgattca tggctgaacc
961 atctcccaga gtttcagatc gcttaggtct ggagtggggc ctcatttgca tttctaacta
1021 cttcccaggt gatgctgatc tgggagcaca gtttgagaac ccgctggtct agagaaagag
1081 gaaggaaaga ggtataaaat gggctgataa aaatagatga gtttgaagtg agacaaagag
1141 atcagatatt tttaaactgt catcctgtaa gtgtaggtaa aacatgtttt gaaagctgtt
1201 tgttctgcca ttccttccat aatggttttc aggtggaaaa cttgatcctc tttttttttt
261 tttttttttg cccaagttcc gcaagaggcc ttctttacct tgtgatgcta atagtgcgtc
1321 ctttggggct ctccaggtgg tactggtggt aaagatccca cctgccagtg cctgggatgt
1381 aagaggtgtg gattggatcc ctgtgttgga aagatcccct ggagaaggaa atggcacccc
1441 gctccagtat tcttgcctgg agactcccca tggacagagg agcctagtgg gctaccgtcc
1501 ctagggtccc aaagagtcgg acactgaagg aatttagcaa gctctcactc cgggatgaga
1561 cttaggaaga ggagaaaact ctgcagccaa acctagctga caaattcagt aatgggaaat
1621 gtcccttcat aagaattggt ctttattgat ttcaaaatag caacaagcaa aggattcagg
1681 tctgtaactt ttttccggcc tgccataatt aaacaatttt cttaaccact tacattatcc
1741 agtaaaactg aaaagatgct tgtagcccaa tatatcggtt agtgctcttt ctctattttg
1801 gtaactaggt ttcacaaaat tatctttctg tgtggggttt attctgtgct tgtctgccag
1861 ggtagcccag ctgaacacgg caaggtgcac atatgtccca attaattttg ctcttttcta
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2281 cagacgtgac tgagcacaca ggcatgtatg ggagttagta aggataattc tgaattgcat
2341 attacattac cgccctttta aacacaacta ttaacttttt attcccagtt tggggctggg
2401 ccatcattac tgtattctta ttttaacttc atggtctgaa ataggattga tactctccag
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2761 ctgaaaatga tcaatttaaa tgacttttgt ataggccaac ctggacatat gtttaattaa
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4441 acaccagatt ctccccctc cacacacata caccttttt gggtaatatc tggcaagtgg
4501 atcccaccaa tttactttaa taagcatact gtttactcta atgacatttg tgtgcagtaa
4561 acaaatgaag taagaaccca atagctcatt taattgtgga aatcgtgtaa ttggttcagc
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4681 gtttggtgcc aaatgacttc agcctagaac tggcaatatc ctcttgtgac atgccttgag
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4801 agtggattct gagcattatg ttcagactta cgatgtttta aatggatagc tgagattttt
4861 aggtgtaatt tgaaaaaacg ttatagacaa aacaagaatc atcctcaata cattataatt
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5101 ttgggcccct ttgtcctaca acaaacatct gtaagactgg cctggggtaa ccactctatt
5161 tctgggaatt ggaacaagac aagtcagcac atttggactt gaaccttaac ctcattacca
5221 tatcctctcc aaacaagtat tctcggttct attttgtttt tgagcttgtc attttctgca
5281 ctctgaaacc aggtcttctg cttaacttgt atgttgtcaa gtgtttggct gttgacaaaa
5341 taattcaagt aacaattatc attgtggaat tttcattatg tcactggtgg ctcagctggt
5401 aaagaatctg cctgcaatgc aggagacctg ggtttgaccc ctagatcggg aagatcctct
5461 ggagaaggaa tgactacccg ctgcagtatt cttgcctgga gaaccccatg gacagaggag
5521 cctggtgggt tacagtgcat ggggttgcaa gagtccgaca tgacttagca actaaactgc
5581 caccaccacg tcaatgggaa atgcagttgt ggcaccgtga ttttcagtgt tcccttactg
5641 catccattgc tgctgctgct aagtcacttc agtcgtgtcc gacggcccac caggctcccc
5701 gtccctggga ttctccaggc aagcacactg gagtgggttg ccatttcctt ctccaatgca
5761 tgaaagtgaa aagtgaaagg gaagtcgctc agtcgtgtcc gactctttgt gaccccatgg
5821 tctgcagcct accaggctcc tccatccatg ggattttcca ggcaagagta ctggagtggg
5881 gtgccgttgc cttctctggc atccattgtt gggggtagc tattgctttc tctctctcta
5941 agctaggtta tttatggcca taggaattta ggcagggaat aagggaaaaa tggcaactcc
6001 cagggaactt cacccattga gccatatacc acatagttct tagaaactgg attagtccca
6061 ttctaaattc ctgtgggata tttttagttt gaagaaattt ggagggccta gaggcaacag
6121 atagccaata ttcagttttt aatttatgtc tcatcccagt tgttccctgt cactgttcct
6181 gcatatggtg acttttgagt tgactggtat atccttaata ctcattcatt tacagtaatc
6241 agtaatgtgt gtgtgtgttt gcattttgat tttcttttaa aaaattattt acttggctgc
6301 tctggatctt agttgctgca tgtgaactct tagttgccac aggtggggtc tagttccctg
6361 accaggatcg aacccaggcc cctccgttgg gagtgcagag gcttagtcgc tgggatacca
6421 gagaagtcgc ctgcatttgt attttcaaag ggctacttac tttctcaagt taagttaccc
6481 tctaaattaa attatcccat agaattctaa agtgtaaagt tcacagattt tttaggatat
6541 tgcagagggt ggggagggaa ggttgttttt ttttttttcc tgttttgttt tgctttttaa
6601 aggaaatttg tgtagtgtag taatgatctg gctaggattc tgtgagtggg ttattttctc
6661 tgttcatgat tttatgcactt tgagaaaatt tggcatctta aggtagggac catgacttct

6721 ccatataaat aaacatcata aaaaggcttg taccttttac tctggtaatt ctcactaaaa
6781 gtgagctgct gatgagaaca ttctatgtgg gtaactactc aggggccaca tgctgttcaa
6841 agcctggtca aggtttacag ttctcttggt atagtaacat atacgattag gcacttagcc
6901 ttttaatgaa gataaatata tgtaacaatt atatttggaa aaatgtaatc atatttgaaa
6961 tattaaaaag ctggctatta gcaattttgg tgtagtctat aaaaagatga atcattgctc
7021 aggataatta gttaaaagct ctcattatga attgttttct ttaaaaagca ttaagatatt
7081 taccatgtac tgtgtgatgg aagattcctc aggtatgctg tgcattgttc atttgtcttt
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7381 gtcttttcct ctggtccctc ctatcttcgg tcttttgctg ttgtatcccc caaggctctg
7441 tttttgcctc tcttcccatc tttctgagta cttgtgatct ttcagcacag atcatttcaa
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7801 gctcagtgtt tcagctcttt acgacccaca ctcccctgat gctgccagcg ctctctgcct
7861 tcgtgattgt ctctaaactg gcagaaccat cactattaca gttggctttt ccacttggtg
7921 atccttgttt ttggaaaatc ctttatcaca ccaattcttg tctcacaccc tcctcccact
7981 ctcacttttc cctgaaaaga tcttttacga gccagctcag tggtcttttc ctttgtgaaa
8041 ctttccccta ccttcccagg gagacttggt tgtttctgtc tgtgcttttt tccccatagt
8101 agttgggatg gattgtagac ttaacagttt ttcttgtaat taattgttta catgtctatc
8161 tcctgcactg ggactgcgag ctctgtctac ttaaagaatg tgttttaagt tcagtgtgta
8221 cccaacaaat gagccaagtc ttctgactcc ctctctgatg gccttctgac atccttctcc
8281 tcttagcctt gactcaggcc gtttccctga gctgaagtgc acttagtcct ccttcctgac
8341 cccagtccta ggctttgcgt cagaccctgt ggctttcaca tggccctgta cccgtctgtc
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8461 tcagttttac tggaactttc tagatggcaa ggattttaaa aaatttaaac attacccagt
8521 agtcctttgc tctcttttct actctgagga ctgagactga ctttaggcac tccagaattc
8581 cctggactca aatgaatgac catgctgagg cccatgaaga ggttcgatgt gtattgttga
8641 atgagctaga actttaaata aataagcata tacacttcag catgaagtgc gcagagcaga
8701 taagttgaac gtagcatcac tgtggttcct tctgtggaca cctttcacat tattcaaagg
8761 aagcaataaa ggtaaaacac aatcatttca ttaggattaa tttttattgt ggaagttttt
8821 cttttcagct aatgaataac atgtcaacat ttctagccaa tttcagaact agctgtaatc
8881 ttttaattaa aaaccataga tctgagagtt catacttgag tcatatttaa tccttaaatc
8941 cctttctttc cctctgtctc tttctctctt tctaaaagct gtgaatcatt ttataaatta
9001 ggattaagaa ctgtctggta ccattgttaa tatccctttt ggctgtgagg aaatggcaca
9061 aataatttca tcctaatatt cattcagatt tatgagccag tattcatcac aacaatctta
9121 aaactcttga aaggatagaa actgtatgac aaagtgagtc atagtctttg tgatgtgatg
9181 tctgcaaggg tgggtgggag agactactga atgaccagtc tcattctgct ttctgagctg
9241 aatcattttg caaatagaaa acaattcata gatttataga tggtcataac ataaatagga
9301 aatggaagag agtaacagag tcaaataata cctctattta aaaaattact ttttgaaaca
9361 taacacttga tgaacagtct ttattttgaa ttagaaatga aattaatcta ctgcctaata
9421 atacatatat tttgatactt gctgtatgtc tttatatatt ttcatttttt cctattggtt
9481 atgtttcttt taaaaaattc tctcatgtaa tttgaccttt atcttcatag ctatttctag
9541 ctttggcttg tttgacaatt gcgtgtgtgt ttgtgtgtgg agaaggaggg gactacttgt
9601 atggaaactt gagagaagaa ggtccctttc ctcttgaaaa ttcttaatag tataatcctg
9661 cattttgcat ggtcggtctc cttttgttac ttttcatctt actagaatta gcaatatgga
9721 gagtctttct ctgagtcaga tttaaccttt aatctttaaa tgtaagattg atttacctta
9781 tttccttatt ttctttgaga caaagtattt gtcaaaacaa ttatatgaaa agtaaactat
9841 tctagtttga gtgtgtttct tgagttttag aactttagga ctcttcttac attcttatat
9901 ttatccatta aactcaacaa tttagtaagg gggatataat acaaataaaa ttgggaagct
9961 aatttttcta actggtttag tagaggacag tagtatatga agaagacata tattacattt
10021 aatacaacgt gttggattaa aaaatagtta cagcaatacc ttcagctgtt acaaggtggg
10081 aaaagtaagg cgcagattat tttggaggga aggtattaaa accatgacgt gttgatggga

10141 tctgtccagc ctgagccaga caccaaagca ggttccatgg caacttggcc acgtccctgc
10201 gcctttaaag aggaagggcc tattgtttgg ccttcaccaa atgacttcac ctgggatctt
10261 gttatttact gaatgttttt tgaatggatg gatgaaattc ctgagaacat gctctgggcc
10321 agctttatga acagtatgtt taatcttatt gtagtcttat gaaagaagtg ttattttcat
10381 cttacagata gggatagagt ttttgctatt ggcttttcaa accatggtct ctttgtgatt
10441 gtaagtaatt aattgtgtct tccagatttg ttagtgttta gaatacagtt catggccaga
10501 atttcagatg gacggtgtgg cataaatttg aacagaaata gtgattttta aaaatagttt
10561 aaacttccca gagcctttac tgtgctcagc aaagttagtc tctcatcttt tcttctaccc
10621 ctttattgca tcctttttta tttagaaaat atttgtcatg aattaatacg aaacaattct
10681 ttaatatttt agggattgct ttctgaagaa ctcaaagatt tttaaaaggc atatttaaaa
10741 attaagagca ggacataatt aagaataaat accatataag aatgggataa acctcaaaga
10801 tagagtctgt aaagatgcag aataagctaa ggcatgcaga aaatacaaag agaatgatta
10861 aaaggatgtt taaaaagtta gttaggccct ttcaaggaaa tttgagatag gctcactatt
10921 taaggacata gtgtaagatg aaaagaaaaa aatttagaaa aaaaagcaga tggacctggg
10981 cctattttat gttaatgtta atcttcttct ccaagtgaga ttgtcaatca ataattgtct
11041 gagtgtctca ttgagaaaat aaagaccaag gtagacaaag agatacaaag aaagcactta
11101 gccagacaca tctagaaatg tgtttataat gaaactcctc tttccttgaa atcacttgtc
11161 cccctttttt gaccccctgt attttaaaat ataaaatatt taactttgta aatttcttgc
11221 caaccagccc atctcgcaga gtacatttct actcttcatc ccctcagtct tcacatccgt
11281 ctcaggctct gtgttttcag ttctgctgtg tccttcatac tcacgggggt ctctgcattg
11341 ttgccacagc tgctctcgtt cggtccctga ctgttgcaac tgccttctac ctgatcccat
11401 ctgtatcagt ttgctagggc tgccataaca gattaccgta gactgagtgg ctcaaacaac
11461 agaaattgat tttctcatag ttctgtagac tagaagtcca agatacagct gtctgcatgt
11521 ctggtctttc tgcggcctct tcggggtttg cagcagccac cttacacatg gtcacctctc
11581 tgtgcacaca tcctgatctc ttcttcttgt aagggcacca ttcagatttg gttagggccc
11641 actct**(A/G)**taac agccccattt tgacttaatc cttctttaga ggccccatct ccaaatagta
11701 attttctgag gtactggggc ttcaggcttc agtgtatgaa tttggggtgg gggtacagtt
11761 cagcccacag caccagtgag tcaactggat attgttcctt ggcagagtat ctttccagag
11821 agcagctctg atcttgttat ccctctattt agaaaaactt catggacagt ctagtcccct
11881 ggttcccaca ttgcttacag atgtgggcac tgtagaaagt ctatgagaat
11941 aggaagttac cagcagatga gtgattgtct tatatatcag aaagtgggat aaaggtattt
12001 tctggaaact ctagatagct aggaagcctg atgtaggtcc ttgaaaaaaa tccaagggac
12061 ttgagaatac ggagaaaaga agataacata gaaaatagta aataggctcg

Notes: **SNP at position 23 (G/T) position 11646 (A/G)** (NC_007304)

Figure 7 Coding sequence for STAT5A

```
11221 ggctcagcgt ccctcccctc ccgcaggggc agtgacaccc tgagctgtcc tggggaccct
11281 gagggaggca gagagccagg aggagagcgg gacccagcag agcaggaggc ccgggccttc
11341 ttcctcatgg ggcctgaggg ggagagtcgg tctgggagga ggaggccctg cagggctgtt
11401 ctgagagccc agaagggccg gctgagccac cgcccgaccc tcaggagctg gccgagaagc
11461 accagaagac cctgcagctg ctgcggaagc agcagaccat catcctggat gacgagctga
11521 tccagtggaa gcggcggcag cagctggcgg ggaacggagg gccccccgag ggcagcctgg
11581 atgtgctaca gtcctggtac caggggtggg gggcggggag gggcaggcag cagagtggtg
11641 ctgccagctg ctgtttgcgc ccacgtctac atgagcagct ggctccctct gtctgggcgc
11701 gggtcttatc ccaccagtgg tgtgtttggt gctgacaccg gtgtcccttt ctgtgccccc
11761 tcccctggga ggatgctggg gtggggccag gtggcaaagt ggcgctcagg ctggttggac
11821 cccagtcagt gtcgctcctc ctgggtgttt ctctggtttt tttggaaggc agggcatctc
11881 tgctgtgccc agtgcacagg cgaggtggct cgggcaccag gccttcctgg gggtggagct
11941 gggtgtgggc cttgtccccg cctgggcgcc tgccagcttc tggcctggag gacgggggtg
12001 aagcccgtgt ccttcccttg ggccctgggg ctcgggttca ggtgtgagaa gttggcggag
12061 attatctggc agaaccggca gcagatccgc agagccgagc acctctgcca gcagctgccc
12121 atccccggcc ccgtggagga gatgctggct gaggtcaacg ccaccatcac tgacatcatc
12181 tcagccctgg tgac(c/G)aggtg actcctggcc acgccccgct cccatctggt tgccctgggt
12241 tgggggcagc agggtctttg cagatgggga gctctggctt aaatccttca gtttctgcct
12301 cacaccctcc tcccatccct ctccatcccc tgttgctatg gcctcttgct gtcgacctca
12361 cccagtattt ctcgtggaca ctacacgggc atttgtctcc tgcaactcct ttcagctgct
12421 gagttccttt tactgcctcc cttcccgcca gctcccctga ctcacagtgg ccccagggag
12481 ggtggactgt ccgcaaaccc tcccttcacc tgctcagcct ggtgcaaggc agcctcccca
12541 cgtggaaggt ggggccagag tcctgtcccc tgaagtgtct cctgtccctt gtgtctccgc
12601 agcaccttca tcatcgagaa gcagcccccct caggtcctga agacccagac caagttcgcg
12661 gccaccgtgc gcctgctggt gggtgggaag ctgaacgtgc acatgaaccc cccccaggtg
12721 aaggccacca tcatcagcga gcagcaggcc aagtcactgc tcaagaacga gaacacccgc
12781 aagtatgctg cccgctcctt catctgccct cccccagctc agcctctgct ctgtagctgg
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Note: SNP G/C AT POSITION 12195

METHODS AND COMPOSITIONS FOR TESTING AND BREEDING CATTLE FOR IMPROVED FERTILITY AND EMBRYONIC SURVIVAL

FIELD OF THE INVENTION

[0001] The present invention relates to methods of genetic testing of cattle using molecular genetic methods by assaying for the presence of at least one genetic marker which is indicative of fertility or embryonic survival.

BACKGROUND OF THE INVENTION

[0002] Dairy cows are significant investments for dairy farmers, and enormous efforts, such as animal breeding and artificial insemination, have been and continue to be invested in ensuring that the animals have high and sustained productivity, and that the milk produced is of high quality. About 50 quantitative trait loci (QTL) affecting milk production traits have been identified (Bagnato et al., 2008; Lipkin et al., 2008). The dairy cattle genome has been significantly restructured over the past 30 years due to intense selection for production traits.

[0003] Such restructuring of the dairy cattle genome over the past 30 years due to intense selection for production traits may have resulted in a hitchhiking effect on a large number of loci adversely affecting fertilization rate and embryo survival, leading to dairy cattle genotypes that are suboptimal for reproductive competence (Royal et al., 2000; Lucy, 2001). The decrease in dairy cattle fertility is a worldwide problem and a major cause of economic loss and cow culling in the global dairy herd.

[0004] Many reasons account for this reduced reproductive efficiency, but the most important component seems to be a reduction in embryo survival rate from over 80% twenty years ago to less than 50% today. There appears to be an important genetic basis for this decline (Veerkamp and Beerda, 2007); so genetic approaches may help alleviate this problem. As such, there is an urgent need to identify the genetic factors responsible for the decline in embryo survival rate.

[0005] Previously the present inventor has demonstrated the effectiveness of the candidate pathway approach in choosing candidate genes affecting milk production traits (Leonard et al., 2005; Cobanoglu et al., 2006; Khatib et al., 2007a,b; Khatib et al., 2008a; Wang et al., 2008). Recently an in vitro fertilization (IVF) experimental system in cattle has been demonstrated that enables the association of single nucleotide polymorphisms (SNPs) in candidate genes with fertilization rate and embryo survival. Using this system, two genes: fibroblast growth factor 2 (FGF2) and signal transducer and activator of transcription 5 (STAT5A) were found to be significantly associated with variation in fertilization and embryo survival rates (Khatib et al., 2008a,b). These two genes were chosen from the interferon-tau (IFNT) and placental lactogen (PL) signal transduction pathway.

[0006] Interferon-τ (IFNT) is a major product of ovine and bovine conceptuses during the period before the trophoblast makes firm attachment to the uterine wall and begins to form a placenta. Its primary function is in preventing a return to ovarian cyclicity and hence ensuring the pregnancy to continue, although it undoubtedly has other roles in ensuring receptivity of the maternal endometrium.

[0007] IFNT is a member of the Type I IFN family, and signals through the Type I IFN receptor and Janus Kinase (JAK)-signal transducer and activator of transcription (STAT) signal transduction pathway (Stewart et al., Endocrinology 142:98-107 (2001)). IFNT activates multiple STATs and has differential effects on IFN-stimulated response element-(ISRE) and γ-activated sequence (GAS) element-driven gene transcription. It is known to induce a number of genes in the ovine uterus including 2',5'-oligoadenylate synthetase (Johnson et al., Biol. Reprod. 64:1392-1399 (2001)), β 2-microglobulin (Vallet et al., J. Endocrinol. 130:R1-4 (1991)), IFN regulatory factor 1 (Spencer et al., 1998), ubiquitin cross-reactive protein (Johnson et al., Biol. Reprod. 62:622-627 (2000)), and Mx protein (Charleston and Stewart, Gene 137: 327-331(1993); Ott et al., Biol. Reprod. 59:784-794 (1998)). Many of these proteins are known to function in the antiviral response as well as in early pregnancy of ungulates especially ruminant animals (see e.g. U.S. Pat. App. No. 20070009969). The aforementioned data most likely apply to cattle as well.

[0008] Identifying additional genetic factors that show association with fertilization rate or embryo survival rate would enable selection or breeding programs that reduce the frequency of deleterious alleles at these loci by marker- or gene-assisted selection, preventing further decline or even improving reproductive status of the global dairy herd.

[0009] Furthermore, a plurality of or multiple genes are likely more reliable than a single gene or SNP in predicting high fertility or enhanced embryo survival.

SUMMARY OF THE INVENTION

[0010] The present inventor investigated the effects of various genes of the IFNT signaling pathway and discovered that several of these genes comprise SNPs that are correlated with increased fertilization rate, or embryo survival rate, or both, and these SNPs may be used in breeding programs or other cattle testing or selection programs for cattle with improved fertility, more specifically for increased pregnancy rate in cattle. Accordingly, in one embodiment, the present invention provides a collection, or an array, of at least two of isolated polynucleotide molecule species selected from the group consisting of (1) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 1296 of SEQ ID NO:1; (2) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 213 of SEQ ID NO:2; (3) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 8504 of SEQ ID NO:3; (4) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 154963 of SEQ ID NO:4; (5) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 577 of SEQ ID NO:5; (6) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 23 of SEQ ID NO:6; (7) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 11646 of SEQ ID NO:6; and (8) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 12195 of SEQ ID NO:7. Preferably, the collection comprises at least three, at least four, at least five, at least six, or at least seven species described above. More preferably, the collection comprises all eight species.

[0011] In another embodiment, the present invention provides a method for genotyping a bovine cell, comprising obtaining a nucleic acid sample from said cell and determining the identity of the nucleotide of eight SNP positions in the cell, wherein the eight SNP positions are (1) position 1296 of

SEQ ID NO:1; (2) position 213 of SEQ ID NO:2; (3) position 8504 of SEQ ID NO:3; (4) position 154963 of SEQ ID NO:4; (5) position 577 of SEQ ID NO:5; (6) position of 23 SEQ ID NO:6; (7) position 11646 of SEQ ID NO:6; and (8) position 12195 of SEQ ID NO:7, the method, comprising (1) determining the identity of a nucleotide at each of the eight SNP positions, and (2) comparing the identity to the nucleotide identity at a corresponding position of in SEQ ID NOs: 1-7, respectively. In preferred embodiments, the method according to the present invention is used to test an adult bovine cell, an embryonic bovine cell, a bovine sperm, a bovine egg, a fertilized bovine egg, or a bovine zygote. In one embodiment, both copies of the respective gene in the cell are genotyped.

[0012] In another embodiment, the present invention provides a method for selectively breeding of cattle using a multiple ovulation and embryo transfer procedure (MOET), the method comprising super-ovulating a female animal, collecting eggs from said superovulated female, in vitro fertilizing said eggs from a suitable male animal, implanting said fertilized eggs into other females allowing for an embryo to develop, and genotyping said developing embryo as described above, and terminating pregnancy if said developing embryo does not all have a corresponding desired polymorphic nucleotide as shown in Table 1A.

DESCRIPTION OF THE DRAWINGS

[0013] FIG. **1** shows the partial sequence of the UTMP gene (SEQ ID NO:1) where the relevant SNP position is noted.

[0014] FIG. **2** shows the partial sequence of the STAT1 gene (SEQ ID NO:2) where the relevant SNP position is noted.

[0015] FIG. **3** shows the partial sequence of the OPN gene (SEQ ID NO:3) where the relevant SNP position is noted.

[0016] FIG. **4** shows the partial sequence of the GHR gene (SEQ ID NO:4) where the relevant SNP position is noted.

[0017] FIG. **5** shows the partial sequence of the POU1F1 gene (SEQ ID NO:5) where the relevant SNP position is noted.

[0018] FIG. **6** shows the partial sequence of the FGF2 gene (SEQ ID NO:6) where the two relevant SNP positions at positions 23 and 11646 are noted.

[0019] FIG. **7** shows the partial sequence of the STAT5A gene (SEQ ID NO:7) where the relevant SNP position is noted.

DETAILED DESCRIPTION OF THE INVENTION

[0020] It has now been found that many genes encoding proteins of the IFNT signaling pathway contain single nucleotide polymorphisms (SNPs), and certain of these alleles correspond to increased fertilization rate, or embryonic survival rate, or both, in dairy cattle, and the beneficial effects of these alleles are additive. Specifically, it has been discovered that SNPs exist in the following genes: growth hormone receptor (GHR), osteopontin (OPN/SPP1), POU1F1, signal transducer and activator of transcription (STAT1), signal transducer and activator of transcription (STAT5A), bovine uterine milk protein (UTMP), and fibroblast growth factor 2 (FGF2).

[0021] These SNPs are summarized in the Table 1 below.

TABLE 1

Gene Names, SNP Locations, and Polymorphisms

Gene	SNP Position	Originally Reported Nucleotide	Polymorphic Nucleotide	Desired Nucleotide
UTMP	1296	A	G	A
STAT1	213	T	C	C
OPN	8504	T	C	T
GHR	154,963	T	A	A
POU1F1	577	C	A	A
FGF2 SNP23	23	G	T	G
FGF2 SNP11646	11646	A	G	G
STAT5A	12195	C	G	C

Gene Names, Chromosomal Locations, and References

Gene	Chromosome	SNP (location)	Reference
POU class 1 homeobox 1 (POU1F1)	1	A/C (exon 3)	Huang et al. 2008
Growth hormone receptor (GHR)	20	A/T (exon 8)	Blott et al. 2003
Signal transducer and activator 5A (STAT5A)	19	C/G (exon 8)	Khatib et al. 2008
Osteopontin (OPN)	6	C/T (intron 4)	Leonard et al. 2005
Uterine milk protein (UTMP)	21	A/G (exon 4)	Khatib et al. 2007
STAT1	2	C/T (3`UTR)	Cobanoglu et al. 2006
FGF2 SNP23	6	G/T (5`UTR)	Khatib et al. 2008
FGF2 SNP 11646	6	A/G (intron 1)	Khatib et al. 2008

[0022] Aside from FGF2 SNP23, the SNPs listed in Table 1 above have been previously reported. Specifically, U.S. patent application Ser. No. 11/179,581 discloses UTMP SNP 1296. (see FIG. **1** of the present invention). This same patent application also discloses STAT1 SNP213 (see FIG. **2**) and OPN SNP8504 (see FIG. **3**).

[0023] GHR SNP 154963 was reported by Blott et al. 2003 (Genetics 163:253-266) (see FIG. **4**).

[0024] U.S. patent application Ser. No. 12/267,104 discloses POU1F1 SNP 577 (see FIG. **5**).

[0025] U.S. Pat. App. No. 61/046,253, filed on Apr. 18, 2008, discloses FGF2 SNP11646 (see FIG. **6**). FIG. **6** further depicts FGF2 SNP23.

[0026] U.S. patent application Ser. No. 12/267,076 discloses STAT5A SNP 12195 (See FIG. **7**).

[0027] These and other references cited herein are all incorporated by reference in their entirety.

[0028] POU1F1 is a member of the tissue specific POU (Pit, Oct, Unc) homeobox transcription factor DNA binding protein family that is found in all mammals studied so far (Bastos et al., 2006; Ingraham et al., 1988; Ingraham et al., 1990). The pituitary specific expression of POU1F1 is required for the activation of growth hormone (GH), prolactin (PRL), and thyroid stimulating hormone (TSH) (Li et al., 1990). These genes are involved in a variety of signaling pathways that are important for many developmental and physiological processes, including pituitary gland development (Li et al., 1990, Mullis, 2007), mammary gland development and growth (Svennersten-Sjaunja and Olsson, 2005), milk protein expression (Akers, 2006), and milk production and secretion (Svennersten-Sjaunja and Olsson, 2005). Moreover, binding of GH and PRL to their receptors on the cell membrane triggers a cascade of signaling events including the JAK/STAT pathway, which has been shown to be required for adult mammary gland development and lactogenesis (Liu et al., 1997).

[0029] Several genes in the same pathway of POU1F1 have been reported to be associated with different milk production and health traits. For example, growth hormone receptor (GHR) has shown associations with milk yield and composition (Viitala et al., 2006). Also, the signal transducer and activator of transcription 1 (STAT1) and osteopontin (OPN) genes have been shown to have significant effects on milk yield and milk protein and fat yields in Holstein dairy cattle (Cobanoglu et al., 2006; Leonard et al., 2005; Schnabel et al., 2005). The uterine milk protein (UTMP) is another gene in the pathway of POU1F1 that has been found to be associated with productive life in dairy cattle (Khatib et al., 2007b).

[0030] The FGF2 regulates the trophectoderm expression of interferon-τ, a key member of the signal transduction pathway involved in milk production (Ocon-Grove et al., 2007). Bovine FGF2 is mapped to chromosome 17, with 3 exons and a total length of over 55 kb; it is expressed by the endometrium throughout the estrous cycle and early pregnancy (Michael et al., 2006).

[0031] The signal transducer and activator (STAT) proteins are known to play an important role in cytokine signaling pathways. STAT proteins are transcription factors that are specifically activated to regulate gene transcription when cells encounter cytokines and growth factors, hence they act as signal transducers in the cytoplasm and transcription activators in the nucleus (Kisseleva et al., 2002). In mammals, STATs comprise a family of seven structurally and functionally related proteins: STAT1, STAT2, STAT3, STAT4, STAT5a and STAT5b, STAT6 (Darnell, 1997). The seven mammalian STAT proteins range in size from 750 to 850 amino acids. The chromosomal distribution of these STATs, as well as the identification of STATs in more primitive eukaryotes, suggest that this family arose from a single primordial gene (Chen et al., 1998). In addition, STATs share a number of structurally and functionally conserved domains.

[0032] The STATS protein is also known as the mammary gland factor. This protein was initially identified in the mammary gland as a regulator of milk protein gene expression (Watson, 2001). STAT5A is a member of the interferon-tau (IFN-tau) and placental lactogen (PL) signaling pathway, which is involved in signal transduction within a variety of cells, including the uterus and mammary epithelial cells. The uterus is exposed to IFN-tau and PL, as well as many others hormones including estrogen, progesterone, and placental growth hormone. The PL stimulates the formation of STAT5 homodimers, which in turn induce the transcription of the bovine uterine milk protein (UTMP) and osteopontin (OPN) genes (Spencer and Bazer, 2002; Stewart et al., 2002; Spencer and Bazer, 2004). In previous studies, the present inventor showed that the UTMP (Khatib et al., 2007a) and OPN (Leonard et al. 2005; Khatib et al. 2007b) genes have surprisingly strong effects on milk production and health traits in cattle. Furthermore, the present inventor showed that STAT1—also a member of the IFN-tau and PL signal transduction pathway—is associated with milk composition and health traits (Cobanoglu et al., 2006).

[0033] Studies in mouse have shown that STAT5A is involved in both milk production and fertility; Stat5 knockout female mice fail to lactate (Miyoshi et al., 2001). Also, it has been shown that disruption of Stat5 leads to infertility in females as a result of small-sized or a lack of corpora lutea (Teglund et al., 1998). Because the primary source of progesterone is the corpora lutea of the ovary, lack of development of corpora lutea would have significant effects on the establishment of pregnancy.

[0034] Polymorphisms at the nucleic acid level may provide functional differences in the genetic sequence, through changes in the encoded polypeptide, changes in mRNA stability, binding of transcriptional and translation factors to the DNA or RNA, and the like. Polymorphisms are also used to detect genetic linkage to phenotypic variation.

[0035] One type of polymorphism, single nucleotide polymorphisms (SNPs), has gained wide use for the detection of genetic linkage recently. SNPs are generally biallelic systems, that is, there are two alleles that an individual may have for any particular SNP marker. In the instant case, the SNPs are used for determining the genotypes of the POU1F1 gene, which are found to have strong correlation to longevity and milk production traits.

[0036] Through the following testing and analysis, it has been established that certain alleles of the SNPs shown in Table 1 correspond to increased fertilization rate, or embryonic survival rate, or both, in dairy cattle, and the beneficial effects of these alleles are additive.

[0037] Gene Selection and Genotyping. The genes POU1F1, GHR, STAT5A, OPN, UTMP, STAT1, and FGF2 were chosen for association tests with fertility traits because they are members of the IFNT and PL/POU1F1 pathway. Genotyping of these genes was performed as described in the literature (Table 1) except for GHR, for which primers, GHR-F CTTTGGAATACTTGGGCTAGCAGTGA-CA"A"TAT (SEQ ID NO:8) and GHR-R GTCTCTCTGTG-

GACACAACA (SEQ ID NO:9) were used to amplify a 230-bp genomic fragment. The original T nucleotide at position −4 of the SNP was mutated to an A nucleotide in the forward primer to create an Ssp/recognition site. Restriction enzyme digestions were carried out according to the manufacturer's instructions.

[0038] Fertility Data Collection. Ovaries from mature cows were collected from a local abattoir and immediately used in the IVF experiments as described in Khatib et al. (2008a,b). Briefly, oocytes were aspirated from antral follicles (>2-6 mm) and immediately incubated in maturation medium. On average, 12 oocytes were aspirated from each ovary. On day 2 (d 2), oocytes were fertilized with frozen-thawed percoll-separated semen that had been adjusted to a final concentration of 1 million sperm/ml. Fertilization rate was calculated as the number of cleaved embryos at 48 h post fertilization out of total number of oocytes exposed to sperm. Survival rate of embryos was calculated as the number of blastocysts on d 7 of development out of the number of total embryos cultured. Viability was determined as a function of the embryo's ability to attain the morphological stage of blastocyst on d 7 of development. Embryos that failed to show cellular compaction (morula stage) on d 5 or d 6 were considered nonviable. Therefore, only embryos exhibiting adequate compaction followed by the formation of a blastocoele on d 7 were considered viable. Ovaries from which fewer than 4 oocytes were harvested were discarded and not further analyzed. A total of 7,413 fertilizations were performed using oocytes from a total of 504 ovaries and semen from 10 different bulls.

[0039] Association of Individual Genes with Fertilization and Survival Rates. Associations of individual genes with fertilization and survival rates were analyzed using the following logistic regression model:

$$\log\left(\frac{p}{1-p}\right)_i = \beta_0 + \beta_{1j} Bull_j + \beta_{2k} Genotype_k \quad (1)$$

where

$$\log\left(\frac{p}{1-p}\right)_i (i = 1, 2, \ldots n)$$

is the natural logarithm of odds of survival rate or fertilization rate, β_0 is a general constant, β_{1j} is the fixed effect associated with the j^{th} bull ($Bull_j$); and β_{2k} is the genotype effect associated with the k^{th} genotype ($Genotype_k$) of the gene analyzed. This model was fitted by Maximum Likelihood approach. Association between the gene and survival/fertilization rate was tested using a Likelihood Ratio Test (LRT).

[0040] Association of Candidate Genes with Embryonic Survival. The GHR, STAT5A, UTMP, FGF2 SNP11646, FGF2 SNP23, and STAT1 genes showed considerable associations with embryonic survival rate (Table 2). For GHR, the survival rate of embryos produced from AA ovaries was 9% higher than that of embryos produced from TT ovaries. For STAT5A, CC ovaries showed 9% and 8% higher survival rates than that of GG and GC ovaries, respectively. The UTMP gene showed 6% survival rate differences between AA and GG genotypes (Table 2). SNP11646 and SNP23 of FGF2 showed differences of 7% each between genotypes GG and AA and between GG and TT, respectively. For STAT1, although not statistically significant, TT genotype was associated with a 4% increase in survival rate compared to GG genotype.

[0041] Association of Individual Genes with Fertilization Rate. The POU1F1, GHR, STAT5A, OPN, STAT1, and FGF2 SNP23 showed association of with fertilization rate (Table 3). The CC genotype of POU1F1 was showed 71.4% fertilization rate vs. 67.7% for AC genotype. Also, AA genotype of GHR showed 70% fertilization rate compared to 66% for AT genotype. Ovaries carrying the TT genotype of OPN showed a 70% fertilization rate vs. a 62% rate for ovaries carrying the CC genotype. The CC genotype of STAT5A showed significant association with fertilization rate (71%) vs. the GC (69%) and GG (66%) genotypes. The genotypes of STAT1 genes (CC vs. TT) showed 3% difference in fertilization rate. Similarly, although less statistically significant, FGF2 SNP23 also showed associations with fertilization rate; fertilization rate of oocytes obtained from TT cows was 63% vs. 68% for GT and GG cows. FGF2 SNP11646 did not show significant association with fertilization rate. However, interestingly, two way interaction between SNP23 and SNP11646 showed significant effects on fertilization rate (P=4.90E-03). The genotype combination of TT(SNP23) and AA(SNP11646) was associated with the lowest fertilization rate (62%) compared to all other genotype combinations.

TABLE 2

Association tests (P values) between individual genes and embryo survival rate, genotypes of ovaries, number of embryos, and observed survival rates

Gene	P value	Genotype	Ovaries	Embryos	Survival rate
GHR	3.80E−06	AA	256	3131	0.37
		AT	125	1426	0.29
		TT	17	153	0.28
STAT5A	1.37E−07	GG	87	902	0.31
		GC	232	2762	0.33
		CC	85	1113	0.40
UTMP	0.00039	GG	140	1735	0.30
		GA	167	1924	0.36
		AA	112	1266	0.36
STAT1	0.115	CC	189	2235	0.34
		CT	180	2216	0.34
		TT	33	356	0.38
FGF2 SNP 11646	3.69E−04	GG	130	1424	0.38
		AG	207	2343	0.32
		AA	107	1281	0.32
FGF2 SNP23	6.87E−04	GG	263	3080	0.36
		GT	121	1370	0.30
		TT	22	221	0.29

TABLE 3

Association tests (P values) between individual genes and fertilization rate, genotypes of ovaries, number of fertilizations, and observed fertilization rate

Gene	P value	Genotype	Ovaries	Fertilizations	Fertilization Rate
POU1F1	0.0516	CC	279	4821	0.714
		AC	51	918	0.677
		AA	1	19	0.74
GHR	0.0647	AA	256	4473	0.70
		AT	125	2154	0.66
		TT	17	223	0.69
STAT5A	0.00371	GG	87	1360	0.66
		GC	232	4028	0.69
		CC	85	1574	0.71

TABLE 3-continued

Association tests (P values) between individual genes and fertilization rate, genotypes of ovaries, number of fertilizations, and observed fertilization rate

Gene	P value	Genotype	Ovaries	Fertili-zations	Fertilization Rate
OPN	0.00529	TT	142	2481	0.70
		TC	204	3601	0.70
		CC	48	739	0.62
STAT1	0.0298	CC	189	3176	0.70
		CT	180	3261	0.68
		TT	33	525	0.67
FGF2	0.172	GG	263	4547	0.68
SNP23		GT	121	2015	0.68
		TT	22	352	0.63

[0042] In the context of the present invention, the provided sequences also encompass the complementary sequence corresponding to any of the provided polymorphisms. In order to provide an unambiguous identification of the specific site of a polymorphism, the numbering of the original nucleic sequences in the GenBank is shown in the figures and is used.

[0043] The present invention provides nucleic acid based genetic markers for identifying bovine animals with superior fertility and survival traits. In general, for use as markers, nucleic acid fragments, preferably DNA fragments, will be of at least 12 nucleotides (nt), preferably at least 15 nt, usually at least 20 nt, often at least 50 nt. Such small DNA fragments are useful as primers for the polymerase chain reaction (PCR), and probes for hybridization screening, etc.

[0044] The term primer refers to a single-stranded oligonucleotide capable of acting as a point of initiation of template-directed DNA synthesis under appropriate conditions (i.e., in the presence of four different nucleoside triphosphates and an agent for polymerization, such as, DNA or RNA polymerase or reverse transcriptase) in an appropriate buffer and at a suitable temperature. The appropriate length of a primer depends on the intended use of the primer but typically ranges from 15 to 30 nucleotides. Short primer molecules generally require cooler temperatures to form sufficiently stable hybrid complexes with the template. A primer need not reflect the exact sequence of the template but must be sufficiently complementary to hybridize with a template. The term primer site, or priming site, refers to the area of the target DNA to which a primer hybridizes. The term primer pair means a set of primers including a 5' upstream primer that hybridizes with the 5' end of the DNA sequence to be amplified and a 3', downstream primer that hybridizes with the complement of the 3' end of the sequence to be amplified.

[0045] The term "probe" or "hybridization probe" denotes a defined nucleic acid segment (or nucleotide analog segment) which can be used to identify by hybridization a specific polynucleotide sequence present in samples, said nucleic acid segment comprising a nucleotide sequence complementary of the specific polynucleotide sequence to be identified. "Probes" or "hybridization probes" are nucleic acids capable of binding in a base-specific manner to a complementary strand of nucleic acid.

[0046] An objective of the present invention is to determine which embodiment of the polymorphisms a specific sample of DNA has. For example, it is desirable to determine whether the nucleotide at a particular position is A or C. An oligonucleotide probe can be used for such purpose. Preferably, the oligonucleotide probe will have a detectable label, and contains an A at the corresponding position. Experimental conditions can be chosen such that if the sample DNA contains an A, they hybridization signal can be detected because the probe hybridizes to the corresponding complementary DNA strand in the sample, while if the sample DNA contains a G, no hybridization signal is detected.

[0047] Similarly, PCR primers and conditions can be devised, whereby the oligonucleotide is used as one of the PCR primers, for analyzing nucleic acids for the presence of a specific sequence. These may be direct amplification of the genomic DNA, or RT-PCR amplification of the mRNA transcript of the POU1F1 gene. The use of the polymerase chain reaction is described in Saiki et al. (1985) Science 230:1350-1354. Amplification may be used to determine whether a polymorphism is present, by using a primer that is specific for the polymorphism. Alternatively, various methods are known in the art that utilize oligonucleotide ligation as a means of detecting polymorphisms, for examples see Riley et al (1990) Nucleic Acids Res. 18:2887-2890; and Delahunty et al (1996) Am. J. Hum. Genet. 58:1239-1246. The detection method may also be based on direct DNA sequencing, or hybridization, or a combination thereof. Where large amounts of DNA are available, genomic DNA is used directly. Alternatively, the region of interest is cloned into a suitable vector and grown in sufficient quantity for analysis. The nucleic acid may be amplified by PCR, to provide sufficient amounts for analysis.

[0048] Hybridization may be performed in solution, or such hybridization may be performed when either the oligonucleotide probe or the target polynucleotide is covalently or noncovalently affixed to a solid support. Attachment may be mediated, for example, by antibody-antigen interactions, poly-L-Lys, streptavidin or avidin-biotin, salt bridges, hydrophobic interactions, chemical linkages, UV cross-linking baking, etc. Oligonucleotides may be synthesized directly on the solid support or attached to the solid support subsequent to synthesis. Solid-supports suitable for use in detection methods of the invention include substrates made of silicon, glass, plastic, paper and the like, which may be formed, for example, into wells (as in 96-well plates), slides, sheets, membranes, fibers, chips, dishes, and beads. The solid support may be treated, coated or derivatized to facilitate the immobilization of the allele-specific oligonucleotide or target nucleic acid. For screening purposes, hybridization probes of the polymorphic sequences may be used where both forms are present, either in separate reactions, spatially separated on a solid phase matrix, or labeled such that they can be distinguished from each other.

[0049] Hybridization may also be performed with nucleic acid arrays and subarrays such as described in WO 95/11995. The arrays would contain a battery of allele-specific oligonucleotides representing each of the polymorphic sites. One or both polymorphic forms may be present in the array, for example the polymorphism of position 1296 may be represented by either, or both, of the listed nucleotides. Usually such an array will include at least 2 different polymorphic sequences, i.e. polymorphisms located at unique positions within the locus, and may include all of the provided polymorphisms. Arrays of interest may further comprise sequences, including polymorphisms, of other genetic sequences, particularly other sequences of interest. The oligonucleotide sequence on the array will usually be at least about 12 nt in length, may be the length of the provided polymorphic sequences, or may extend into the flanking regions to generate fragments of 100 to 200 nt in length. For examples of arrays, see Ramsay (1998) Nat. Biotech. 16:4044; Hacia et al. (1996) Nature Genetics 14:441-447; Lockhart et al. (1996) Nature Biotechnol. 14:1675-1680; and De Risi et al. (1996) Nature Genetics 14:457-460.

[0050] The identity of polymorphisms may also be determined using a mismatch detection technique, including but not limited to the RNase protection method using riboprobes (Winter et al., Proc. Natl. Acad. Sci. USA 82:7575, 1985; Meyers et al., Science 230:1242, 1985) and proteins which recognize nucleotide mismatches, such as the *E. coli* mutS protein (Modrich, P. Ann Rev. Genet. 25:229-253, 1991). Alternatively, variant alleles can be identified by single strand conformation polymorphism (SSCP) analysis (Orita et al., Genomics 5:874-879, 1989; Humphries et al., in Molecular Diagnosis of Genetic Diseases, R. Elles, ed., pp. 321-340, 1996) or denaturing gradient gel electrophoresis (DGGE) (Wartell et al., Nucl. Acids Res. 18:2699-2706, 1990; Sheffield et al., Proc. Natl. Acad. Sci. USA 86:232-236, 1989).

[0051] A polymerase-mediated primer extension method may also be used to identify the polymorphism(s). Several such methods have been described in the patent and scientific literature and include the "Genetic Bit Analysis" method (WO92/15712) and the ligase/polymerase mediated genetic bit analysis (U.S. Pat. No. 5,679,524). Related methods are disclosed in WO91/02087, WO90/09455, WO95/17676, U.S. Pat. Nos. 5,302,509, and 5,945,283. Extended primers containing a polymorphism may be detected by mass spectrometry as described in U.S. Pat. No. 5,605,798. Another primer extension method is allele-specific PCR (Ruao et al., Nucl. Acids Res. 17:8392, 1989; Ruao et al., Nucl. Acids Res. 19, 6877-6882, 1991; WO 93/22456; Turki et al., J. Clin. Invest. 95:1635-1641, 1995). In addition, multiple polymorphic sites may be investigated by simultaneously amplifying multiple regions of the nucleic acid using sets of allele-specific primers as described in Wallace et al. (WO 89/10414).

[0052] A detectable label may be included in an amplification reaction. Suitable labels include fluorochromes, e.g. fluorescein isothiocyanate (FITC), rhodamine, Texas Red, phycoerythrin, allophycocyanin, 6-carboxyfluorescein (6-FAM), 2',7'-dimethoxy-4',5'-dichloro-6-carboxyfluorescein (JOE), 6-carboxy-X-rhodamine (ROX), 6-carboxy-2',4',7',4,7-hexachlorofluorescein (HEX), 5-carboxyfluorescein (5-FAM) or N,N,N',N'-tetramethy-6-carboxyrhodamine (TAMRA), radioactive labels, e.g. ^{32}P, ^{35}S, ^{3}H; etc. The label may be a two stage system, where the amplified DNA is conjugated to biotin, haptens, etc. having a high affinity binding partner, e.g. avidin, specific antibodies, etc., where the binding partner is conjugated to a detectable label. The label may be conjugated to one or both of the primers. Alternatively, the pool of nucleotides used in the amplification is labeled, so as to incorporate the label into the amplification product.

[0053] It is readily recognized by those ordinarily skilled in the art that in order to maximize the signal to noise ratio, in probe hybridization detection procedure, the polymorphic site should at the center of the probe fragment used, whereby a mismatch has a maximum effect on destabilizing the hybrid molecule; and in a PCR detection procedure, the polymorphic site should be placed at the very 3'-end of the primer, whereby a mismatch has the maximum effect on preventing a chain elongation reaction by the DNA polymerase. The location of nucleotides in a polynucleotide with respect to the center of the polynucleotide are described herein in the following manner. When a polynucleotide has an odd number of nucleotides, the nucleotide at an equal distance from the 3' and 5' ends of the polynucleotide is considered to be "at the center" of the polynucleotide, and any nucleotide immediately adjacent to the nucleotide at the center, or the nucleotide at the center itself is considered to be "within 1 nucleotide of the center." With an odd number of nucleotides in a polynucleotide any of the five nucleotides positions in the middle of the polynucleotide would be considered to be within 2 nucleotides of the center, and so on. When a polynucleotide has an even number of nucleotides, there would be a bond and not a nucleotide at the center of the polynucleotide. Thus, either of the two central nucleotides would be considered to be "within 1 nucleotide of the center" and any of the four nucleotides in the middle of the polynucleotide would be considered to be "within 2 nucleotides of the center," and so on.

[0054] In some embodiments, a composition contains two or more differently labeled oligonucleotides for simultaneously probing the identity of nucleotides or nucleotide pairs at two or more polymorphic sites. It is also contemplated that primer compositions may contain two or more sets of allele-specific primer pairs to allow simultaneous targeting and amplification of two or more regions containing a polymorphic site.

[0055] Alternatively, the relevant portion of the gene of the sample of interest may be amplified via PCR and directly sequenced, and the sequence be compared to the wild type sequence shown in the figures. It is readily recognized that, other than those disclosed specifically herein, numerous primers can be devised to achieve the objectives. PCR and sequencing techniques are well known in the art and reagents and equipments are readily available commercially.

[0056] DNA markers have several advantages; segregation is easy to measure and is unambiguous, and DNA markers are co-dominant, i.e., heterozygous and homozygous animals can be distinctively identified. Once a marker system is established selection decisions could be made very easily, since DNA markers can be assayed any time after a blood sample can be collected from the individual infant animal, or even earlier by testing embryos in vitro if very early embryos are collected. The use of marker assisted genetic selection will greatly facilitate and speed up cattle breeding problems. For example, a modification of the multiple ovulation and embryo transfer (MOET) procedure can be used with genetic marker technology. Specifically, females are superovulated, eggs are collected, in vitro fertilized using semen from superior males and implanted into other females allowing for use of the superior genetics of the female (as well as the male) without having to wait for her to give birth to one calf at a time. Developing blastomeres at the 4-8 cell stage may be assayed for presence of the marker, and selection decisions made accordingly.

[0057] In one embodiment of the invention an assay is provided for detection of presence of a desirable genotype using the markers.

[0058] The term "genotype" as used herein refers to the identity of the alleles present in an individual or a sample. In the context of the present invention a genotype preferably refers to the description of the polymorphic alleles present in an individual or a sample. The term "genotyping" a sample or an individual for a polymorphic marker refers to determining the specific allele or the specific nucleotide carried by an individual at a polymorphic marker.

[0059] The present invention is suitable for identifying a bovine, including a young or adult bovine animal, an embryo, a semen sample, an egg, a fertilized egg, or a zygote, or other cell or tissue sample therefrom, to determine whether said bovine possesses the desired genotypes of the present invention, some of which are indicative of improved milk production traits.

[0060] Further provided is a method for genotyping one of the bovine genes listed in Table 1, comprising determining for the two copies of the gene present the identity of the nucleotide pair at the relevant SNP position.

[0061] One embodiment of a genotyping method of the invention involves examining both copies of the gene, or a fragment thereof, to identify the nucleotide pair at the polymorphic site in the two copies to assign a genotype to the individual. In some embodiments, "examining a gene" may include examining one or more of: DNA containing the gene, mRNA transcripts thereof, or cDNA copies thereof. As will be readily understood by the skilled artisan, the two "copies" of a gene, mRNA or cDNA, or fragment thereof in an individual may be the same allele or may be different alleles. In another embodiment, a genotyping method of the invention comprises determining the identity of the nucleotide pair at the polymorphic site.

[0062] The present invention further provides a kit for genotyping a bovine sample, the kit comprising in a container a nucleic acid molecule, as described above, designed for detecting the polymorphism, and optionally at least another component for carrying out such detection. Preferably, a kit comprises at least two oligonucleotides packaged in the same or separate containers. The kit may also contain other components such as hybridization buffer (where the oligonucleotides are to be used as a probe) packaged in a separate container. Alternatively, where the oligonucleotides are to be used to amplify a target region, the kit may contain, preferably packaged in separate containers, a polymerase and a reaction buffer optimized for primer extension mediated by the polymerase, such as PCR.

[0063] In one embodiment the present invention provides a breeding method whereby genotyping as described above is conducted on bovine embryos, and based on the results, certain cattle are either selected or dropped out of the breeding program.

[0064] Through use of the linked marker loci, procedures termed "marker assisted selection" (MAS) may be used for genetic improvement within a breeding nucleus; or "marker assisted introgression" for transferring useful alleles from a resource population to a breeding nucleus (Soller 1990; Soller 1994).

[0065] The present invention discloses the association between the genes listed in Table 1 and fertilization rate or embryonic survival.

[0066] The following examples are intended to illustrate preferred embodiments of the invention and should not be interpreted to limit the scope of the invention as defined in the claims.

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SEQUENCE LISTING

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            20                  25                  30

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        35                  40                  45

Thr Cys Thr Cys Thr Gly Gly Thr Cys Thr Thr Cys Ala Thr Cys Cys
    50                  55                  60

Thr Cys Thr Gly Thr Gly Gly Cys Cys Thr Gly Thr Thr Thr Ala Ala
65                  70                  75                  80

Thr Ala Gly Cys Ala Thr Cys Thr Thr Cys Thr Gly Thr Gly Ala Ala
                85                  90                  95

Ala Ala Gly Cys Ala Ala Cys Ala Ala Cys Ala Cys Thr Cys Thr Cys
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            100                 105                 110

Ala Ala Ala Ala Gly Cys Ala Cys Ala Thr Gly Ala Ala Cys Cys Thr
        115                 120                 125

Ala Gly Thr Cys Thr Thr Ala Thr Thr Ala Ala Ala Gly Ala Ala Ala
    130                 135                 140

Ala Thr Thr Thr Cys Ala Gly Cys Thr Cys Thr Cys Thr Cys Cys Cys
145                 150                 155                 160

Ala Gly Ala Ala Gly Ala Thr Gly Gly Ala Ala Gly Cys Thr Cys Ala
                165                 170                 175

Cys Cys Cys Thr Ala Ala Gly Gly Ala Thr Thr Thr Thr Gly Cys Cys
            180                 185                 190

Cys Ala Ala Gly Ala Ala Thr Thr Gly Thr Thr Cys Ala Ala Gly Gly
        195                 200                 205

Cys Thr Thr Thr Gly Ala Thr Ala Ala Thr Thr Gly Ala Gly Gly Ala
    210                 215                 220

Thr Cys Cys Cys Ala Gly Ala Ala Ala Gly Ala Ala Thr Ala Thr Cys
225                 230                 235                 240

Ala Thr Cys Thr Thr Cys Thr Cys Cys Cys Cys Cys Ala Thr Gly Gly
                245                 250                 255

Cys Cys Ala Thr Gly Ala Cys Cys Ala Cys Cys Ala Cys Cys Cys Thr
            260                 265                 270

Gly Gly Cys Cys Ala Cys Cys Cys Thr Cys Thr Cys Cys Cys Thr Gly
        275                 280                 285

Gly Gly Gly Ala Thr Cys Ala Ala Gly Thr Cys Thr Ala Cys Ala Ala
    290                 295                 300

Thr Gly Ala Gly Ala Ala Cys Cys Cys Ala Cys Cys Ala Cys Cys Cys
305                 310                 315                 320

Thr Gly Ala Gly Gly Ala Cys Cys Thr Gly Ala Ala Ala Cys Thr Thr
                325                 330                 335

Gly Ala Gly Cys Cys Cys Ala Ala Ala Cys Thr Gly Thr Thr Gly Gly
            340                 345                 350

Ala Thr Gly Thr Gly Cys Ala Cys Ala Ala Gly Thr Ala Cys Thr Thr
        355                 360                 365

Ala Cys Ala Gly Cys Cys Thr Cys Thr Gly Gly Thr Cys Cys Ala Cys
    370                 375                 380

Gly Thr Gly Gly Gly Gly Cys Gly Thr Gly Ala Gly Cys Thr Ala Gly
385                 390                 395                 400

Thr Gly Ala Ala Gly Cys Ala Gly Ala Ala Gly Gly Thr Ala Cys Thr
                405                 410                 415

Gly Ala Ala Gly Cys Ala Cys Cys Ala Gly Cys Ala Cys Ala Thr Thr
            420                 425                 430

Cys Thr Cys Thr Thr Thr Ala Thr Cys Ala Ala Cys Ala Gly Ala Ala
        435                 440                 445

Ala Ala Ala Thr Gly Ala Thr Gly Gly Thr Cys Ala Ala Cys Cys Ala
    450                 455                 460

Gly Ala Thr Gly Cys Thr Thr Cys Thr Ala Cys Ala Gly Cys Ala Gly
465                 470                 475                 480

Ala Thr Ala Ala Gly Cys Ala Ala Gly Cys Thr Gly Cys Ala Gly Gly
                485                 490                 495

Gly Ala Ala Thr Gly Gly Ala Cys Ala Thr Cys Cys Ala Gly Ala Thr
            500                 505                 510
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Gly Ala Thr Thr Gly Ala Cys Thr Thr Thr Ala Cys Ala Gly Ala Thr
        515                 520                 525

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    530                 535                 540

Ala Gly Ala Cys Cys Ala Thr Cys Ala Gly Cys Cys Ala Cys Cys Ala
545                 550                 555                 560

Thr Gly Thr Gly Gly Cys Thr Gly Ala Ala Ala Ala Ala Ala Cys Ala
                565                 570                 575

Cys Ala Thr Ala Cys Gly Ala Ala Ala Ala Thr Cys Ala Cys Ala Ala
            580                 585                 590

Ala Cys Thr Thr Ala Ala Thr Cys Ala Cys Cys Gly Ala Cys Cys Thr
        595                 600                 605

Gly Ala Ala Cys Cys Cys Thr Gly Ala Gly Ala Cys Cys Ala Thr Cys
    610                 615                 620

Cys Thr Gly Thr Gly Thr Cys Thr Thr Gly Thr Thr Ala Ala Cys Cys
625                 630                 635                 640

Ala Cys Ala Thr Thr Thr Thr Cys Thr Thr Cys Ala Ala Ala Gly Gly
                645                 650                 655

Cys Ala Thr Cys Thr Thr Gly Ala Ala Ala Ala Gly Ala Gly Cys Thr
            660                 665                 670

Thr Thr Thr Cys Ala Gly Cys Cys Cys Ala Ala Ala Cys Thr Cys Ala
        675                 680                 685

Cys Cys Cys Ala Gly Ala Ala Gly Gly Ala Gly Gly Thr Cys Thr Thr
    690                 695                 700

Cys Thr Thr Thr Gly Thr Gly Ala Ala Thr Gly Ala Cys Cys Ala Ala
705                 710                 715                 720

Ala Cys Cys Ala Ala Ala Gly Thr Gly Cys Ala Gly Gly Thr Gly Gly
                725                 730                 735

Ala Cys Ala Thr Gly Ala Thr Gly Ala Gly Ala Ala Ala Gly Ala Cys
            740                 745                 750

Ala Gly Ala Ala Cys Gly Gly Ala Thr Gly Cys Thr Thr Thr Ala Cys
        755                 760                 765

Ala Gly Cys Cys Gly Gly Thr Cys Ala Gly Ala Gly Gly Ala Gly Cys
    770                 775                 780

Thr Ala Cys Ala Thr Gly Cys Thr Ala Cys Gly Ala Thr Gly Gly Thr
785                 790                 795                 800

Thr Ala Ala Gly Ala Thr Gly Cys Cys Thr Thr Gly Cys Ala Ala Ala
                805                 810                 815

Gly Gly Ala Ala Ala Thr Gly Thr Gly Thr Cys Cys Cys Thr Ala Ala
            820                 825                 830

Cys Thr Cys Thr Cys Ala Thr Gly Cys Thr Thr Cys Cys Ala Gly Ala
        835                 840                 845

Thr Gly Cys Cys Gly Gly Ala Cys Ala Ala Thr Thr Thr Gly Ala Cys
    850                 855                 860

Ala Cys Thr Gly Ala Thr Cys Thr Thr Ala Ala Ala Ala Ala Gly Ala
865                 870                 875                 880

Thr Gly Ala Cys Thr Gly Cys Thr Ala Ala Gly Cys Gly Ala Gly Cys
                885                 890                 895

Thr Ala Ala Ala Cys Thr Thr Cys Ala Gly Ala Ala Ala Ala Thr Cys
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    930                 935                 940

Cys Ala Ala Gly Thr Thr Gly Ala Ala Gly Ala Thr Cys Thr Cys Cys
945                 950                 955                 960

Thr Thr Cys Ala Ala Gly Ala Thr Ala Ala Ala Cys Thr Thr Thr Ala
                965                 970                 975

Ala Gly Cys Ala Thr Cys Thr Gly Cys Thr Thr Cys Cys Cys Ala Ala
            980                 985                 990

Gly Ala Thr Thr Gly Ala Cys Cys  Cys Cys Ala Ala Ala  Cys Ala Thr
        995                 1000                1005

Ala Thr  Ala Cys Thr Gly Ala  Cys Thr Gly Cys Cys  Ala Cys Ala
    1010                 1015                 1020

Gly Cys  Ala Ala Thr Cys Thr  Cys Ala Cys Ala Gly  Gly Cys Cys
    1025                 1030                 1035

Ala Thr  Cys Ala Cys Ala Thr  Cys Gly Ala Ala Gly  Gly Cys Thr
    1040                 1045                 1050

Cys Cys  Cys Cys Thr Gly Cys  Cys Thr Ala Ala Thr  Thr Thr Gly
    1055                 1060                 1065

Gly Ala  Gly Gly Cys Cys Cys  Thr Ala Cys Ala Thr  Cys Ala Ala
    1070                 1075                 1080

Gly Cys  Thr Gly Ala Gly Ala  Thr Ala Gly Ala Gly  Cys Thr Gly
    1085                 1090                 1095

Ala Gly  Cys Gly Ala Gly Cys  Ala Cys Gly Cys Cys  Thr Thr Ala
    1100                 1105                 1110

Ala Cys  Cys Gly Thr Gly Gly  Ala Cys Ala Cys Ala  Gly Cys Cys
    1115                 1120                 1125

Ala Thr  Thr Cys Ala Cys Ala  Cys Ala Gly Ala Thr  Ala Ala Thr
    1130                 1135                 1140

Cys Thr  Gly Thr Thr Gly Ala  Ala Ala Gly Thr Cys  Cys Cys Ala
    1145                 1150                 1155

Gly Thr  Gly Ala Ala Gly Gly  Cys Ala Ala Ala Gly  Gly Ala Gly
    1160                 1165                 1170

Gly Thr  Cys Cys Cys Gly Gly  Cys Gly Gly Thr Cys  Gly Thr Gly
    1175                 1180                 1185

Ala Ala  Ala Gly Thr Cys Cys  Cys Ala Ala Thr Gly  Ala Ala Gly
    1190                 1195                 1200

Gly Cys  Ala Ala Ala Gly Gly  Ala Gly Gly Thr Cys  Cys Cys Gly
    1205                 1210                 1215

Gly Cys  Gly Gly Thr Cys Gly  Thr Gly Ala Ala Ala  Gly Thr Cys
    1220                 1225                 1230

Cys Cys  Ala Ala Thr Gly Ala  Ala Cys Ala Cys Ala  Ala Ala Gly
    1235                 1240                 1245

Gly Ala  Gly Gly Thr Cys Cys  Cys Ala Gly Thr Gly  Gly Thr Cys
    1250                 1255                 1260

Gly Thr  Gly Ala Ala Ala Gly  Thr Cys Cys Cys Ala  Ala Thr Gly
    1265                 1270                 1275

Ala Ala  Cys Ala Cys Ala Ala  Ala Gly Gly Ala Gly  Gly Thr Cys
    1280                 1285                 1290

Cys Cys  Ala Gly Gly Thr Gly  Gly Thr Cys Gly Thr  Gly Ala Ala
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    1295                1300                1305

Gly Gly  Thr Cys Ala Ala Cys  Ala Gly Ala Cys Cys  Cys Thr Thr
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Cys Thr  Thr Gly Cys Thr Gly  Thr Thr Thr Gly Thr  Gly Gly Ala
    1325                1330                1335

Gly Gly  Ala Thr Gly Ala Gly  Ala Ala Gly Ala Cys  Thr Cys Ala
    1340                1345                1350

Ala Ala  Gly Ala Gly Ala Cys  Cys Thr Cys Thr Thr  Thr Gly Thr
    1355                1360                1365

Gly Gly  Gly Cys Ala Ala Ala  Gly Thr Cys Cys Thr  Cys Ala Ala
    1370                1375                1380

Cys Cys  Cys Cys Cys Ala Ala  Gly Thr Thr Gly Ala  Gly Thr Ala
    1385                1390                1395

Gly Ala  Gly Cys Cys Ala Gly  Gly Gly Cys Cys Ala  Cys Ala Cys
    1400                1405                1410

Thr Gly  Thr Gly Cys Ala Gly  Cys Ala Cys Ala Gly  Gly Ala Ala
    1415                1420                1425

Cys Thr  Thr Ala Gly Cys Ala  Gly Gly Cys Cys Ala  Thr Gly Ala
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            20                  25                  30

Thr Gly Cys Cys Thr Gly Thr Gly Ala Ala Ala Thr Ala Gly Thr Gly
        35                  40                  45

Cys Ala Ala Ala Gly Cys Thr Gly Thr Cys Cys Thr Gly Thr Ala Thr
    50                  55                  60

Cys Thr Gly Gly Gly Cys Ala Gly Ala Gly Gly Ala Thr Ala Ala Ala
65                  70                  75                  80

Ala Gly Thr Thr Ala Thr Gly Thr Gly Thr Gly Thr Thr Ala Thr Thr
                85                  90                  95

Ala Thr Ala Thr Thr Thr Thr Cys Cys Ala Cys Ala Cys Thr Gly Gly
            100                 105                 110

Cys Cys Ala Thr Thr Gly Ala Ala Ala Ala Cys Thr Ala Ala Ala Gly
        115                 120                 125

Ala Thr Thr Cys Thr Cys Thr Thr Thr Cys Thr Thr Gly Gly Gly Ala
    130                 135                 140

Gly Ala Ala Thr Thr Ala Gly Cys Thr Thr Thr Thr Gly Gly Thr Ala
145                 150                 155                 160

Thr Gly Gly Cys Thr Thr Thr Ala Thr Gly Ala Thr Gly Cys Thr Gly
                165                 170                 175
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Gly Cys Thr Ala Ala Thr Ala Thr Cys Ala Ala Thr Ala Gly Ala Ala
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Gly Gly Ala Ala Gly Thr Ala Ala Ala Cys Thr Thr Thr Ala Cys Ala
        195                 200                 205

Ala Ala Thr Thr Cys Thr Ala Thr Gly Ala Gly Thr Ala Gly Thr Ala
    210                 215                 220

Thr Cys Thr Thr Cys Cys Ala Thr Thr Thr Cys Ala Gly Cys Thr Thr
225                 230                 235                 240

Thr Ala Ala Thr Ala Cys Cys Ala Ala Ala Gly Thr Thr Gly Ala Ala
                245                 250                 255

Thr Ala Thr Ala Thr Thr Cys Thr Gly Cys Cys Thr Thr Cys Ala Thr
            260                 265                 270

Cys Ala Thr Gly Ala Ala Ala Thr Thr Gly Ala Ala Gly Thr Thr Ala
        275                 280                 285

Gly Thr Ala Ala Ala Thr Gly Ala Ala Ala Cys Thr Gly Thr Cys Thr
    290                 295                 300

Thr Cys Ala Cys Ala Gly Thr Thr Cys Thr Ala Thr Cys Ala Ala Gly
305                 310                 315                 320

Gly Gly Ala Gly Cys Cys Ala Ala Ala Cys Thr Ala Thr Thr Ala Ala
                325                 330                 335

Cys Ala Gly Cys Thr Cys Thr Cys Thr Thr Ala Ala Gly Gly Cys Ala
            340                 345                 350

Ala Ala Thr Cys Cys Thr Ala Thr Thr Ala Thr Thr Thr Thr Thr Thr
        355                 360                 365

Cys Ala Ala Ala Ala Ala Gly Thr Thr Gly Ala Ala Ala Thr Thr Ala
    370                 375                 380

Ala Thr Thr Gly Thr Ala Gly Ala Thr Gly Thr Ala Ala Ala Cys Ala
385                 390                 395                 400

Ala Ala Cys Thr Cys Ala Gly Ala Ala Ala Thr Thr Thr Ala Ala Thr
                405                 410                 415

Gly Cys Ala Thr Gly Thr Thr Thr Cys Ala Thr Ala Ala Gly Thr Gly
            420                 425                 430

Gly Gly Thr Thr Cys Ala Cys Thr Thr Gly Thr Cys Thr Thr Thr Ala
        435                 440                 445

Thr Thr Gly Thr Thr Thr Ala Gly Thr Ala Ala Ala Ala Ala Thr Thr
    450                 455                 460

Thr Thr Ala Ala Ala Ala Thr Thr Gly Ala Gly Ala Ala Gly Ala Ala
465                 470                 475                 480

Ala Ala Ala Cys Thr Ala Gly Thr Ala Ala Thr Thr Gly Ala Cys Ala
                485                 490                 495

Ala Ala Thr Cys Ala Thr Thr Ala Gly Gly Thr Gly Gly Ala Gly Ala
            500                 505                 510

Thr Thr Ala Thr Gly Ala Gly Ala Ala Thr Cys Cys Ala Ala Thr Ala
        515                 520                 525

Ala Thr Thr Thr Gly Ala Ala Ala Ala Cys Thr Cys Ala Thr Cys Cys
    530                 535                 540

Thr Gly Thr Gly Thr Ala Ala Cys Thr Gly Cys Cys Thr Thr Gly Ala
545                 550                 555                 560

Gly Ala Ala Thr Thr Gly Gly Gly Thr Ala Ala Thr Thr Thr Thr Cys
                565                 570                 575

Ala Cys Thr Gly Gly Cys Ala Ala Ala Thr Gly Thr Gly Thr Ala Thr
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            580                 585                 590

Cys Thr Cys Thr Cys Ala Cys Ala Ala Ala Thr Ala Cys Ala Thr Thr
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    610                 615                 620

Ala Ala Ala
625


&lt;210&gt; SEQ ID NO 3
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            20                  25                  30

Thr Ala Ala Ala Gly Ala Ala Cys Ala Ala Cys Cys Ala Cys Thr Cys
        35                  40                  45

Cys Ala Ala Ala Ala Ala Ala Thr Ala Gly Cys Cys Ala Cys Cys Ala
    50                  55                  60

Ala Gly Cys Ala Gly Gly Cys Cys Ala Thr Thr Thr Gly Gly Gly Cys
65                  70                  75                  80

Thr Gly Gly Thr Thr Ala Ala Ala Thr Gly Gly Ala Thr Cys Thr Thr
                85                  90                  95

Cys Cys Cys Thr Gly Cys Cys Thr Gly Thr Thr Gly Gly Gly Cys Thr
            100                 105                 110

Thr Cys Cys Cys Thr Gly Ala Thr Ala Gly Cys Thr Cys Ala Gly Thr
        115                 120                 125

Thr Gly Gly Thr Ala Ala Ala Gly Cys Ala Thr Cys Thr Gly Cys Cys
    130                 135                 140

Thr Gly Cys Ala Ala Cys Thr Thr Gly Gly Ala Ala Gly Ala Cys Cys
145                 150                 155                 160

Cys Gly Gly Gly Thr Thr Cys Ala Gly Thr Cys Cys Cys Thr Gly Gly
                165                 170                 175

Gly Thr Cys Gly Gly Gly Ala Ala Gly Ala Cys Thr Cys Cys Cys Thr
            180                 185                 190

Gly Gly Ala Gly Ala Ala Gly Gly Ala Ala Ala Thr Gly Gly Cys Ala
        195                 200                 205

Ala Cys Cys Cys Cys Cys Thr Cys Thr Ala Gly Thr Ala Cys Thr Cys
    210                 215                 220

Thr Thr Gly Cys Cys Thr Gly Gly Ala Ala Ala Ala Thr Thr Thr Cys
225                 230                 235                 240

Cys Ala Thr Gly Gly Ala Cys Thr Gly Ala Gly Gly Ala Cys Cys Cys
                245                 250                 255

Thr Gly Gly Thr Ala Gly Gly Cys Thr Ala Ala Gly Ala Gly Thr Cys
            260                 265                 270

Ala Gly Ala Cys Ala Gly Ala Ala Cys Thr Gly Ala Gly Cys Ala Ala
        275                 280                 285

Cys Thr Thr Cys Ala Cys Thr Thr Cys Ala Cys Thr Thr Thr Cys Cys
    290                 295                 300
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Thr Gly Cys Cys Thr Gly Thr Thr Thr Gly Thr Ala Ala Ala Ala Gly
305 310 315 320

Thr Gly Ala Gly Cys Thr Thr Ala Gly Gly Ala Cys Ala Cys Cys Ala
325 330 335

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340 345 350

Gly Thr Cys Thr Thr Cys Cys Gly Gly Cys Thr Thr Ala Ala Thr Cys
355 360 365

Cys Thr Thr Cys Cys Ala Cys Ala Ala Thr Gly Ala Gly Gly Cys Thr
370 375 380

Ala Gly Ala Ala Ala Ala Ala Thr Ala Ala Gly Ala Cys Cys Thr Gly
385 390 395 400

Cys Thr Thr Thr Gly Gly Ala Thr Gly Gly Ala Ala Ala Cys Ala Gly
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Cys Thr Ala Ala Cys Thr Thr Thr Thr Gly Ala Ala Thr Ala Ala Ala
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435 440 445

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Ala Thr Gly Thr Cys Thr Gly Thr Thr Gly Thr Gly Cys Cys Thr Thr
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Ala Thr Thr Gly Cys Cys Cys Ala Gly Gly Thr Thr Cys Ala Ala Ala
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Thr Thr Cys Cys Gly Gly Cys Ala Ala Ala Ala Thr Thr Cys Cys Ala
610 615 620

Cys Thr Ala Gly Cys Ala Ala Ala Cys Cys Cys Thr Thr Cys Ala Gly
625 630 635 640

Gly Ala Ala Cys Thr Ala Cys Thr Thr Thr Thr Thr Ala Thr Thr Gly
645 650 655

Gly Gly Ala Cys Thr Ala Thr Thr Ala Ala Thr Ala Gly Gly Gly Ala
660 665 670

Thr Ala Ala Gly Thr Thr Ala Ala Ala Thr Thr Thr Gly Cys Thr Thr
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Thr Cys Cys Thr Thr Ala Ala Gly Ala Thr Thr Cys Thr Ala Thr Thr
690 695 700

Thr Gly Ala Ala Gly Ala Thr Gly Cys Thr Gly Ala Gly Ala Ala Thr

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705                 710                 715                 720

Cys Thr Ala Thr Ala Ala Gly Ala Gly Ala Ala Gly Thr Thr Ala Gly
                725                 730                 735

Ala Thr Ala Ala Ala Thr Gly Ala Cys Cys Cys Ala Gly Gly Ala Thr
            740                 745                 750

Ala Thr Thr Thr Gly Cys Ala Ala Ala Thr Cys Ala Gly Ala Ala Gly
        755                 760                 765

Thr Gly Thr Gly Ala Thr Ala Gly Ala Cys Ala Thr Thr Ala Ala Cys
    770                 775                 780

Thr Gly Ala Gly Cys Thr Ala Thr Ala Gly Thr Thr Thr Cys Thr Ala
785                 790                 795                 800

Cys Ala Cys Ala Thr Gly Gly Ala Thr Ala Ala Gly Ala Gly Ala Gly
                805                 810                 815

Thr Cys Ala Cys Cys Thr Thr Thr Thr Gly Ala Thr Thr Ala Thr Cys
            820                 825                 830

Cys Ala Gly Gly Cys Thr Ala Ala Thr Ala Gly Gly Gly Ala Gly Gly
        835                 840                 845

Thr Gly Ala Thr Thr Thr Thr Ala Gly Thr Thr Thr Thr Gly Gly Gly
    850                 855                 860

Gly Gly Thr Gly Thr Gly Cys Ala Thr Thr Ala Ala Thr Ala Cys Ala
865                 870                 875                 880

Thr Gly Gly Ala Thr Thr Cys Thr Cys Thr Gly Ala Thr Cys Cys Cys
                885                 890                 895

Cys Thr Gly Ala Gly Ala Ala Thr Thr Thr Thr Cys Ala Thr Thr Thr
            900                 905                 910

Cys Ala Ala Ala Thr Ala Gly Ala Ala Ala Ala Gly Gly Thr Ala Gly
        915                 920                 925

Thr Cys Thr Cys Ala Cys Ala Ala Thr Thr Ala Thr Gly Thr Ala Thr
    930                 935                 940

Cys Cys Thr Gly Thr Ala Thr Thr Thr Ala Thr Thr Gly Gly Ala Thr
945                 950                 955                 960

Cys Ala Thr Thr Gly Ala Ala Ala Thr Thr Thr Gly Gly Thr Ala Ala
                965                 970                 975

Ala Thr Thr Ala Gly Thr Gly Thr Thr Thr Ala Thr Thr Ala Thr Gly
            980                 985                 990

Ala Ala Cys Ala Ala Gly Gly Ala  Ala Ala Ala Ala Cys  Ala Gly Thr
        995                 1000                1005

Gly Thr  Cys Ala Thr Thr Gly  Ala Thr Ala Cys Ala  Ala Ala Thr
    1010                1015                1020

Ala Thr  Thr Ala Thr Ala Ala  Cys Thr Cys Ala Thr  Ala Cys Gly
    1025                1030                1035

Thr Thr  Thr Gly Gly Cys Thr  Thr Gly Ala Ala Ala  Ala Thr Ala
    1040                1045                1050

Thr Cys  Thr Gly Thr Gly Ala  Ala Ala Ala Thr Cys  Gly Thr Thr
    1055                1060                1065

Thr Thr  Thr Ala Thr Gly Ala  Gly Ala Ala Ala Cys  Cys Ala Ala
    1070                1075                1080

Gly Ala  Ala Ala Ala Ala Thr  Gly Cys Cys Thr Thr  Ala Gly Ala
    1085                1090                1095

Ala Thr  Ala Gly Gly Ala Thr  Thr Cys Cys Ala Thr  Thr Thr Ala
    1100                1105                1110
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Cys Cys  Cys Thr Thr Gly Thr  Gly Thr Thr Ala Ala  Ala Gly Gly
    1115                 1120                 1125

Gly Gly  Ala Ala Ala Thr Thr  Gly Gly Ala Ala Thr  Ala Ala Gly
    1130                 1135                 1140

Cys Thr  Cys Ala Thr Thr Thr  Thr Ala Gly Cys Ala  Thr Thr Thr
    1145                 1150                 1155

Ala Ala  Ala Ala Gly Cys Cys  Ala Thr Thr Ala Ala  Gly Thr Gly
    1160                 1165                 1170

Cys Thr  Thr Thr Gly Thr Thr  Gly Thr Gly Ala Ala  Thr Ala Cys
    1175                 1180                 1185

Ala Ala  Ala Gly Ala Thr Thr  Cys Thr Ala Ala Ala  Ala Cys Thr
    1190                 1195                 1200

Ala Ala  Ala Thr Ala Ala Ala  Gly Ala Thr Ala Gly  Thr Ala Ala
    1205                 1210                 1215

Ala Ala  Thr Ala Cys Thr Ala  Ala Thr Gly Cys Ala  Cys Thr Gly
    1220                 1225                 1230

Thr Ala  Ala Ala Gly Cys Cys  Thr Ala Ala Gly Gly  Gly Ala Cys
    1235                 1240                 1245

Ala Gly  Thr Ala Ala Ala Ala  Ala Cys Cys Cys Thr  Gly Ala Cys
    1250                 1255                 1260

Ala Cys  Cys Cys Ala Thr Thr  Thr Thr Thr Cys Thr  Gly Gly Cys
    1265                 1270                 1275

Cys Ala  Thr Cys Thr Thr Gly  Ala Thr Thr Thr Cys  Thr Ala Gly
    1280                 1285                 1290

Ala Cys  Cys Cys Thr Cys Cys  Cys Ala Ala Gly Thr  Ala Ala Gly
    1295                 1300                 1305

Thr Cys  Cys Ala Ala Thr Gly  Ala Ala Ala Gly Cys  Cys Cys Thr
    1310                 1315                 1320

Gly Ala  Gly Cys Ala Ala Ala  Cys Ala Gly Ala Cys  Gly Ala Thr
    1325                 1330                 1335

Cys Thr  Ala Gly Ala Thr Gly  Ala Cys Gly Ala Thr  Gly Ala Thr
    1340                 1345                 1350

Gly Ala  Thr Ala Ala Cys Ala  Gly Cys Cys Ala Gly  Gly Ala Cys
    1355                 1360                 1365

Gly Thr  Cys Ala Ala Cys Thr  Cys Thr Ala Ala Thr  Gly Ala Cys
    1370                 1375                 1380

Thr Cys  Cys Gly Ala Cys Gly  Ala Cys Gly Cys Thr  Gly Ala Ala
    1385                 1390                 1395

Ala Cys  Cys Ala Cys Thr Gly  Ala Thr Gly Ala Cys  Cys Cys Thr
    1400                 1405                 1410

Gly Ala  Cys Cys Ala Thr Thr  Cys Cys Gly Ala Cys  Gly Ala Gly
    1415                 1420                 1425

Thr Cys  Thr Cys Ala Cys Cys  Ala Thr Thr Cys Thr  Gly Ala Thr
    1430                 1435                 1440

Gly Ala  Ala Thr Cys Thr Gly  Ala Thr Gly Ala Ala  Gly Thr Thr
    1445                 1450                 1455

Gly Ala  Thr Thr Thr Thr Cys  Cys Cys Ala Cys Thr  Gly Ala Thr
    1460                 1465                 1470

Ala Thr  Thr Cys Cys Ala Ala  Cys Ala Ala Thr Cys  Gly Cys Ala
    1475                 1480                 1485
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Gly Thr Thr Thr Thr Cys Ala Cys Thr Cys Cys Gly Thr Thr Thr
1490 1495 1500

Ala Thr Cys Cys Cys Thr Ala Cys Gly Gly Ala Ala Ala Gly Cys
1505 1510 1515

Gly Cys Ala Ala Ala Thr Gly Ala Thr Gly Gly Cys Cys Gly Ala
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Gly Gly Thr Gly Ala Thr Ala Gly Thr Gly Thr Gly Gly Cys Thr
1535 1540 1545

Thr Ala Cys Gly Gly Ala Cys Thr Gly Ala Ala Gly Thr
1550 1555 1560

<210> SEQ ID NO 4
<211> LENGTH: 1381
<212> TYPE: PRT
<213> ORGANISM: bovine

<400> SEQUENCE: 4

Cys Ala Gly Ala Thr Ala Ala Thr Gly Ala Ala Gly Gly Ala Thr Ala
1 5 10 15

Ala Gly Gly Ala Ala Gly Gly Cys Thr Gly Gly Cys Ala Thr Gly Cys
20 25 30

Thr Gly Cys Ala Gly Thr Thr Cys Ala Thr Gly Gly Gly Gly Thr Thr
35 40 45

Gly Cys Ala Ala Ala Gly Ala Gly Thr Cys Ala Gly Ala Cys Ala Thr
50 55 60

Gly Ala Cys Thr Thr Ala Gly Cys Ala Ala Cys Thr Gly Ala Ala Cys
65 70 75 80

Ala Gly Cys Ala Thr Thr Cys Thr Ala Ala Ala Ala Thr Cys Thr Gly
85 90 95

Ala Gly Ala Gly Thr Cys Cys Thr Ala Gly Thr Ala Cys Thr Gly Ala
100 105 110

Thr Cys Thr Thr Cys Thr Gly Thr Cys Ala Ala Ala Cys Ala Gly Thr
115 120 125

Ala Cys Thr Thr Thr Thr Thr Ala Cys Gly Cys Thr Gly Thr Ala Ala
130 135 140

Ala Ala Ala Thr Gly Thr Ala Cys Ala Cys Cys Cys Thr Gly Cys Ala
145 150 155 160

Thr Ala Thr Cys Thr Ala Ala Gly Ala Ala Gly Thr Thr Thr Thr Ala
165 170 175

Ala Thr Ala Ala Thr Gly Ala Thr Thr Cys Ala Ala Ala Ala Ala Thr
180 185 190

Ala Cys Ala Ala Cys Thr Thr Gly Gly Cys Cys Cys Cys Cys Ala Thr
195 200 205

Cys Thr Thr Thr Thr Thr Gly Ala Thr Gly Gly Ala Thr Cys Cys Thr
210 215 220

Cys Ala Gly Thr Cys Thr Ala Gly Ala Thr Cys Ala Gly Ala Thr Cys
225 230 235 240

Thr Ala Gly Ala Thr Cys Thr Ala Ala Ala Gly Ala Thr Cys Ala Cys
245 250 255

Ala Thr Thr Ala Ala Ala Ala Ala Ala Ala Ala Ala Ala Ala Ala Gly
260 265 270

Ala Ala Thr Thr Gly Gly Ala Cys Ala Thr Thr Ala Thr Thr Thr Ala
275 280 285

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Gly Gly Thr Ala Ala Ala Gly Thr Ala Gly Thr Ala Thr Ala Thr Thr
    290                 295                 300

Ala Ala Cys Ala Ala Gly Cys Ala Thr Cys Ala Cys Thr Thr Thr Thr
305                 310                 315                 320

Cys Cys Cys Thr Cys Ala Ala Gly Cys Thr Ala Ala Ala Gly Cys Cys
                325                 330                 335

Thr Thr Thr Thr Ala Ala Thr Gly Ala Cys Ala Cys Ala Cys Cys Cys
            340                 345                 350

Thr Gly Ala Ala Cys Ala Cys Ala Thr Ala Ala Gly Ala Thr Gly Thr
        355                 360                 365

Thr Thr Ala Ala Ala Gly Cys Ala Gly Gly Thr Thr Gly Thr Thr Thr
    370                 375                 380

Ala Thr Ala Thr Ala Ala Thr Ala Ala Ala Cys Ala Thr Gly Gly Ala
385                 390                 395                 400

Thr Thr Gly Thr Gly Cys Thr Thr Ala Ala Ala Thr Thr Gly Thr Ala
                405                 410                 415

Thr Gly Cys Thr Gly Thr Thr Ala Cys Thr Cys Thr Thr Thr Thr Thr
            420                 425                 430

Thr Thr Thr Thr Thr Gly Gly Thr Ala Thr Ala Cys Ala Ala Ala Ala
        435                 440                 445

Gly Gly Ala Thr Cys Thr Gly Ala Ala Gly Ala Ala Gly Thr Gly Gly
    450                 455                 460

Ala Thr Ala Gly Ala Gly Gly Thr Gly Thr Thr Cys Thr Thr Ala Gly
465                 470                 475                 480

Ala Ala Ala Ala Thr Ala Cys Thr Ala Ala Gly Thr Ala Ala Thr Thr
                485                 490                 495

Gly Cys Ala Thr Thr Cys Thr Ala Thr Thr Cys Ala Gly Thr Gly
            500                 505                 510

Gly Cys Thr Ala Thr Cys Ala Ala Gly Thr Gly Ala Ala Ala Thr Cys
        515                 520                 525

Ala Thr Thr Gly Ala Cys Thr Thr Thr Ala Cys Thr Ala Gly Ala Thr
    530                 535                 540

Gly Ala Ala Thr Ala Cys Ala Ala Ala Thr Thr Ala Gly Gly Ala Ala
545                 550                 555                 560

Gly Thr Thr Thr Thr Ala Thr Gly Thr Gly Gly Ala Ala Cys Ala Gly
                565                 570                 575

Gly Ala Gly Ala Ala Thr Gly Ala Gly Ala Thr Ala Thr Ala Ala Ala
            580                 585                 590

Cys Thr Thr Cys Ala Ala Cys Thr Gly Thr Thr Cys Ala Thr Ala Gly
        595                 600                 605

Thr Thr Cys Thr Gly Thr Gly Ala Gly Ala Thr Ala Thr Thr Ala Thr
    610                 615                 620

Thr Thr Thr Thr Gly Thr Gly Thr Thr Thr Thr Thr Cys Ala Gly Ala
625                 630                 635                 640

Thr Thr Thr Cys Cys Ala Gly Thr Thr Thr Cys Cys Ala Thr Gly Gly
                645                 650                 655

Thr Thr Cys Thr Thr Ala Ala Thr Thr Ala Thr Thr Ala Thr Cys Thr
            660                 665                 670

Thr Thr Gly Gly Ala Ala Thr Ala Cys Thr Thr Gly Gly Gly Cys Thr
        675                 680                 685
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```
Ala Gly Cys Ala Gly Thr Gly Ala Cys Ala Thr Thr Ala Thr Thr Ala
    690                 695                 700

Thr Thr Thr Ala Cys Thr Cys Ala Thr Ala Thr Thr Thr Thr Cys Thr
705                 710                 715                 720

Ala Ala Ala Cys Ala Gly Cys Ala Ala Ala Gly Gly Thr Ala Ala Gly
                725                 730                 735

Thr Gly Thr Gly Ala Thr Ala Thr Ala Ala Cys Cys Thr Ala Cys Thr
            740                 745                 750

Cys Thr Gly Ala Thr Ala Thr Gly Thr Thr Thr Thr Gly Cys Cys Ala
        755                 760                 765

Gly Thr Thr Ala Thr Thr Thr Ala Gly Cys Ala Ala Ala Thr Gly Thr
    770                 775                 780

Cys Cys Ala Thr Gly Thr Thr Thr Cys Cys Ala Thr Thr Thr Thr Thr
785                 790                 795                 800

Thr Gly Thr Thr Thr Gly Ala Thr Gly Thr Thr Thr Thr Cys Thr Thr
                805                 810                 815

Thr Thr Gly Thr Gly Ala Ala Thr Cys Cys Thr Gly Ala Gly Thr Gly
            820                 825                 830

Ala Ala Gly Thr Gly Thr Thr Thr Cys Ala Thr Cys Ala Ala Cys Cys
        835                 840                 845

Cys Ala Gly Thr Gly Ala Ala Cys Gly Thr Thr Ala Thr Cys Gly
    850                 855                 860

Cys Thr Cys Thr Ala Cys Ala Thr Thr Thr Ala Cys Ala Thr Cys Thr
865                 870                 875                 880

Thr Thr Gly Thr Thr Gly Thr Gly Thr Cys Cys Ala Cys Ala Gly Ala
                885                 890                 895

Gly Ala Gly Ala Cys Ala Ala Cys Ala Cys Ala Gly Gly Thr Cys Thr
            900                 905                 910

Cys Ala Gly Thr Thr Thr Thr Ala Thr Cys Thr Gly Gly Ala Ala Ala
        915                 920                 925

Gly Thr Thr Gly Cys Ala Thr Ala Gly Gly Ala Thr Gly Thr Thr Ala
    930                 935                 940

Ala Gly Ala Gly Gly Gly Thr Gly Ala Gly Gly Cys Thr Ala Gly Thr
945                 950                 955                 960

Gly Ala Cys Thr Ala Cys Ala Thr Ala Cys Cys Ala Thr Gly Thr Gly
                965                 970                 975

Ala Cys Ala Thr Gly Cys Ala Cys Cys Thr Thr Ala Ala Ala Gly Thr
            980                 985                 990

Thr Cys Cys Gly Cys Ala Cys Thr  Gly Ala Thr Ala Thr  Thr Thr Ala
        995                  1000                 1005

Thr Thr  Cys Cys Ala Gly Gly  Ala Cys Cys Cys Ala  Gly Ala Gly
    1010                 1015                 1020

Gly Thr  Ala Gly Cys Thr Thr  Thr Gly Ala Gly Cys  Ala Ala Ala
    1025                 1030                 1035

Ala Ala  Thr Thr Thr Ala Ala  Gly Thr Gly Gly Thr  Gly Ala Ala
    1040                 1045                 1050

Cys Thr  Ala Ala Ala Gly Cys  Thr Ala Cys Thr Ala  Gly Ala Thr
    1055                 1060                 1065

Ala Ala  Thr Thr Cys Ala Gly  Thr Cys Thr Ala Ala  Thr Ala Ala
    1070                 1075                 1080

Ala Ala  Cys Cys Thr Thr Thr  Cys Thr Thr Thr Ala  Gly Ala Cys
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    1085                1090                1095

Thr Thr  Cys Ala Thr Ala Thr  Gly Ala Thr Ala Cys  Cys Ala Ala
    1100                1105                1110

Thr Cys  Thr Thr Ala Ala Gly  Thr Ala Ala Ala Thr  Thr Thr Gly
    1115                1120                1125

Gly Gly  Thr Thr Thr Ala Thr  Thr Thr Ala Ala Ala  Thr Thr Gly
    1130                1135                1140

Gly Thr  Thr Gly Gly Cys Thr  Ala Cys Thr Thr Ala  Cys Ala Gly
    1145                1150                1155

Thr Thr  Thr Gly Gly Thr Ala  Thr Thr Thr Thr Ala  Cys Cys Thr
    1160                1165                1170

Thr Cys  Thr Thr Thr Thr Gly  Thr Cys Ala Gly Ala  Gly Ala Thr
    1175                1180                1185

Ala Ala  Ala Ala Thr Thr Cys  Thr Ala Ala Gly Thr  Thr Thr Gly
    1190                1195                1200

Ala Gly  Gly Ala Cys Ala Cys  Cys Ala Thr Cys Cys  Thr Gly Cys
    1205                1210                1215

Ala Thr  Cys Cys Thr Cys Thr  Thr Gly Cys Ala Gly  Cys Cys Ala
    1220                1225                1230

Gly Ala  Ala Gly Gly Cys Ala  Gly Gly Thr Thr Thr  Cys Ala Gly
    1235                1240                1245

Thr Thr  Ala Thr Thr Ala Thr  Thr Cys Thr Gly Cys  Cys Ala Cys
    1250                1255                1260

Thr Gly  Thr Thr Gly Thr Thr  Thr Gly Ala Gly Thr  Thr Cys Ala
    1265                1270                1275

Thr Thr  Thr Gly Ala Gly Thr  Cys Cys Cys Thr Thr  Thr Ala Thr
    1280                1285                1290

Cys Thr  Cys Thr Ala Gly Gly  Ala Cys Thr Cys Cys  Ala Cys Gly
    1295                1300                1305

Thr Thr  Cys Thr Cys Ala Thr  Gly Gly Gly Thr Ala  Ala Thr Thr
    1310                1315                1320

Thr Gly  Ala Gly Gly Gly Thr  Gly Gly Thr Gly Gly  Ala Thr Thr
    1325                1330                1335

Gly Thr  Ala Thr Gly Ala Thr  Gly Thr Thr Thr Ala  Ala Gly Thr
    1340                1345                1350

Thr Thr  Cys Cys Cys Thr Thr  Ala Ala Gly Cys Thr  Gly Thr Ala
    1355                1360                1365

Ala Gly  Gly Ala Cys Cys Ala  Thr Thr Ala Thr Thr  Cys
    1370                1375                1380
```

<210> SEQ ID NO 5
<211> LENGTH: 1503
<212> TYPE: PRT
<213> ORGANISM: bovine

<400> SEQUENCE: 5

```
Gly Cys Ala Ala Ala Thr Ala Cys Thr Gly Thr Gly Ala Thr Thr Thr
1               5                   10                  15

Gly Ala Ala Gly Cys Thr Ala Ala Cys Cys Ala Ala Ala Thr Ala Ala
            20                  25                  30

Ala Cys Thr Ala Ala Thr Thr Thr Cys Thr Ala Thr Thr Thr Thr Gly
        35                  40                  45
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-continued

```
Gly Cys Thr Gly Gly Ala Gly Ala Ala Gly Ala Gly Ala Ala Ala Gly
    50                  55                  60

Gly Ala Ala Thr Gly Ala Ala Ala Gly Thr Ala Gly Ala Ala Ala Cys
65                  70                  75                  80

Ala Cys Thr Cys Gly Cys Thr Ala Thr Thr Ala Cys Ala Cys Ala Thr
                85                  90                  95

Ala Gly Gly Ala Gly Ala Gly Cys Cys Thr Ala Thr Cys Thr Gly Ala
            100                 105                 110

Ala Thr Thr Cys Gly Ala Gly Ala Thr Gly Cys Thr Cys Cys Thr Thr
        115                 120                 125

Ala Gly Ala Ala Ala Thr Ala Gly Thr Ala Ala Ala Thr Ala Ala Ala
    130                 135                 140

Cys Thr Cys Thr Gly Ala Thr Thr Cys Ala Gly Gly Cys Thr Thr Gly
145                 150                 155                 160

Thr Cys Thr Thr Cys Ala Cys Cys Cys Gly Thr Thr Thr Thr Thr Cys
                165                 170                 175

Thr Cys Thr Cys Thr Gly Cys Thr Thr Cys Gly Gly Thr Thr Ala Cys
            180                 185                 190

Ala Ala Ala Ala Cys Cys Ala Ala Ala Cys Cys Cys Thr Cys Ala Cys
        195                 200                 205

Cys Ala Cys Thr Thr Cys Thr Thr Thr Cys Thr Cys Cys Ala Gly Gly
    210                 215                 220

Thr Thr Thr Ala Gly Thr Thr Cys Thr Thr Cys Ala Gly Cys Cys Ala
225                 230                 235                 240

Thr Cys Cys Gly Cys Ala Gly Gly Ala Thr Cys Thr Cys Cys Thr Gly
                245                 250                 255

Ala Gly Ala Gly Gly Ala Ala Gly Gly Cys Thr Thr Ala Thr Thr Cys
            260                 265                 270

Thr Gly Thr Thr Cys Thr Cys Cys Ala Ala Ala Gly Thr Gly Thr Cys
        275                 280                 285

Thr Cys Thr Cys Cys Ala Gly Gly Gly Cys Gly Thr Cys Thr Thr Thr
    290                 295                 300

Ala Gly Cys Ala Gly Cys Ala Ala Thr Ala Cys Thr Gly Ala Thr Thr
305                 310                 315                 320

Gly Thr Thr Gly Thr Thr Cys Thr Cys Cys Gly Thr Thr Thr Cys Thr
                325                 330                 335

Ala Thr Thr Cys Thr Thr Thr Thr Gly Thr Gly Gly Gly Ala Ala Thr
            340                 345                 350

Gly Ala Gly Thr Thr Gly Cys Cys Ala Ala Cys Cys Thr Thr Thr Thr
        355                 360                 365

Ala Cys Thr Thr Cys Gly Ala Cys Thr Gly Ala Thr Ala Cys Cys Thr
    370                 375                 380

Thr Thr Ala Thr Ala Cys Cys Thr Cys Thr Gly Ala Ala Thr Thr Cys
385                 390                 395                 400

Thr Gly Ala Gly Thr Cys Thr Thr Cys Thr Gly Cys Ala Ala Cys Thr
                405                 410                 415

Cys Thr Gly Cys Cys Thr Cys Thr Gly Ala Thr Ala Ala Thr Gly Cys
            420                 425                 430

Ala Thr Cys Cys Cys Ala Gly Thr Gly Cys Thr Gly Cys Gly Gly Ala
        435                 440                 445

Gly Thr Gly Cys Cys Thr Ala Cys Cys Gly Gly Thr Cys Thr Cys Cys
```

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```
    450                 455                 460

Ala Ala Cys Cys Ala Cys Gly Cys Cys Ala Cys Cys Ala Ala Cys Gly
465                 470                 475                 480

Thr Gly Ala Thr Gly Thr Cys Cys Ala Cys Ala Gly Cys Ala Ala Cys
                485                 490                 495

Ala Gly Gly Ala Cys Thr Thr Cys Ala Thr Thr Ala Thr Thr Cys Thr
            500                 505                 510

Gly Thr Thr Cys Cys Thr Thr Thr Cys Thr Gly Thr Cys Ala Thr Thr
        515                 520                 525

Ala Thr Gly Gly Ala Ala Ala Cys Cys Ala Gly Thr Cys Ala Thr Cys
    530                 535                 540

Gly Ala Cys Cys Thr Ala Thr Gly Gly Cys Gly Thr Gly Ala Thr Gly
545                 550                 555                 560

Gly Cys Ala Gly Gly Gly Ala Gly Cys Thr Thr Ala Ala Cys Cys Cys
                565                 570                 575

Cys Ala Thr Thr Gly Thr Cys Thr Thr Thr Ala Thr Ala Ala Gly Thr
            580                 585                 590

Thr Thr Cys Cys Thr Gly Ala Cys Cys Ala Cys Ala Cys Gly Thr Thr
        595                 600                 605

Gly Ala Gly Thr Cys Ala Thr Gly Gly Thr Thr Thr Thr Cys Cys Thr
    610                 615                 620

Cys Cys Cys Ala Thr Gly Cys Ala Thr Cys Ala Gly Cys Cys Thr Cys
625                 630                 635                 640

Thr Cys Cys Thr Thr Thr Cys Ala Gly Ala Gly Gly Ala Cys Cys Cys
                645                 650                 655

Cys Ala Cys Thr Gly Cys Cys Gly Cys Thr Gly Ala Thr Thr Thr Cys
            660                 665                 670

Ala Ala Gly Cys Ala Gly Gly Ala Gly Cys Thr Cys Ala Gly Gly Cys
        675                 680                 685

Gly Gly Ala Ala Ala Ala Gly Cys Ala Ala Ala Thr Thr Gly Gly Thr
    690                 695                 700

Thr Gly Ala Ala Gly Ala Gly Cys Cys Ala Ala Thr Ala Gly Ala Cys
705                 710                 715                 720

Ala Thr Gly Gly Ala Thr Thr Cys Thr Cys Cys Ala Gly Ala Ala Ala
                725                 730                 735

Thr Cys Cys Gly Ala Gly Ala Ala Cys Thr Thr Gly Ala Ala Ala Ala
            740                 745                 750

Gly Thr Thr Thr Gly Cys Cys Ala Ala Thr Gly Ala Gly Thr Thr Thr
        755                 760                 765

Ala Ala Ala Gly Thr Gly Ala Gly Ala Ala Gly Ala Ala Thr Thr Ala
    770                 775                 780

Ala Gly Cys Thr Ala Gly Gly Ala Thr Ala Cys Ala Cys Cys Cys Ala
785                 790                 795                 800

Gly Ala Cys Ala Ala Ala Thr Gly Thr Thr Gly Gly Gly Gly Ala Ala
                805                 810                 815

Gly Cys Thr Cys Thr Gly Gly Cys Ala Gly Cys Thr Gly Thr Gly Cys
            820                 825                 830

Ala Thr Gly Gly Cys Thr Cys Thr Gly Ala Ala Thr Thr Cys Ala Gly
        835                 840                 845

Thr Cys Ala Ala Ala Cys Ala Ala Cys Thr Ala Thr Cys Thr Gly Cys
    850                 855                 860
```

-continued

```
Cys Gly Ala Thr Thr Thr Gly Ala Ala Ala Ala Cys Cys Thr Gly Cys
865                 870                 875                 880

Ala Gly Cys Thr Cys Ala Gly Cys Thr Thr Cys Ala Ala Ala Ala Ala
                885                 890                 895

Thr Gly Cys Ala Thr Gly Cys Ala Ala Ala Cys Thr Ala Ala Ala Ala
            900                 905                 910

Gly Cys Ala Ala Thr Ala Thr Thr Ala Thr Cys Cys Ala Ala Ala Thr
        915                 920                 925

Gly Gly Cys Thr Gly Gly Ala Gly Gly Ala Ala Gly Cys Cys Gly Ala
    930                 935                 940

Gly Cys Ala Ala Gly Thr Ala Gly Gly Ala Gly Cys Thr Thr Thr Ala
945                 950                 955                 960

Thr Ala Cys Ala Ala Thr Gly Ala Gly Ala Ala Ala Gly Thr Thr Gly
                965                 970                 975

Gly Thr Gly Cys Ala Ala Ala Thr Gly Ala Ala Ala Gly Ala Ala Ala
            980                 985                 990

Ala Ala Gly Gly Ala Ala Ala Cys  Gly Gly Ala Gly Ala  Ala Cys Ala
        995                 1000                1005

Ala Cys  Ala Ala Thr Cys Ala  Gly Thr Ala Thr Thr  Gly Cys Thr
    1010                 1015                 1020

Gly Cys  Thr Ala Ala Ala Gly  Ala Cys Gly Cys Gly  Cys Thr Gly
    1025                 1030                 1035

Gly Ala  Gly Ala Gly Ala Cys  Ala Cys Thr Thr Thr  Gly Gly Ala
    1040                 1045                 1050

Gly Ala  Ala Cys Ala Gly Ala  Ala Thr Ala Ala Gly  Cys Cys Thr
    1055                 1060                 1065

Thr Cys  Cys Thr Cys Thr Cys  Ala Gly Gly Ala Gly  Ala Thr Cys
    1070                 1075                 1080

Cys Thr  Gly Cys Gly Gly Ala  Thr Gly Gly Cys Thr  Gly Ala Ala
    1085                 1090                 1095

Gly Ala  Ala Cys Thr Ala Ala  Ala Cys Cys Thr Gly  Gly Ala Gly
    1100                 1105                 1110

Ala Ala  Ala Gly Ala Ala Gly  Thr Gly Gly Thr Gly  Ala Gly Gly
    1115                 1120                 1125

Gly Thr  Thr Thr Gly Gly Thr  Thr Thr Thr Gly Thr  Ala Ala Cys
    1130                 1135                 1140

Cys Gly  Ala Ala Gly Gly Cys  Ala Gly Ala Gly Ala  Gly Ala Ala
    1145                 1150                 1155

Ala Ala  Ala Cys Gly Gly Gly  Thr Gly Ala Ala Gly  Ala Cys Ala
    1160                 1165                 1170

Ala Gly  Cys Cys Thr Ala Ala  Ala Thr Cys Ala Gly  Ala Gly Thr
    1175                 1180                 1185

Thr Thr  Ala Thr Thr Thr Ala  Cys Thr Ala Thr Thr  Thr Cys Thr
    1190                 1195                 1200

Ala Ala  Gly Gly Ala Gly Cys  Ala Thr Cys Thr Cys  Gly Ala Ala
    1205                 1210                 1215

Thr Gly  Cys Ala Gly Ala Thr  Ala Gly Gly Cys Thr  Cys Thr Cys
    1220                 1225                 1230

Cys Thr  Ala Thr Thr Gly Thr  Gly Thr Ala Ala Thr  Ala Gly Cys
    1235                 1240                 1245
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```
Gly Ala  Thr Thr Cys Thr Ala  Cys Thr Thr Thr Thr  Cys Ala Thr
    1250                1255                1260

Thr Cys  Cys Thr Thr Thr Cys  Thr Cys Thr Thr Cys  Thr Cys Ala
    1265                1270                1275

Gly Cys  Cys Ala Ala Ala Ala  Thr Ala Gly Ala Ala  Ala Thr Thr
    1280                1285                1290

Ala Gly  Thr Thr Ala Thr Thr  Thr Gly Gly Thr Thr  Ala Gly Cys
    1295                1300                1305

Asn Asn  Asn Ala Ala Ala Ala  Ala Thr Cys Ala Cys  Ala Thr Cys
    1310                1315                1320

Ala Gly  Thr Ala Ala Thr Thr  Thr Thr Thr Gly Asn  Cys Ala Gly
    1325                1330                1335

Ala Ala  Gly Thr Gly Thr Thr  Thr Cys Thr Thr Thr  Thr Cys Thr
    1340                1345                1350

Ala Cys  Thr Thr Thr Ala Ala  Ala Ala Ala Thr Ala  Ala Ala Thr
    1355                1360                1365

Ala Cys  Ala Ala Thr Thr Thr  Ala Ala Ala Thr Thr  Ala Thr Gly
    1370                1375                1380

Thr Thr  Gly Ala Thr Gly Ala  Ala Asn Thr Ala Thr  Thr Cys Thr
    1385                1390                1395

Cys Ala  Gly Ala Ala Gly Gly  Ala Asn Asn Asn Asn  Asn Thr Cys
    1400                1405                1410

Ala Asn  Thr Gly Thr Ala Cys  Ala Asn Thr Thr Thr  Ala Ala Gly
    1415                1420                1425

Cys Cys  Ala Ala Ala Gly Ala  Cys Thr Ala Ala Thr  Ala Gly Gly
    1430                1435                1440

Ala Thr  Thr Ala Ala Ala Ala  Cys Ala Ala Thr Gly  Ala Thr Thr
    1445                1450                1455

Cys Thr  Gly Thr Cys Cys Cys  Thr Thr Thr Cys Ala  Cys Thr Ala
    1460                1465                1470

Thr Ala  Thr Cys Thr Thr Thr  Cys Cys Cys Thr Cys  Thr Ala Thr
    1475                1480                1485

Cys Thr  Cys Thr Cys Cys Cys  Asn Gly Gly Ala Ala  Thr Thr Cys
    1490                1495                1500
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<210> SEQ ID NO 6
<211> LENGTH: 12112
<212> TYPE: PRT
<213> ORGANISM: bovine

<400> SEQUENCE: 6

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Cys Cys Gly Gly Gly Gly Cys Cys Gly Cys Gly Cys Cys Gly Cys Gly
1               5                   10                  15

Gly Ala Gly Cys Gly Cys Gly Thr Thr Cys Gly Gly Ala Gly Gly Cys
            20                  25                  30

Cys Gly Gly Gly Gly Cys Cys Gly Gly Gly Gly Cys Gly Cys Gly Gly
        35                  40                  45

Cys Gly Gly Cys Thr Cys Cys Cys Cys Gly Cys Gly Cys Gly Gly Cys
    50                  55                  60

Thr Cys Cys Ala Gly Gly Gly Gly Cys Thr Cys Gly Gly Gly Gly Ala
65                  70                  75                  80

Cys Cys Cys Cys Gly Cys Cys Ala Gly Gly Gly Cys Cys Thr Thr Gly
                85                  90                  95
```

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Gly Thr Gly Gly Gly Gly Cys Cys Ala Thr Gly Gly Cys Cys Gly Cys
                100   105   110

Cys Gly Gly Gly Ala Gly Cys Ala Thr Cys Ala Cys Cys Ala Cys Gly
        115   120   125

Cys Thr Gly Cys Cys Ala Gly Thr Cys Cys Cys Thr Gly Cys Cys Gly
    130   135   140

Gly Ala Gly Gly Ala Cys Gly Gly Cys Gly Gly Cys Ala Gly Cys Gly
145   150   155   160

Gly Cys Gly Cys Thr Thr Thr Cys Cys Cys Gly Cys Cys Gly Gly Gly
                165   170   175

Cys Cys Ala Cys Thr Thr Cys Ala Ala Gly Gly Ala Cys Cys Cys Cys
                180   185   190

Ala Ala Gly Cys Gly Gly Cys Thr Gly Thr Ala Cys Thr Gly Cys Ala
        195   200   205

Ala Gly Ala Ala Cys Gly Gly Gly Gly Gly Cys Thr Thr Cys Thr Thr
    210   215   220

Cys Cys Thr Gly Cys Gly Cys Ala Thr Cys Cys Ala Cys Cys Cys Cys
225   230   235   240

Gly Ala Cys Gly Gly Cys Cys Gly Ala Gly Thr Gly Gly Ala Cys Gly
                245   250   255

Gly Gly Gly Thr Cys Cys Gly Cys Gly Ala Gly Ala Ala Gly Ala Gly
                260   265   270

Cys Gly Ala Cys Cys Cys Ala Cys Ala Cys Ala Gly Thr Gly Ala Gly
        275   280   285

Thr Gly Cys Thr Cys Cys Cys Cys Ala Gly Gly Thr Cys Thr Thr Cys
    290   295   300

Cys Cys Cys Gly Gly Thr Gly Cys Cys Gly Thr Cys Thr Thr Cys Gly
305   310   315   320

Thr Cys Cys Cys Cys Thr Gly Cys Gly Gly Thr Thr Cys Thr Cys Thr
                325   330   335

Cys Cys Cys Cys Cys Gly Cys Cys Cys Cys Thr Gly Cys Cys Thr Thr
                340   345   350

Cys Cys Ala Gly Cys Cys Thr Cys Cys Gly Cys Gly Cys Thr Cys Cys
        355   360   365

Thr Thr Cys Thr Thr Cys Cys Thr Cys Thr Thr Cys Ala Cys Thr Gly
    370   375   380

Thr Gly Ala Cys Cys Cys Cys Gly Gly Thr Gly Gly Gly Ala Cys Thr
385   390   395   400

Thr Gly Thr Gly Gly Thr Thr Thr Cys Thr Cys Thr Cys Cys Gly Cys
                405   410   415

Thr Cys Gly Gly Cys Cys Cys Thr Cys Gly Gly Cys Gly Gly Thr Thr
                420   425   430

Thr Cys Gly Gly Gly Cys Thr Cys Ala Cys Cys Ala Cys Thr Cys Gly
        435   440   445

Cys Cys Cys Cys Cys Cys Thr Cys Cys Thr Gly Cys Cys Cys Cys Gly
    450   455   460

Ala Gly Cys Thr Gly Cys Gly Gly Thr Gly Gly Cys Gly Gly Thr Ala
465   470   475   480

Gly Ala Cys Gly Cys Thr Cys Cys Thr Cys Cys Ala Gly Gly Cys Thr
                485   490   495

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```
Thr Thr Gly Gly Ala Gly Thr Gly Thr Gly Cys Cys Gly Gly Cys Thr
            500                 505                 510

Gly Cys Thr Cys Ala Gly Cys Ala Ala Ala Gly Cys Cys Ala Gly Thr
        515                 520                 525

Cys Cys Cys Cys Thr Gly Gly Gly Cys Cys Cys Cys Gly Ala Gly Cys
    530                 535                 540

Cys Cys Cys Cys Gly Gly Cys Gly Cys Cys Cys Gly Gly Gly Cys Thr
545                 550                 555                 560

Thr Thr Gly Cys Gly Gly Gly Cys Gly Gly Cys Thr Cys Cys Cys Thr
                565                 570                 575

Gly Gly Gly Cys Gly Cys Ala Gly Ala Cys Ala Ala Cys Cys Thr Gly
            580                 585                 590

Thr Cys Gly Cys Gly Thr Cys Gly Gly Gly Gly Gly Thr Gly Cys Cys
        595                 600                 605

Cys Gly Gly Cys Gly Gly Cys Thr Gly Ala Gly Cys Ala Gly Ala Gly
    610                 615                 620

Gly Thr Gly Ala Gly Cys Gly Gly Cys Thr Cys Ala Gly Cys Gly Ala
625                 630                 635                 640

Gly Gly Thr Gly Cys Cys Gly Cys Cys Cys Gly Cys Gly Cys Cys Cys
                645                 650                 655

Cys Gly Ala Gly Cys Cys Thr Gly Ala Ala Gly Thr Thr Cys Cys Gly
            660                 665                 670

Ala Cys Cys Gly Cys Thr Thr Cys Thr Ala Thr Gly Gly Gly Ala Thr
        675                 680                 685

Gly Cys Cys Cys Gly Thr Thr Gly Thr Cys Thr Cys Cys Gly Gly Gly
    690                 695                 700

Gly Cys Ala Ala Ala Gly Cys Cys Ala Gly Gly Ala Gly Gly Gly Ala
705                 710                 715                 720

Cys Cys Gly Cys Ala Gly Ala Cys Cys Ala Ala Cys Thr Ala Ala Ala
                725                 730                 735

Ala Gly Gly Thr Cys Cys Thr Thr Gly Thr Thr Gly Gly Ala Ala Ala
            740                 745                 750

Gly Ala Thr Ala Cys Cys Thr Thr Gly Cys Ala Thr Cys Ala Gly Gly
        755                 760                 765

Thr Thr Thr Gly Ala Gly Gly Ala Thr Cys Ala Ala Ala Thr Gly Ala
    770                 775                 780

Gly Ala Ala Thr Thr Thr Gly Ala Ala Gly Thr Gly Cys Gly Cys Ala
785                 790                 795                 800

Gly Ala Gly Gly Ala Cys Thr Cys Ala Ala Thr Thr Thr Ala Cys Thr
                805                 810                 815

Ala Gly Thr Cys Thr Ala Cys Ala Gly Thr Thr Gly Cys Ala Thr Thr
            820                 825                 830

Thr Thr Cys Thr Gly Thr Ala Ala Ala Ala Ala Thr Ala Ala Thr Ala
        835                 840                 845

Ala Thr Gly Ala Thr Gly Thr Ala Thr Cys Thr Gly Thr Gly Gly Thr
    850                 855                 860

Ala Ala Thr Ala Gly Cys Ala Ala Thr Ala Ala Gly Ala Thr Thr Gly
865                 870                 875                 880

Gly Thr Cys Thr Gly Ala Gly Gly Cys Gly Thr Thr Gly Gly Thr Thr
                885                 890                 895

Gly Thr Cys Ala Ala Ala Cys Thr Ala Ala Gly Ala Gly Thr Gly Cys
```

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900 905 910

Ala Thr Ala Ala Gly Ala Ala Thr Cys Ala Cys Cys Thr Gly Gly Ala
915 920 925

Ala Gly Gly Thr Gly Thr Gly Thr Gly Thr Gly Thr Thr Gly Thr Gly
930 935 940

Thr Gly Ala Thr Thr Cys Ala Thr Gly Gly Cys Thr Gly Ala Ala Cys
945 950 955 960

Cys Ala Thr Cys Thr Cys Cys Cys Ala Gly Ala Gly Thr Thr Thr Cys
965 970 975

Ala Gly Ala Thr Cys Gly Cys Thr Thr Ala Gly Gly Thr Cys Thr Gly
980 985 990

Gly Ala Gly Thr Gly Gly Gly Gly Cys Cys Thr Cys Ala Thr Thr Thr
995 1000 1005

Gly Cys Ala Thr Thr Thr Cys Thr Ala Ala Cys Thr Ala Cys Thr
1010 1015 1020

Thr Cys Cys Cys Ala Gly Gly Thr Gly Ala Thr Gly Cys Thr Gly
1025 1030 1035

Ala Thr Cys Thr Gly Gly Gly Ala Gly Cys Ala Cys Ala Gly Thr
1040 1045 1050

Thr Thr Gly Ala Gly Ala Ala Cys Cys Cys Gly Cys Thr Gly Gly
1055 1060 1065

Thr Cys Thr Ala Gly Ala Gly Ala Ala Ala Gly Ala Gly Gly Ala
1070 1075 1080

Ala Gly Gly Ala Ala Ala Gly Ala Gly Gly Thr Ala Thr Ala Ala
1085 1090 1095

Ala Ala Thr Gly Gly Gly Cys Thr Gly Ala Thr Ala Ala Ala Ala
1100 1105 1110

Ala Thr Ala Gly Ala Thr Gly Ala Gly Thr Thr Thr Gly Ala Ala
1115 1120 1125

Gly Thr Gly Ala Gly Ala Cys Ala Ala Ala Gly Ala Gly Ala Thr
1130 1135 1140

Cys Ala Gly Ala Thr Ala Thr Thr Thr Thr Thr Ala Ala Ala Cys
1145 1150 1155

Thr Gly Thr Cys Ala Thr Cys Cys Thr Gly Thr Ala Ala Gly Thr
1160 1165 1170

Gly Thr Ala Gly Gly Thr Ala Ala Ala Ala Cys Ala Thr Gly Thr
1175 1180 1185

Thr Thr Thr Gly Ala Ala Ala Gly Cys Thr Gly Thr Thr Thr Gly
1190 1195 1200

Thr Thr Cys Thr Gly Cys Cys Ala Thr Thr Cys Cys Thr Thr Cys
1205 1210 1215

Cys Ala Thr Ala Ala Thr Gly Gly Thr Thr Thr Thr Cys Ala Gly
1220 1225 1230

Gly Thr Gly Gly Ala Ala Ala Ala Cys Thr Thr Gly Ala Thr Cys
1235 1240 1245

Cys Thr Cys Thr Thr Thr Thr Thr Thr Thr Thr Thr Thr Thr Thr
1250 1255 1260

Thr Thr Thr Thr Thr Thr Thr Gly Cys Cys Cys Ala Ala Gly Thr
1265 1270 1275

Thr Cys Cys Gly Cys Ala Ala Gly Ala Gly Gly Cys Cys Thr Thr
1280 1285 1290

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```
Cys Thr  Thr Thr Ala Cys Cys  Thr Thr Gly Thr Gly  Ala Thr Gly
    1295                 1300                 1305

Cys Thr  Ala Ala Thr Ala Gly  Thr Gly Cys Gly Thr  Cys Cys Thr
    1310                 1315                 1320

Thr Thr  Gly Gly Gly Gly Cys  Thr Cys Thr Cys Cys  Ala Gly Gly
    1325                 1330                 1335

Thr Gly  Gly Thr Ala Cys Thr  Gly Gly Thr Gly Gly  Thr Ala Ala
    1340                 1345                 1350

Ala Gly  Ala Thr Cys Cys Cys  Ala Cys Cys Thr Gly  Cys Cys Ala
    1355                 1360                 1365

Gly Thr  Gly Cys Cys Thr Gly  Gly Gly Ala Thr Gly  Thr Ala Ala
    1370                 1375                 1380

Gly Ala  Gly Gly Thr Gly Thr  Gly Gly Ala Thr Thr  Gly Gly Ala
    1385                 1390                 1395

Thr Cys  Cys Cys Thr Gly Thr  Gly Thr Thr Gly Gly  Ala Ala Ala
    1400                 1405                 1410

Gly Ala  Thr Cys Cys Cys Cys  Thr Gly Gly Ala Gly  Ala Ala Gly
    1415                 1420                 1425

Gly Ala  Ala Ala Thr Gly Gly  Cys Ala Cys Cys Cys  Cys Gly Cys
    1430                 1435                 1440

Thr Cys  Cys Ala Gly Thr Ala  Thr Thr Cys Thr Thr  Gly Cys Cys
    1445                 1450                 1455

Thr Gly  Gly Ala Gly Ala Cys  Thr Cys Cys Cys Cys  Ala Thr Gly
    1460                 1465                 1470

Gly Ala  Cys Ala Gly Ala Gly  Gly Ala Gly Cys Cys  Thr Ala Gly
    1475                 1480                 1485

Thr Gly  Gly Gly Cys Thr Ala  Cys Cys Gly Thr Cys  Cys Cys Thr
    1490                 1495                 1500

Ala Gly  Gly Gly Thr Cys Cys  Cys Ala Ala Ala Gly  Ala Gly Thr
    1505                 1510                 1515

Cys Gly  Gly Ala Cys Ala Cys  Thr Gly Ala Ala Gly  Gly Ala Ala
    1520                 1525                 1530

Thr Thr  Thr Ala Gly Cys Ala  Ala Gly Cys Thr Cys  Thr Cys Ala
    1535                 1540                 1545

Cys Thr  Cys Cys Gly Gly Gly  Ala Thr Gly Ala Gly  Ala Cys Thr
    1550                 1555                 1560

Thr Ala  Gly Gly Ala Ala Gly  Ala Gly Gly Ala Gly  Ala Ala Ala
    1565                 1570                 1575

Ala Cys  Thr Cys Thr Gly Cys  Ala Gly Cys Cys Ala  Ala Ala Cys
    1580                 1585                 1590

Cys Thr  Ala Gly Cys Thr Gly  Ala Cys Ala Ala Ala  Thr Thr Cys
    1595                 1600                 1605

Ala Gly  Thr Ala Ala Thr Gly  Gly Gly Ala Ala Ala  Thr Gly Thr
    1610                 1615                 1620

Cys Cys  Cys Thr Thr Cys Ala  Thr Ala Ala Gly Ala  Ala Thr Thr
    1625                 1630                 1635

Gly Gly  Thr Cys Thr Thr Thr  Ala Thr Thr Gly Ala  Thr Thr Thr
    1640                 1645                 1650

Cys Ala  Ala Ala Ala Thr Ala  Gly Cys Ala Ala Cys  Ala Ala Gly
    1655                 1660                 1665
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Cys Ala Ala Ala Gly Gly Ala Thr Thr Cys Ala Gly Gly Thr Cys
1670 1675 1680

Thr Gly Thr Ala Ala Cys Thr Thr Thr Thr Thr Thr Cys Cys Gly
1685 1690 1695

Gly Cys Cys Thr Gly Cys Cys Ala Thr Ala Ala Thr Thr Ala Ala
1700 1705 1710

Ala Cys Ala Ala Thr Thr Thr Thr Cys Thr Thr Ala Ala Cys Cys
1715 1720 1725

Ala Cys Thr Thr Ala Cys Ala Thr Thr Ala Thr Cys Cys Ala Gly
1730 1735 1740

Thr Ala Ala Ala Ala Cys Thr Gly Ala Ala Ala Ala Gly Ala Thr
1745 1750 1755

Gly Cys Thr Thr Gly Thr Ala Gly Cys Cys Cys Ala Ala Thr Ala
1760 1765 1770

Thr Ala Thr Cys Gly Gly Thr Thr Ala Gly Thr Gly Cys Thr Cys
1775 1780 1785

Thr Thr Thr Cys Thr Cys Thr Ala Thr Thr Thr Thr Gly Gly Thr
1790 1795 1800

Ala Ala Cys Thr Ala Gly Gly Thr Thr Thr Cys Ala Cys Ala Ala
1805 1810 1815

Ala Ala Thr Thr Ala Thr Cys Thr Thr Thr Cys Thr Gly Thr Gly
1820 1825 1830

Thr Gly Gly Gly Gly Thr Thr Thr Ala Thr Thr Cys Thr Gly Thr
1835 1840 1845

Gly Cys Thr Thr Gly Thr Cys Thr Gly Cys Cys Ala Gly Gly Gly
1850 1855 1860

Thr Ala Gly Cys Cys Cys Ala Gly Cys Thr Gly Ala Ala Cys Ala
1865 1870 1875

Cys Gly Gly Cys Ala Ala Gly Gly Thr Gly Cys Ala Cys Ala Thr
1880 1885 1890

Ala Thr Gly Thr Cys Cys Cys Ala Ala Thr Thr Ala Ala Thr Thr
1895 1900 1905

Thr Thr Gly Cys Thr Cys Thr Thr Thr Thr Cys Thr Ala Gly Thr
1910 1915 1920

Ala Thr Cys Ala Cys Ala Ala Ala Ala Ala Gly Thr Ala Gly Thr
1925 1930 1935

Thr Thr Gly Thr Thr Cys Thr Thr Thr Gly Ala Cys Gly Ala Gly
1940 1945 1950

Ala Ala Gly Ala Cys Ala Gly Ala Ala Cys Thr Cys Thr Thr Cys
1955 1960 1965

Cys Cys Cys Cys Ala Gly Ala Thr Thr Ala Gly Gly Thr Thr Thr
1970 1975 1980

Ala Thr Ala Cys Thr Gly Gly Ala Gly Cys Thr Thr Cys Cys Thr
1985 1990 1995

Thr Thr Ala Gly Thr Ala Cys Ala Thr Thr Thr Thr Cys Thr Thr
2000 2005 2010

Cys Cys Ala Gly Ala Cys Ala Thr Thr Thr Thr Ala Thr Gly Ala
2015 2020 2025

Gly Thr Thr Gly Cys Ala Gly Thr Ala Thr Thr Thr Thr Cys Thr
2030 2035 2040

Thr Thr Gly Cys Cys Thr Thr Cys Thr Cys Ala Ala Thr Ala Cys

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    2045                2050                2055

Cys Cys  Thr Ala Thr Thr Thr  Cys Cys Thr Thr Thr  Ala Ala Ala
    2060                2065                2070

Ala Cys  Ala Ala Ala Ala Cys  Thr Gly Thr Ala Thr  Ala Gly Gly
    2075                2080                2085

Gly Gly  Cys Thr Gly Gly Gly  Cys Thr Thr Thr Cys  Cys Ala Gly
    2090                2095                2100

Gly Thr  Gly Gly Cys Gly Cys  Ala Gly Thr Gly Gly  Thr Ala Ala
    2105                2110                2115

Gly Gly  Ala Ala Thr Cys Cys  Gly Cys Cys Thr Gly  Cys Cys Ala
    2120                2125                2130

Ala Thr  Ala Thr Ala Gly Gly  Ala Gly Ala Thr Gly  Cys Ala Gly
    2135                2140                2145

Gly Ala  Gly Ala Cys Ala Cys  Thr Cys Gly Thr Thr  Cys Ala Ala
    2150                2155                2160

Thr Cys  Cys Cys Thr Gly Gly  Ala Thr Thr Gly Gly  Gly Thr Ala
    2165                2170                2175

Gly Ala  Thr Cys Cys Cys Cys  Thr Gly Gly Ala Ala  Ala Ala Gly
    2180                2185                2190

Gly Gly  Ala Ala Thr Gly Gly  Cys Ala Ala Cys Cys  Ala Ala Cys
    2195                2200                2205

Thr Cys  Cys Ala Gly Thr Ala  Thr Thr Cys Thr Thr  Gly Cys Cys
    2210                2215                2220

Thr Gly  Gly Gly Ala Ala Ala  Thr Cys Cys Cys Ala  Thr Gly Ala
    2225                2230                2235

Gly Thr  Gly Gly Ala Gly Gly  Ala Gly Cys Cys Thr  Gly Gly Cys
    2240                2245                2250

Ala Gly  Gly Cys Ala Cys Ala  Gly Thr Cys Cys Ala  Gly Gly Gly
    2255                2260                2265

Gly Gly  Thr Cys Cys Cys Ala  Gly Ala Ala Ala Ala  Thr Cys Ala
    2270                2275                2280

Gly Ala  Cys Gly Thr Gly Ala  Cys Thr Gly Ala Gly  Cys Ala Cys
    2285                2290                2295

Ala Cys  Ala Gly Gly Cys Ala  Thr Gly Thr Ala Thr  Gly Gly Gly
    2300                2305                2310

Ala Gly  Thr Thr Ala Gly Thr  Ala Ala Gly Gly Ala  Thr Ala Ala
    2315                2320                2325

Thr Thr  Cys Thr Gly Ala Ala  Thr Thr Gly Cys Ala  Thr Ala Thr
    2330                2335                2340

Thr Ala  Cys Ala Thr Thr Ala  Cys Cys Gly Cys Cys  Cys Thr Thr
    2345                2350                2355

Thr Thr  Ala Ala Ala Cys Ala  Cys Ala Ala Cys Thr  Ala Thr Thr
    2360                2365                2370

Ala Ala  Cys Thr Thr Thr Thr  Thr Ala Thr Thr Cys  Cys Cys Ala
    2375                2380                2385

Gly Thr  Thr Thr Gly Gly Gly  Gly Cys Thr Gly Gly  Gly Cys Cys
    2390                2395                2400

Ala Thr  Cys Ala Thr Thr Ala  Cys Thr Gly Thr Ala  Thr Thr Cys
    2405                2410                2415

Thr Thr  Ala Thr Thr Thr Thr  Ala Ala Cys Thr Thr  Cys Ala Thr
    2420                2425                2430
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Gly Gly  Thr Cys Thr Gly Ala  Ala Ala Thr Ala Gly  Gly Ala Thr
    2435                 2440                 2445

Thr Gly  Ala Thr Ala Cys Thr  Cys Thr Cys Cys Ala  Gly Gly Gly
    2450                 2455                 2460

Gly Ala  Cys Ala Thr Thr Thr  Gly Gly Cys Ala Gly  Thr Gly Cys
    2465                 2470                 2475

Cys Thr  Gly Gly Ala Gly Ala  Thr Gly Thr Thr Thr  Thr Cys Ala
    2480                 2485                 2490

Cys Thr  Cys Ala Thr Gly Cys  Cys Thr Gly Gly Ala  Ala Gly Gly
    2495                 2500                 2505

Gly Thr  Gly Cys Thr Ala Cys  Thr Gly Thr Cys Ala  Thr Thr Thr
    2510                 2515                 2520

Gly Cys  Thr Ala Ala Gly Thr  Ala Gly Ala Gly Gly  Cys Cys Ala
    2525                 2530                 2535

Gly Gly  Gly Ala Thr Gly Thr  Thr Ala Cys Ala Gly  Thr Gly Cys
    2540                 2545                 2550

Ala Cys  Ala Gly Gly Ala Cys  Ala Cys Cys Thr Cys  Cys Cys Thr
    2555                 2560                 2565

Ala Ala  Thr Cys Gly Cys Thr  Cys Ala Gly Cys Ala  Ala Ala Ala
    2570                 2575                 2580

Ala Ala  Thr Thr Ala Ala Ala  Ala Ala Thr Gly Thr  Thr Cys Thr
    2585                 2590                 2595

Gly Ala  Cys Cys Gly Thr Ala  Ala Ala Thr Gly Thr  Thr Ala Ala
    2600                 2605                 2610

Thr Ala  Gly Thr Gly Thr Thr  Ala Ala Gly Gly Cys  Thr Gly Ala
    2615                 2620                 2625

Gly Ala  Ala Ala Cys Cys Cys  Ala Gly Cys Cys Ala  Ala Cys Cys
    2630                 2635                 2640

Thr Gly  Ala Thr Ala Ala Cys  Thr Ala Gly Cys Thr  Cys Gly Thr
    2645                 2650                 2655

Ala Gly  Ala Cys Cys Thr Thr  Thr Ala Ala Ala Gly  Gly Thr Ala
    2660                 2665                 2670

Gly Ala  Gly Ala Gly Thr Ala  Gly Ala Gly Thr Ala  Cys Thr Cys
    2675                 2680                 2685

Ala Thr  Cys Cys Ala Gly Ala  Cys Thr Thr Gly Thr  Gly Gly Ala
    2690                 2695                 2700

Gly Ala  Gly Cys Ala Cys Thr  Gly Ala Thr Thr Thr  Thr Thr Ala
    2705                 2710                 2715

Ala Ala  Ala Ala Thr Cys Ala  Cys Cys Thr Thr Gly  Thr Ala Cys
    2720                 2725                 2730

Cys Ala  Gly Gly Thr Gly Gly  Thr Ala Gly Ala Cys  Thr Gly Ala
    2735                 2740                 2745

Cys Ala  Ala Gly Ala Ala Thr  Ala Gly Ala Ala Ala  Cys Cys Thr
    2750                 2755                 2760

Gly Ala  Ala Ala Ala Thr Gly  Ala Thr Cys Ala Ala  Thr Thr Thr
    2765                 2770                 2775

Ala Ala  Ala Thr Gly Ala Cys  Thr Thr Thr Thr Gly  Thr Ala Thr
    2780                 2785                 2790

Ala Gly  Gly Cys Cys Ala Ala  Cys Cys Thr Gly Gly  Ala Cys Ala
    2795                 2800                 2805
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Thr Ala Thr Gly Thr Thr Thr Ala Ala Thr Thr Ala Ala Gly Gly
2810 2815 2820

Ala Cys Ala Gly Thr Gly Thr Thr Thr Thr Thr Thr Thr Thr Thr
2825 2830 2835

Thr Thr Thr Thr Thr Thr Cys Cys Cys Cys Thr Gly Ala Cys Ala
2840 2845 2850

Thr Ala Thr Cys Ala Ala Ala Gly Gly Thr Gly Thr Ala Cys Thr
2855 2860 2865

Gly Ala Thr Ala Gly Thr Thr Gly Ala Cys Ala Ala Ala Ala Cys
2870 2875 2880

Cys Ala Gly Gly Ala Gly Gly Ala Gly Ala Cys Ala Gly Gly Thr
2885 2890 2895

Ala Ala Gly Ala Ala Ala Thr Ala Thr Ala Thr Ala Gly Gly Ala
2900 2905 2910

Ala Ala Ala Ala Cys Ala Ala Thr Gly Cys Cys Ala Thr Ala Thr
2915 2920 2925

Cys Ala Gly Thr Ala Thr Cys Cys Thr Cys Thr Thr Ala Ala Cys
2930 2935 2940

Cys Ala Thr Ala Thr Cys Cys Cys Cys Thr Cys Cys Ala Thr Thr
2945 2950 2955

Cys Cys Cys Cys Thr Ala Ala Ala Gly Gly Ala Gly Cys Ala Ala
2960 2965 2970

Ala Ala Cys Thr Gly Ala Thr Cys Gly Gly Cys Ala Ala Ala Cys
2975 2980 2985

Gly Thr Gly Gly Ala Gly Ala Ala Ala Thr Ala Ala Ala Ala Gly
2990 2995 3000

Cys Thr Gly Thr Thr Ala Ala Thr Gly Cys Thr Thr Gly Cys Thr
3005 3010 3015

Ala Cys Ala Gly Cys Thr Thr Cys Cys Cys Ala Cys Cys Gly Ala
3020 3025 3030

Ala Thr Thr Ala Ala Gly Gly Thr Thr Cys Ala Gly Ala Gly Ala
3035 3040 3045

Thr Cys Thr Ala Gly Ala Cys Ala Thr Ala Thr Thr Thr Gly Ala
3050 3055 3060

Ala Ala Cys Ala Thr Thr Gly Gly Ala Ala Ala Ala Thr Cys Cys
3065 3070 3075

Ala Ala Gly Gly Cys Cys Cys Cys Cys Thr Cys Cys Cys Thr Cys
3080 3085 3090

Ala Ala Ala Cys Thr Cys Ala Thr Thr Thr Gly Thr Cys Cys Ala
3095 3100 3105

Thr Ala Cys Ala Cys Cys Cys Ala Ala Ala Ala Thr Cys Thr Ala
3110 3115 3120

Thr Cys Ala Cys Thr Gly Gly Ala Gly Ala Thr Thr Thr Ala Thr
3125 3130 3135

Cys Cys Cys Thr Thr Thr Gly Gly Cys Ala Thr Thr Ala Ala Cys
3140 3145 3150

Thr Cys Thr Cys Thr Gly Thr Cys Cys Ala Gly Ala Thr Gly Thr
3155 3160 3165

Thr Thr Cys Thr Ala Ala Ala Ala Thr Gly Cys Ala Ala Ala Thr
3170 3175 3180

Gly Cys Ala Gly Thr Gly Thr Gly Cys Thr Cys Thr Cys Cys Gly

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    3185                3190                3195

Ala Ala  Thr Cys Cys Ala Cys  Ala Gly Thr Cys Thr  Cys Cys Ala
    3200                3205                3210

Thr Cys  Thr Gly Thr Gly Gly  Thr Gly Ala Thr Gly  Ala Cys Ala
    3215                3220                3225

Gly Cys  Cys Gly Ala Cys Gly  Gly Cys Cys Cys Thr  Ala Cys Ala
    3230                3235                3240

Cys Cys  Gly Thr Thr Thr Thr  Cys Cys Ala Cys Gly  Ala Gly Gly
    3245                3250                3255

Gly Ala  Cys Thr Thr Gly Ala  Gly Cys Cys Thr Cys  Gly Gly Cys
    3260                3265                3270

Gly Gly  Gly Thr Gly Cys Thr  Gly Gly Ala Ala Ala  Cys Cys Cys
    3275                3280                3285

Thr Gly  Gly Ala Cys Cys Cys  Gly Gly Gly Thr Cys  Cys Thr Cys
    3290                3295                3300

Ala Thr  Gly Gly Gly Thr Ala  Cys Gly Gly Gly Gly  Thr Gly Gly
    3305                3310                3315

Ala Gly  Gly Gly Thr Gly Cys  Cys Thr Cys Thr Gly  Gly Ala Ala
    3320                3325                3330

Gly Gly  Ala Cys Ala Ala Gly  Thr Gly Gly Ala Gly  Cys Ala Gly
    3335                3340                3345

Thr Thr  Ala Cys Cys Cys Gly  Gly Thr Thr Thr Thr  Ala Ala Cys
    3350                3355                3360

Ala Thr  Thr Thr Cys Gly Thr  Gly Thr Gly Ala Ala  Thr Thr Ala
    3365                3370                3375

Ala Ala  Thr Thr Gly Thr Ala  Thr Gly Thr Gly Cys  Ala Thr Gly
    3380                3385                3390

Ala Thr  Thr Thr Cys Thr Thr  Cys Cys Cys Cys Ala  Ala Ala Ala
    3395                3400                3405

Gly Cys  Thr Gly Ala Cys Cys  Ala Gly Cys Ala Gly  Gly Gly Cys
    3410                3415                3420

Thr Gly  Gly Ala Gly Thr Thr  Gly Ala Gly Gly Gly  Gly Gly Gly
    3425                3430                3435

Ala Gly  Gly Cys Thr Gly Thr  Gly Ala Ala Gly Thr  Cys Gly Gly
    3440                3445                3450

Thr Gly  Gly Cys Ala Thr Gly  Ala Ala Thr Gly Thr  Gly Gly Gly
    3455                3460                3465

Gly Cys  Ala Cys Thr Gly Gly  Thr Cys Ala Gly Gly  Gly Gly Cys
    3470                3475                3480

Ala Gly  Gly Gly Gly Ala Cys  Ala Thr Gly Gly Cys  Thr Ala Gly
    3485                3490                3495

Gly Thr  Thr Cys Thr Gly Ala  Ala Gly Gly Gly Ala  Cys Ala Thr
    3500                3505                3510

Ala Gly  Gly Gly Cys Ala Gly  Gly Ala Cys Gly Gly  Thr Gly Thr
    3515                3520                3525

Gly Gly  Gly Gly Cys Thr Gly  Gly Gly Cys Gly Gly  Ala Cys Ala
    3530                3535                3540

Gly Cys  Gly Thr Thr Thr Cys  Cys Ala Gly Cys Thr  Thr Cys Cys
    3545                3550                3555

Cys Ala  Cys Thr Thr Thr Thr  Gly Cys Thr Gly Gly  Ala Gly Ala
    3560                3565                3570
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Thr Cys  Ala Cys Cys Thr Gly  Thr Gly Thr Thr Thr  Cys Thr Cys
    3575                 3580                 3585

Cys Cys  Cys Gly Gly Gly Thr  Thr Thr Thr Cys Thr  Cys Thr Thr
    3590                 3595                 3600

Gly Ala  Ala Thr Thr Gly Thr  Thr Thr Thr Cys Ala  Cys Ala Ala
    3605                 3610                 3615

Thr Thr  Gly Thr Thr Thr Cys  Ala Ala Ala Ala Gly  Gly Cys Cys
    3620                 3625                 3630

Cys Ala  Cys Thr Thr Thr Cys  Cys Thr Gly Cys Ala  Cys Thr Thr
    3635                 3640                 3645

Thr Thr  Cys Thr Cys Ala Cys  Ala Ala Thr Cys Cys  Thr Gly Ala
    3650                 3655                 3660

Ala Ala  Thr Ala Ala Cys Cys  Thr Gly Thr Ala Thr  Thr Thr Gly
    3665                 3670                 3675

Ala Cys  Ala Cys Gly Ala Gly  Thr Gly Thr Gly Thr  Thr Gly Gly
    3680                 3685                 3690

Thr Ala  Ala Ala Ala Gly Cys  Gly Ala Gly Ala Thr  Ala Ala Ala
    3695                 3700                 3705

Gly Ala  Cys Ala Gly Gly Gly  Cys Cys Ala Gly Cys  Gly Thr Gly
    3710                 3715                 3720

Gly Gly  Thr Gly Cys Cys Gly  Cys Ala Cys Ala Thr  Cys Cys Ala
    3725                 3730                 3735

Cys Cys  Thr Thr Cys Cys Cys  Thr Thr Thr Gly Gly  Thr Gly Thr
    3740                 3745                 3750

Cys Cys  Cys Ala Cys Thr Thr  Gly Cys Cys Cys Ala  Cys Gly Gly
    3755                 3760                 3765

Gly Gly  Ala Thr Gly Thr Gly  Thr Ala Ala Cys Ala  Gly Ala Ala
    3770                 3775                 3780

Gly Thr  Ala Thr Ala Thr Gly  Cys Cys Cys Thr Gly  Ala Ala Gly
    3785                 3790                 3795

Thr Ala  Cys Thr Gly Ala Ala  Ala Cys Cys Ala Thr  Gly Thr Gly
    3800                 3805                 3810

Ala Ala  Ala Ala Cys Ala Thr  Thr Cys Gly Gly Ala  Ala Gly Ala
    3815                 3820                 3825

Gly Ala  Gly Cys Ala Cys Ala  Thr Thr Thr Thr Ala  Thr Cys Cys
    3830                 3835                 3840

Cys Ala  Gly Gly Cys Ala Gly  Cys Ala Cys Gly Thr  Thr Cys Ala
    3845                 3850                 3855

Ala Cys  Ala Thr Gly Thr Gly  Gly Thr Gly Gly Ala  Gly Thr Ala
    3860                 3865                 3870

Thr Ala  Gly Thr Cys Ala Gly  Gly Gly Cys Ala Ala  Ala Gly Thr
    3875                 3880                 3885

Ala Thr  Gly Cys Thr Gly Cys  Thr Thr Gly Thr Gly  Thr Ala Cys
    3890                 3895                 3900

Ala Thr  Thr Thr Thr Ala Gly  Cys Ala Thr Thr Ala  Ala Ala Thr
    3905                 3910                 3915

Thr Thr  Ala Thr Thr Cys Cys  Ala Gly Ala Thr Gly  Cys Thr Thr
    3920                 3925                 3930

Thr Thr  Ala Thr Thr Thr Thr  Gly Gly Ala Ala Ala  Ala Ala Ala
    3935                 3940                 3945
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Cys Gly Ala Ala Gly Gly Thr Ala Gly Thr Thr Ala Ala Ala Ala
    3950                3955                3960

Gly Thr Gly Cys Thr Ala Gly Ala Thr Cys Gly Ala Cys Cys Thr
    3965                3970                3975

Thr Thr Gly Gly Gly Thr Cys Thr Thr Cys Thr Cys Cys Cys Ala
    3980                3985                3990

Gly Gly Ala Gly Gly Thr Gly Ala Cys Cys Gly Cys Cys Thr Gly
    3995                4000                4005

Cys Thr Thr Gly Cys Cys Ala Cys Ala Cys Thr Cys Cys Thr Cys
    4010                4015                4020

Thr Gly Gly Cys Thr Thr Cys Cys Gly Gly Cys Cys Thr Cys Cys
    4025                4030                4035

Ala Gly Ala Gly Gly Ala Cys Ala Cys Thr Gly Ala Gly Cys Cys
    4040                4045                4050

Thr Thr Gly Ala Ala Gly Ala Gly Gly Cys Thr Gly Ala Gly Gly
    4055                4060                4065

Gly Ala Cys Cys Thr Gly Cys Cys Cys Ala Cys Cys Cys Cys Cys
    4070                4075                4080

Ala Ala Gly Thr Gly Gly Ala Gly Cys Ala Gly Gly Gly Cys Thr
    4085                4090                4095

Gly Gly Gly Ala Thr Cys Cys Cys Gly Thr Cys Thr Gly Ala Cys
    4100                4105                4110

Thr Cys Cys Cys Ala Cys Cys Cys Thr Cys Thr Gly Thr Gly Cys
    4115                4120                4125

Cys Ala Cys Cys Gly Cys Ala Cys Ala Thr Ala Thr Thr Cys Cys
    4130                4135                4140

Ala Thr Gly Cys Ala Gly Cys Cys Cys Cys Gly Thr Cys Ala Thr
    4145                4150                4155

Thr Ala Ala Ala Ala Ala Cys Gly Ala Ala Cys Thr Gly Thr Thr
    4160                4165                4170

Cys Ala Cys Cys Ala Gly Cys Thr Thr Cys Ala Thr Cys Thr Thr
    4175                4180                4185

Gly Thr Ala Gly Ala Ala Gly Ala Cys Gly Ala Gly Ala Thr Thr
    4190                4195                4200

Gly Ala Gly Gly Thr Cys Cys Ala Cys Ala Gly Gly Cys Gly Gly
    4205                4210                4215

Ala Ala Cys Thr Gly Ala Thr Thr Gly Cys Cys Gly Gly Ala Gly
    4220                4225                4230

Thr Thr Thr Ala Cys Cys Thr Gly Cys Cys Gly Ala Thr Thr Cys
    4235                4240                4245

Thr Thr Gly Cys Cys Cys Ala Cys Thr Thr Gly Cys Cys Cys Cys
    4250                4255                4260

Cys Thr Thr Gly Cys Gly Gly Ala Cys Thr Gly Thr Cys Cys Cys
    4265                4270                4275

Thr Gly Cys Thr Gly Thr Thr Cys Thr Gly Gly Cys Thr Thr Thr
    4280                4285                4290

Thr Thr Ala Gly Gly Cys Thr Thr Cys Cys Thr Cys Cys Ala Cys
    4295                4300                4305

Thr Thr Cys Ala Ala Ala Ala Thr Ala Thr Thr Gly Ala Cys Ala
    4310                4315                4320

Thr Ala Gly Thr Cys Gly Cys Thr Cys Thr Gly Gly Gly Gly Ala
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    4325                4330                4335

Gly Gly  Thr Cys Thr Thr Ala  Thr Gly Ala Gly Thr  Cys Cys Ala
    4340                4345                4350

Cys Ala  Gly Gly Thr Thr Gly  Cys Cys Thr Cys Thr  Gly Gly Thr
    4355                4360                4365

Thr Gly  Thr Ala Cys Cys Cys  Cys Cys Thr Gly Gly  Ala Gly Cys
    4370                4375                4380

Ala Ala  Thr Gly Ala Ala Gly  Ala Ala Ala Gly Cys  Cys Ala Cys
    4385                4390                4395

Cys Thr  Thr Thr Thr Cys Thr  Thr Cys Thr Cys Thr  Thr Cys Cys
    4400                4405                4410

Thr Thr  Thr Ala Thr Gly Thr  Cys Ala Ala Thr Gly  Gly Ala Ala
    4415                4420                4425

Cys Thr  Thr Thr Thr Gly Ala  Thr Thr Gly Ala Thr  Gly Ala Cys
    4430                4435                4440

Ala Cys  Cys Ala Gly Ala Thr  Thr Cys Thr Cys Cys  Cys Cys Cys
    4445                4450                4455

Cys Thr  Cys Cys Ala Cys Ala  Cys Ala Cys Ala Thr  Ala Cys Ala
    4460                4465                4470

Cys Cys  Thr Thr Thr Thr Thr  Thr Gly Gly Gly Thr  Ala Ala Thr
    4475                4480                4485

Ala Thr  Cys Thr Gly Gly Cys  Ala Ala Gly Thr Gly  Gly Ala Thr
    4490                4495                4500

Cys Cys  Cys Ala Cys Cys Ala  Ala Thr Thr Thr Ala  Cys Thr Thr
    4505                4510                4515

Thr Ala  Ala Thr Ala Ala Gly  Cys Ala Thr Ala Cys  Thr Gly Thr
    4520                4525                4530

Thr Thr  Ala Cys Thr Cys Thr  Ala Ala Thr Gly Ala  Cys Ala Thr
    4535                4540                4545

Thr Thr  Gly Thr Gly Thr Gly  Cys Ala Gly Thr Ala  Ala Ala Cys
    4550                4555                4560

Ala Ala  Ala Thr Gly Ala Ala  Gly Thr Ala Ala Gly  Ala Ala Cys
    4565                4570                4575

Cys Cys  Ala Ala Thr Ala Gly  Cys Thr Cys Ala Thr  Thr Thr Ala
    4580                4585                4590

Ala Thr  Thr Gly Thr Gly Gly  Ala Ala Ala Thr Cys  Gly Thr Gly
    4595                4600                4605

Thr Ala  Ala Thr Thr Gly Gly  Thr Thr Cys Ala Gly  Cys Ala Ala
    4610                4615                4620

Thr Gly  Ala Ala Ala Gly Gly  Ala Cys Ala Ala Thr  Thr Cys Ala
    4625                4630                4635

Thr Gly  Ala Gly Thr Cys Ala  Thr Gly Gly Ala Thr  Ala Thr Thr
    4640                4645                4650

Ala Cys  Cys Ala Cys Ala Cys  Cys Thr Thr Ala Gly  Gly Ala Gly
    4655                4660                4665

Cys Cys  Thr Thr Thr Thr Ala  Ala Ala Ala Thr Gly  Ala Gly Thr
    4670                4675                4680

Thr Thr  Gly Gly Thr Gly Cys  Cys Ala Ala Ala Thr  Gly Ala Cys
    4685                4690                4695

Thr Thr  Cys Ala Gly Cys Cys  Thr Ala Gly Ala Ala  Cys Thr Gly
    4700                4705                4710
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Gly Cys Ala Ala Thr Ala Thr Cys Cys Thr Cys Thr Thr Gly Thr
4715 4720 4725

Gly Ala Cys Ala Thr Gly Cys Cys Thr Thr Gly Ala Gly Gly Gly
4730 4735 4740

Cys Thr Thr Thr Cys Thr Thr Thr Gly Thr Gly Thr Thr Thr Ala
4745 4750 4755

Thr Ala Ala Ala Gly Thr Gly Gly Cys Cys Ala Thr Cys Cys Cys
4760 4765 4770

Ala Thr Ala Ala Thr Thr Gly Gly Ala Thr Thr Thr Thr Gly Ala
4775 4780 4785

Cys Ala Gly Ala Gly Gly Thr Ala Thr Gly Ala Ala Ala Ala Gly
4790 4795 4800

Thr Gly Gly Ala Thr Thr Cys Thr Gly Ala Gly Cys Ala Thr Thr
4805 4810 4815

Ala Thr Gly Thr Thr Cys Ala Gly Ala Cys Thr Thr Ala Cys Gly
4820 4825 4830

Ala Thr Gly Thr Thr Thr Thr Ala Ala Ala Thr Gly Gly Ala Thr
4835 4840 4845

Ala Gly Cys Thr Gly Ala Gly Ala Thr Thr Thr Thr Thr Ala Gly
4850 4855 4860

Gly Thr Gly Thr Ala Ala Thr Thr Thr Gly Ala Ala Ala Ala Ala
4865 4870 4875

Ala Cys Gly Thr Thr Ala Thr Ala Gly Ala Cys Ala Ala Ala Ala
4880 4885 4890

Cys Ala Ala Gly Ala Ala Thr Cys Ala Thr Cys Cys Thr Cys Ala
4895 4900 4905

Ala Thr Ala Cys Ala Thr Thr Ala Thr Ala Ala Thr Thr Ala Thr
4910 4915 4920

Ala Ala Ala Ala Thr Thr Gly Ala Cys Thr Gly Thr Thr Cys Ala
4925 4930 4935

Thr Cys Thr Ala Cys Ala Thr Ala Thr Thr Gly Ala Thr Thr Cys
4940 4945 4950

Thr Cys Ala Gly Ala Ala Ala Thr Thr Ala Cys Thr Cys Thr Cys
4955 4960 4965

Ala Gly Cys Gly Ala Thr Ala Thr Thr Gly Ala Ala Ala Ala Ala
4970 4975 4980

Ala Gly Gly Cys Ala Gly Thr Ala Thr Ala Ala Gly Gly Thr Cys
4985 4990 4995

Thr Cys Gly Cys Ala Thr Thr Ala Thr Thr Ala Gly Ala Ala Thr
5000 5005 5010

Thr Gly Thr Thr Ala Thr Thr Thr Thr Cys Thr Gly Gly Cys Cys
5015 5020 5025

Ala Ala Ala Ala Gly Ala Thr Gly Cys Cys Thr Gly Thr Gly Gly
5030 5035 5040

Ala Ala Cys Ala Gly Gly Gly Ala Gly Gly Thr Ala Ala Cys Thr
5045 5050 5055

Ala Cys Thr Cys Ala Thr Gly Thr Gly Cys Cys Ala Thr Thr Gly
5060 5065 5070

Cys Cys Thr Thr Thr Ala Cys Thr Thr Gly Thr Thr Thr Thr Thr
5075 5080 5085

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Cys Ala  Ala Ala Ala Cys Cys  Cys Cys Cys Thr Gly  Cys Thr Thr
    5090                 5095                 5100

Gly Gly  Gly Cys Cys Cys Cys  Thr Thr Thr Gly Thr  Cys Cys Thr
    5105                 5110                 5115

Ala Cys  Ala Ala Cys Ala Ala  Ala Cys Ala Thr Cys  Thr Gly Thr
    5120                 5125                 5130

Ala Ala  Gly Ala Cys Thr Gly  Gly Cys Cys Thr Gly  Gly Gly Gly
    5135                 5140                 5145

Thr Ala  Ala Cys Cys Ala Cys  Thr Cys Thr Ala Thr  Thr Thr Cys
    5150                 5155                 5160

Thr Gly  Gly Gly Ala Ala Thr  Thr Gly Gly Ala Ala  Cys Ala Ala
    5165                 5170                 5175

Gly Ala  Cys Ala Ala Gly Thr  Cys Ala Gly Cys Ala  Cys Ala Thr
    5180                 5185                 5190

Thr Thr  Gly Gly Ala Cys Thr  Thr Gly Ala Ala Cys  Cys Thr Thr
    5195                 5200                 5205

Ala Ala  Cys Cys Thr Cys Ala  Thr Thr Ala Cys Cys  Ala Thr Ala
    5210                 5215                 5220

Thr Cys  Cys Thr Cys Thr Cys  Cys Ala Ala Ala Cys  Ala Ala Gly
    5225                 5230                 5235

Thr Ala  Thr Thr Cys Thr Cys  Gly Gly Thr Thr Cys  Thr Ala Thr
    5240                 5245                 5250

Thr Thr  Thr Gly Thr Thr Thr  Thr Thr Gly Ala Gly  Cys Thr Thr
    5255                 5260                 5265

Gly Thr  Cys Ala Thr Thr Thr  Thr Cys Thr Gly Cys  Ala Cys Thr
    5270                 5275                 5280

Cys Thr  Gly Ala Ala Ala Cys  Cys Ala Gly Gly Thr  Cys Thr Thr
    5285                 5290                 5295

Cys Thr  Gly Cys Thr Thr Ala  Ala Cys Thr Thr Gly  Thr Ala Thr
    5300                 5305                 5310

Gly Thr  Thr Gly Thr Cys Ala  Ala Gly Thr Gly Thr  Thr Thr Gly
    5315                 5320                 5325

Gly Cys  Thr Gly Thr Thr Gly  Ala Cys Ala Ala Ala  Ala Thr Ala
    5330                 5335                 5340

Ala Thr  Thr Cys Ala Ala Gly  Thr Ala Ala Cys Ala  Ala Thr Thr
    5345                 5350                 5355

Ala Thr  Cys Ala Thr Thr Gly  Thr Gly Gly Ala Ala  Thr Thr Thr
    5360                 5365                 5370

Thr Cys  Ala Thr Thr Ala Thr  Gly Thr Cys Ala Cys  Thr Gly Gly
    5375                 5380                 5385

Thr Gly  Gly Cys Thr Cys Ala  Gly Cys Thr Gly Gly  Thr Ala Ala
    5390                 5395                 5400

Ala Gly  Ala Ala Thr Cys Thr  Gly Cys Cys Thr Gly  Cys Ala Ala
    5405                 5410                 5415

Thr Gly  Cys Ala Gly Gly Ala  Gly Ala Cys Cys Thr  Gly Gly Gly
    5420                 5425                 5430

Thr Thr  Thr Gly Ala Cys Cys  Cys Cys Thr Ala Gly  Ala Thr Cys
    5435                 5440                 5445

Gly Gly  Gly Ala Ala Gly Ala  Thr Cys Cys Thr Cys  Thr Gly Gly
    5450                 5455                 5460

Ala Gly  Ala Ala Gly Gly Ala  Ala Thr Gly Ala Cys  Thr Ala Cys
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    5465                5470                5475

Cys Cys  Gly Cys Thr Gly Cys  Ala Gly Thr Ala Thr  Thr Cys Thr
    5480                5485                5490

Thr Gly  Cys Cys Thr Gly Gly  Ala Gly Ala Ala Cys  Cys Cys Cys
    5495                5500                5505

Ala Thr  Gly Gly Ala Cys Ala  Gly Ala Gly Gly Ala  Gly Cys Cys
    5510                5515                5520

Thr Gly  Gly Thr Gly Gly Gly  Thr Thr Ala Cys Ala  Gly Thr Gly
    5525                5530                5535

Cys Ala  Thr Gly Gly Gly Gly  Thr Thr Gly Cys Ala  Ala Gly Ala
    5540                5545                5550

Gly Thr  Cys Cys Gly Ala Cys  Ala Thr Gly Ala Cys  Thr Thr Ala
    5555                5560                5565

Gly Cys  Ala Ala Cys Thr Ala  Ala Ala Cys Thr Gly  Cys Cys Ala
    5570                5575                5580

Cys Cys  Ala Cys Cys Ala Cys  Gly Thr Cys Ala Ala  Thr Gly Gly
    5585                5590                5595

Gly Ala  Ala Ala Thr Gly Cys  Ala Gly Thr Thr Gly  Thr Gly Gly
    5600                5605                5610

Cys Ala  Cys Cys Gly Thr Gly  Ala Thr Thr Thr Thr  Cys Ala Gly
    5615                5620                5625

Thr Gly  Thr Thr Cys Cys Cys  Thr Thr Ala Cys Thr  Gly Cys Ala
    5630                5635                5640

Thr Cys  Cys Ala Thr Thr Gly  Cys Thr Gly Cys Thr  Gly Cys Thr
    5645                5650                5655

Gly Cys  Thr Ala Ala Gly Thr  Cys Ala Cys Thr Thr  Cys Ala Gly
    5660                5665                5670

Thr Cys  Gly Thr Gly Thr Cys  Cys Gly Ala Cys Gly  Gly Cys Cys
    5675                5680                5685

Cys Ala  Cys Cys Ala Gly Gly  Cys Thr Cys Cys Cys  Cys Gly Thr
    5690                5695                5700

Cys Cys  Cys Thr Gly Gly Gly  Ala Thr Thr Cys Thr  Cys Cys Ala
    5705                5710                5715

Gly Gly  Cys Ala Ala Gly Cys  Ala Cys Ala Cys Thr  Gly Gly Ala
    5720                5725                5730

Gly Thr  Gly Gly Gly Thr Thr  Gly Cys Cys Ala Thr  Thr Thr Cys
    5735                5740                5745

Cys Thr  Thr Cys Thr Cys Cys  Ala Ala Thr Gly Cys  Ala Thr Gly
    5750                5755                5760

Ala Ala  Ala Gly Thr Gly Ala  Ala Ala Ala Gly Thr  Gly Ala Ala
    5765                5770                5775

Ala Gly  Gly Gly Ala Ala Gly  Thr Cys Gly Cys Thr  Cys Ala Gly
    5780                5785                5790

Thr Cys  Gly Thr Gly Thr Cys  Cys Gly Ala Cys Thr  Cys Thr Thr
    5795                5800                5805

Thr Gly  Thr Gly Ala Cys Cys  Cys Cys Ala Thr Gly  Gly Thr Cys
    5810                5815                5820

Thr Gly  Cys Ala Gly Cys Cys  Thr Ala Cys Cys Ala  Gly Gly Cys
    5825                5830                5835

Thr Cys  Cys Thr Cys Cys Ala  Thr Cys Cys Ala Thr  Gly Gly Gly
    5840                5845                5850
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Ala Thr  Thr Thr Thr Cys Cys  Ala Gly Gly Cys Ala  Ala Gly Ala
    5855                 5860                 5865

Gly Thr  Ala Cys Thr Gly Gly  Ala Gly Thr Gly Gly  Gly Gly Thr
    5870                 5875                 5880

Gly Cys  Cys Gly Thr Thr Gly  Cys Cys Thr Thr Cys  Thr Cys Thr
    5885                 5890                 5895

Gly Gly  Cys Ala Thr Cys Cys  Ala Thr Thr Gly Thr  Thr Gly Gly
    5900                 5905                 5910

Gly Gly  Gly Gly Thr Ala Gly  Cys Thr Ala Thr Thr  Gly Cys Thr
    5915                 5920                 5925

Thr Thr  Cys Thr Cys Thr Cys  Thr Cys Thr Cys Thr  Ala Ala Gly
    5930                 5935                 5940

Cys Thr  Ala Gly Gly Thr Thr  Ala Thr Thr Thr Ala  Thr Gly Gly
    5945                 5950                 5955

Cys Cys  Ala Thr Ala Gly Gly  Ala Ala Thr Thr Thr  Ala Gly Gly
    5960                 5965                 5970

Cys Ala  Gly Gly Gly Ala Ala  Thr Ala Ala Gly Gly  Gly Ala Ala
    5975                 5980                 5985

Ala Ala  Ala Thr Gly Gly Cys  Ala Ala Cys Thr Cys  Cys Cys Ala
    5990                 5995                 6000

Gly Gly  Gly Ala Ala Cys Thr  Thr Cys Ala Cys Cys  Cys Ala Thr
    6005                 6010                 6015

Thr Gly  Ala Gly Cys Cys Ala  Thr Ala Thr Ala Cys  Cys Ala Cys
    6020                 6025                 6030

Ala Thr  Ala Gly Thr Thr Cys  Thr Thr Ala Gly Ala  Ala Ala Cys
    6035                 6040                 6045

Thr Gly  Gly Ala Thr Thr Ala  Gly Thr Cys Cys Cys  Ala Thr Thr
    6050                 6055                 6060

Cys Thr  Ala Ala Ala Thr Thr  Cys Cys Thr Gly Thr  Gly Gly Gly
    6065                 6070                 6075

Ala Thr  Ala Thr Thr Thr Thr  Thr Ala Gly Thr Thr  Thr Gly Ala
    6080                 6085                 6090

Ala Gly  Ala Ala Ala Thr Thr  Thr Gly Gly Ala Gly  Gly Gly Cys
    6095                 6100                 6105

Cys Thr  Ala Gly Ala Gly Gly  Cys Ala Ala Cys Ala  Gly Ala Thr
    6110                 6115                 6120

Ala Gly  Cys Cys Ala Ala Thr  Ala Thr Thr Cys Ala  Gly Thr Thr
    6125                 6130                 6135

Thr Thr  Thr Ala Ala Thr Thr  Thr Ala Thr Gly Thr  Cys Thr Cys
    6140                 6145                 6150

Ala Thr  Cys Cys Cys Ala Gly  Thr Thr Gly Thr Thr  Cys Cys Cys
    6155                 6160                 6165

Thr Gly  Thr Cys Ala Cys Thr  Gly Thr Thr Cys Cys  Thr Gly Cys
    6170                 6175                 6180

Ala Thr  Ala Thr Gly Gly Thr  Gly Ala Cys Thr Thr  Thr Thr Gly
    6185                 6190                 6195

Ala Gly  Thr Thr Gly Ala Cys  Thr Gly Gly Thr Ala  Thr Ala Thr
    6200                 6205                 6210

Cys Cys  Thr Thr Ala Ala Thr  Ala Cys Thr Cys Ala  Thr Thr Cys
    6215                 6220                 6225
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Ala Thr  Thr Thr Ala Cys Ala  Gly Thr Ala Ala Thr  Cys Ala Gly
     6230                6235                6240

Thr Ala  Ala Thr Gly Thr Gly  Thr Gly Thr Gly Thr  Gly Thr Gly
     6245                6250                6255

Thr Thr  Thr Gly Cys Ala Thr  Thr Thr Thr Gly Ala  Thr Thr Thr
     6260                6265                6270

Thr Cys  Thr Thr Thr Thr Ala  Ala Ala Ala Ala Ala  Thr Thr Ala
     6275                6280                6285

Thr Thr  Thr Ala Cys Thr Thr  Gly Gly Cys Thr Gly  Cys Thr Cys
     6290                6295                6300

Thr Gly  Gly Ala Thr Cys Thr  Thr Ala Gly Thr Thr  Gly Cys Thr
     6305                6310                6315

Gly Cys  Ala Thr Gly Thr Gly  Ala Ala Cys Thr Cys  Thr Thr Ala
     6320                6325                6330

Gly Thr  Thr Gly Cys Cys Ala  Cys Ala Gly Gly Thr  Gly Gly Gly
     6335                6340                6345

Gly Thr  Cys Thr Ala Gly Thr  Thr Cys Cys Cys Thr  Gly Ala Cys
     6350                6355                6360

Cys Ala  Gly Gly Ala Thr Cys  Gly Ala Ala Cys Cys  Cys Ala Gly
     6365                6370                6375

Gly Cys  Cys Cys Cys Thr Cys  Cys Gly Thr Thr Gly  Gly Gly Ala
     6380                6385                6390

Gly Thr  Gly Cys Ala Gly Ala  Gly Gly Cys Thr Thr  Ala Gly Thr
     6395                6400                6405

Cys Gly  Cys Thr Gly Gly Gly  Ala Thr Ala Cys Cys  Ala Gly Ala
     6410                6415                6420

Gly Ala  Ala Gly Thr Cys Gly  Cys Cys Thr Gly Cys  Ala Thr Thr
     6425                6430                6435

Thr Gly  Thr Ala Thr Thr Thr  Thr Cys Ala Ala Ala  Gly Gly Gly
     6440                6445                6450

Cys Thr  Ala Cys Thr Thr Ala  Cys Thr Thr Thr Cys  Thr Cys Ala
     6455                6460                6465

Ala Gly  Thr Thr Ala Ala Gly  Thr Thr Ala Cys Cys  Cys Thr Cys
     6470                6475                6480

Thr Ala  Ala Ala Thr Thr Ala  Ala Ala Thr Thr Ala  Thr Cys Cys
     6485                6490                6495

Cys Ala  Thr Ala Gly Ala Ala  Thr Thr Cys Thr Ala  Ala Ala Gly
     6500                6505                6510

Thr Gly  Thr Ala Ala Ala Gly  Thr Thr Cys Ala Cys  Ala Gly Ala
     6515                6520                6525

Thr Thr  Thr Thr Thr Thr Ala  Gly Gly Ala Thr Ala  Thr Thr Gly
     6530                6535                6540

Cys Ala  Gly Ala Gly Gly Gly  Thr Gly Gly Gly Gly  Ala Gly Gly
     6545                6550                6555

Gly Ala  Ala Gly Gly Thr Thr  Gly Thr Thr Thr Thr  Thr Thr Thr
     6560                6565                6570

Thr Thr  Thr Thr Thr Thr Cys  Cys Thr Gly Thr Thr  Thr Thr Gly
     6575                6580                6585

Thr Thr  Thr Thr Gly Cys Thr  Thr Thr Thr Thr Ala  Ala Ala Gly
     6590                6595                6600

Gly Ala  Ala Ala Thr Thr Thr  Gly Thr Gly Thr Ala  Gly Thr Gly
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    6605                6610                6615

Thr Ala  Gly Thr Ala Ala Thr  Gly Ala Thr Cys Thr  Gly Gly Cys
    6620                6625                6630

Thr Ala  Gly Gly Ala Thr Thr  Cys Thr Gly Thr Gly  Ala Gly Thr
    6635                6640                6645

Gly Gly  Gly Thr Thr Ala Thr  Thr Thr Thr Cys Thr  Cys Thr Gly
    6650                6655                6660

Thr Thr  Cys Ala Thr Gly Ala  Thr Thr Thr Ala Thr  Gly Cys Ala
    6665                6670                6675

Cys Thr  Thr Thr Gly Ala Gly  Ala Ala Ala Ala Thr  Thr Thr Gly
    6680                6685                6690

Gly Cys  Ala Thr Cys Thr Thr  Ala Ala Gly Gly Thr  Ala Gly Gly
    6695                6700                6705

Gly Ala  Cys Cys Ala Thr Gly  Ala Cys Thr Thr Cys  Thr Cys Cys
    6710                6715                6720

Ala Thr  Ala Thr Ala Ala Ala  Thr Ala Ala Ala Cys  Ala Thr Cys
    6725                6730                6735

Ala Thr  Ala Ala Ala Ala Ala  Gly Gly Cys Thr Thr  Gly Thr Ala
    6740                6745                6750

Cys Cys  Thr Thr Thr Thr Ala  Cys Thr Cys Thr Gly  Gly Thr Ala
    6755                6760                6765

Ala Thr  Thr Cys Thr Cys Ala  Cys Thr Ala Ala Ala  Ala Gly Thr
    6770                6775                6780

Gly Ala  Gly Cys Thr Gly Cys  Thr Gly Ala Thr Gly  Ala Gly Ala
    6785                6790                6795

Ala Cys  Ala Thr Thr Cys Thr  Ala Thr Gly Thr Gly  Gly Gly Thr
    6800                6805                6810

Ala Ala  Cys Thr Ala Cys Thr  Cys Ala Gly Gly Gly  Gly Cys Cys
    6815                6820                6825

Ala Cys  Ala Thr Gly Cys Thr  Gly Thr Thr Cys Ala  Ala Ala Gly
    6830                6835                6840

Cys Cys  Thr Gly Gly Thr Cys  Ala Ala Gly Gly Thr  Thr Thr Ala
    6845                6850                6855

Cys Ala  Gly Thr Thr Cys Thr  Cys Thr Thr Gly Gly  Thr Ala Thr
    6860                6865                6870

Ala Gly  Thr Ala Ala Cys Ala  Thr Ala Thr Ala Cys  Gly Ala Thr
    6875                6880                6885

Thr Ala  Gly Gly Cys Ala Cys  Thr Thr Ala Gly Cys  Cys Thr Thr
    6890                6895                6900

Thr Thr  Ala Ala Thr Gly Ala  Ala Gly Ala Thr Ala  Ala Ala Thr
    6905                6910                6915

Ala Thr  Ala Thr Gly Thr Ala  Ala Cys Ala Ala Thr  Thr Ala Thr
    6920                6925                6930

Ala Thr  Thr Thr Gly Gly Ala  Ala Ala Ala Ala Thr  Gly Thr Ala
    6935                6940                6945

Ala Thr  Cys Ala Thr Ala Thr  Thr Thr Gly Ala Ala  Ala Thr Ala
    6950                6955                6960

Thr Thr  Ala Ala Ala Ala Ala  Gly Cys Thr Gly Gly  Cys Thr Ala
    6965                6970                6975

Thr Thr  Ala Gly Cys Ala Ala  Thr Thr Thr Thr Gly  Gly Thr Gly
    6980                6985                6990
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Thr Ala  Gly Thr Cys Thr Ala  Thr Ala Ala Ala Ala  Ala Gly Ala
    6995                 7000                 7005

Thr Gly  Ala Ala Thr Cys Ala  Thr Thr Gly Cys Thr  Cys Ala Gly
    7010                 7015                 7020

Gly Ala  Thr Ala Ala Thr Thr  Ala Gly Thr Thr Ala  Ala Ala Ala
    7025                 7030                 7035

Gly Cys  Thr Cys Thr Cys Ala  Thr Thr Ala Thr Gly  Ala Ala Thr
    7040                 7045                 7050

Thr Gly  Thr Thr Thr Thr Cys  Thr Thr Thr Ala Ala  Ala Ala Ala
    7055                 7060                 7065

Gly Cys  Ala Thr Thr Ala Ala  Gly Ala Thr Ala Thr  Thr Thr Ala
    7070                 7075                 7080

Cys Cys  Ala Thr Gly Thr Ala  Cys Thr Gly Thr Gly  Thr Gly Ala
    7085                 7090                 7095

Thr Gly  Gly Ala Ala Gly Ala  Thr Thr Cys Cys Thr  Cys Ala Gly
    7100                 7105                 7110

Gly Thr  Ala Thr Gly Cys Thr  Gly Thr Gly Cys Ala  Thr Thr Gly
    7115                 7120                 7125

Thr Thr  Cys Ala Thr Thr Thr  Gly Thr Cys Thr Thr  Thr Cys Thr
    7130                 7135                 7140

Gly Thr  Gly Ala Cys Cys Gly  Gly Thr Ala Thr Cys  Cys Thr Ala
    7145                 7150                 7155

Gly Ala  Ala Thr Cys Cys Thr  Gly Thr Ala Cys Thr  Cys Thr Cys
    7160                 7165                 7170

Thr Thr  Cys Thr Ala Cys Thr  Thr Cys Ala Thr Cys  Thr Cys Cys
    7175                 7180                 7185

Thr Thr  Thr Thr Cys Thr Cys  Thr Thr Thr Cys Thr  Ala Ala Cys
    7190                 7195                 7200

Thr Cys  Thr Gly Gly Ala Thr  Thr Gly Thr Gly Cys  Thr Thr Cys
    7205                 7210                 7215

Thr Gly  Gly Thr Ala Thr Thr  Cys Thr Gly Cys Thr  Thr Ala Ala
    7220                 7225                 7230

Ala Thr  Cys Ala Thr Thr Cys  Thr Gly Gly Gly Cys  Cys Cys Cys
    7235                 7240                 7245

Gly Gly  Cys Ala Gly Thr Cys  Thr Thr Cys Cys Ala  Gly Thr Thr
    7250                 7255                 7260

Cys Ala  Ala Thr Cys Ala Cys  Ala Thr Gly Gly Ala  Cys Thr Thr
    7265                 7270                 7275

Ala Cys  Cys Cys Ala Gly Thr  Gly Thr Gly Thr Cys  Ala Cys Cys
    7280                 7285                 7290

Cys Thr  Ala Thr Thr Thr Cys  Thr Gly Ala Cys Ala  Cys Thr Thr
    7295                 7300                 7305

Cys Ala  Cys Ala Cys Thr Ala  Thr Thr Gly Thr Cys  Thr Gly Cys
    7310                 7315                 7320

Cys Thr  Cys Thr Gly Thr Cys  Thr Cys Ala Cys Cys  Ala Gly Ala
    7325                 7330                 7335

Ala Thr  Thr Cys Cys Thr Thr  Gly Gly Cys Ala Cys  Ala Thr Thr
    7340                 7345                 7350

Ala Ala  Cys Cys Cys Gly Gly  Thr Thr Thr Cys Cys  Thr Cys Thr
    7355                 7360                 7365
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Cys Ala Cys Cys Cys Thr Thr Cys Cys Ala Ala Cys Cys Gly Thr
7370 7375 7380

Cys Thr Thr Thr Thr Cys Cys Thr Cys Thr Gly Gly Thr Cys Cys
7385 7390 7395

Cys Thr Cys Cys Thr Ala Thr Cys Thr Thr Cys Gly Gly Thr Cys
7400 7405 7410

Thr Thr Thr Thr Gly Cys Thr Gly Thr Thr Gly Thr Ala Thr Cys
7415 7420 7425

Cys Cys Cys Cys Ala Ala Gly Gly Cys Thr Cys Thr Gly Thr Thr
7430 7435 7440

Thr Thr Thr Gly Cys Cys Thr Cys Thr Cys Thr Thr Cys Cys Cys
7445 7450 7455

Ala Thr Cys Thr Thr Thr Cys Thr Gly Ala Gly Thr Ala Cys Thr
7460 7465 7470

Thr Gly Thr Gly Ala Thr Cys Thr Thr Thr Cys Ala Gly Cys Ala
7475 7480 7485

Cys Ala Gly Ala Thr Cys Ala Thr Thr Thr Cys Ala Ala Cys Thr
7490 7495 7500

Cys Thr Cys Thr Cys Thr Gly Cys Thr Thr Thr Thr Cys Thr Gly
7505 7510 7515

Thr Cys Thr Cys Thr Gly Thr Gly Thr Thr Ala Gly Thr Ala Thr
7520 7525 7530

Cys Gly Thr Gly Thr Thr Cys Cys Thr Gly Cys Thr Gly Cys Cys
7535 7540 7545

Thr Ala Ala Ala Gly Gly Ala Thr Ala Gly Ala Thr Gly Thr Ala
7550 7555 7560

Cys Thr Gly Cys Cys Gly Cys Ala Gly Cys Cys Thr Cys Ala Ala
7565 7570 7575

Thr Thr Cys Ala Thr Cys Cys Cys Ala Cys Ala Gly Ala Ala Gly
7580 7585 7590

Ala Cys Ala Gly Ala Ala Cys Ala Thr Ala Gly Cys Ala Thr Cys
7595 7600 7605

Ala Thr Thr Thr Thr Cys Thr Cys Cys Ala Cys Cys Thr Gly Gly
7610 7615 7620

Cys Ala Cys Cys Cys Thr Thr Cys Cys Thr Ala Cys Thr Gly Ala
7625 7630 7635

Ala Thr Thr Thr Cys Thr Gly Cys Cys Thr Gly Ala Ala Ala Thr
7640 7645 7650

Gly Ala Ala Ala Thr Thr Cys Thr Thr Cys Thr Thr Cys Thr Ala
7655 7660 7665

Gly Thr Cys Thr Cys Cys Ala Ala Ala Ala Cys Thr Ala Gly Ala
7670 7675 7680

Cys Ala Cys Cys Thr Gly Gly Gly Ala Thr Thr Cys Ala Thr Cys
7685 7690 7695

Cys Cys Thr Gly Cys Cys Thr Cys Ala Gly Thr Gly Ala Cys Thr
7700 7705 7710

Thr Thr Thr Cys Thr Thr Cys Gly Cys Cys Cys Thr Gly Thr Cys
7715 7720 7725

Thr Cys Thr Thr Gly Gly Thr Thr Thr Cys Cys Thr Cys Thr Gly
7730 7735 7740

Thr Cys Cys Thr Thr Thr Thr Cys Thr Thr Ala Cys Cys Thr Ala

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    7745                7750                7755

Thr Gly  Ala Ala Cys Ala Gly  Ala Cys Cys Cys Thr  Cys Cys Ala
    7760                7765                7770

Gly Ala  Cys Thr Thr Thr Cys  Cys Cys Thr Cys Thr  Gly Ala Ala
    7775                7780                7785

Gly Cys  Ala Thr Gly Ala Cys  Cys Thr Ala Cys Cys  Gly Gly Cys
    7790                7795                7800

Thr Cys  Ala Gly Thr Gly Thr  Thr Thr Cys Ala Gly  Cys Thr Cys
    7805                7810                7815

Thr Thr  Thr Ala Cys Gly Ala  Cys Cys Cys Ala Cys  Ala Cys Thr
    7820                7825                7830

Cys Cys  Cys Cys Thr Gly Ala  Thr Gly Cys Thr Gly  Cys Cys Ala
    7835                7840                7845

Gly Cys  Gly Cys Thr Cys Thr  Cys Thr Gly Cys Cys  Thr Thr Cys
    7850                7855                7860

Gly Thr  Gly Ala Thr Thr Gly  Thr Cys Thr Cys Thr  Ala Ala Ala
    7865                7870                7875

Cys Thr  Gly Gly Cys Ala Gly  Ala Ala Cys Cys Ala  Thr Cys Ala
    7880                7885                7890

Cys Thr  Ala Thr Thr Ala Cys  Ala Gly Thr Thr Gly  Gly Cys Thr
    7895                7900                7905

Thr Thr  Thr Cys Cys Ala Cys  Thr Thr Gly Gly Thr  Gly Ala Thr
    7910                7915                7920

Cys Cys  Thr Thr Gly Thr Thr  Thr Thr Thr Gly Gly  Ala Ala Ala
    7925                7930                7935

Ala Thr  Cys Cys Thr Thr Thr  Ala Thr Cys Ala Cys  Ala Cys Cys
    7940                7945                7950

Ala Ala  Thr Thr Cys Thr Thr  Gly Thr Cys Thr Cys  Ala Cys Ala
    7955                7960                7965

Cys Cys  Cys Thr Cys Cys Thr  Cys Cys Cys Ala Cys  Thr Cys Thr
    7970                7975                7980

Cys Ala  Cys Thr Thr Thr Thr  Cys Cys Cys Thr Gly  Ala Ala Ala
    7985                7990                7995

Ala Gly  Ala Thr Cys Thr Thr  Thr Thr Ala Cys Gly  Ala Gly Cys
    8000                8005                8010

Cys Ala  Gly Cys Thr Cys Ala  Gly Thr Gly Gly Thr  Cys Thr Thr
    8015                8020                8025

Thr Thr  Cys Cys Thr Thr Thr  Gly Thr Gly Ala Ala  Ala Cys Thr
    8030                8035                8040

Thr Thr  Cys Cys Cys Cys Thr  Ala Cys Cys Thr Thr  Cys Cys Cys
    8045                8050                8055

Ala Gly  Gly Gly Ala Gly Ala  Cys Thr Thr Gly Gly  Thr Thr Gly
    8060                8065                8070

Thr Thr  Thr Cys Thr Gly Thr  Cys Thr Gly Thr Gly  Cys Thr Thr
    8075                8080                8085

Thr Thr  Thr Thr Cys Cys Cys  Cys Ala Thr Ala Gly  Thr Ala Gly
    8090                8095                8100

Thr Thr  Gly Gly Gly Ala Thr  Gly Gly Ala Thr Thr  Gly Thr Ala
    8105                8110                8115

Gly Ala  Cys Thr Thr Ala Ala  Cys Ala Gly Thr Thr  Thr Thr Thr
    8120                8125                8130
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Cys Thr Thr Gly Thr Ala Ala Thr Thr Ala Ala Thr Thr Gly Thr
8135 8140 8145

Thr Thr Ala Cys Ala Thr Gly Thr Cys Thr Ala Thr Cys Thr Cys
8150 8155 8160

Cys Thr Gly Cys Ala Cys Thr Gly Gly Gly Ala Cys Thr Gly Cys
8165 8170 8175

Gly Ala Gly Cys Thr Cys Thr Gly Thr Cys Thr Ala Cys Thr Thr
8180 8185 8190

Ala Ala Ala Gly Ala Ala Thr Gly Thr Gly Thr Thr Thr Thr Ala
8195 8200 8205

Ala Gly Thr Thr Cys Ala Gly Thr Gly Thr Gly Thr Ala Cys Cys
8210 8215 8220

Cys Ala Ala Cys Ala Ala Ala Thr Gly Ala Gly Cys Cys Ala Ala
8225 8230 8235

Gly Thr Cys Thr Thr Cys Thr Gly Ala Cys Thr Cys Cys Cys Thr
8240 8245 8250

Cys Thr Cys Thr Gly Ala Thr Gly Gly Cys Cys Thr Thr Cys Thr
8255 8260 8265

Gly Ala Cys Ala Thr Cys Cys Thr Thr Cys Thr Cys Cys Thr Cys
8270 8275 8280

Thr Thr Ala Gly Cys Cys Thr Thr Gly Ala Cys Thr Cys Ala Gly
8285 8290 8295

Gly Cys Cys Gly Thr Thr Thr Cys Cys Cys Thr Gly Ala Gly Cys
8300 8305 8310

Thr Gly Ala Ala Gly Thr Gly Cys Ala Cys Thr Thr Ala Gly Thr
8315 8320 8325

Cys Cys Thr Cys Cys Thr Thr Cys Cys Thr Gly Ala Cys Cys Cys
8330 8335 8340

Cys Ala Gly Thr Cys Cys Thr Ala Gly Gly Cys Thr Thr Thr Gly
8345 8350 8355

Cys Gly Thr Cys Ala Gly Ala Cys Cys Cys Thr Gly Thr Gly Gly
8360 8365 8370

Cys Thr Thr Thr Cys Ala Cys Ala Thr Gly Gly Cys Cys Cys Thr
8375 8380 8385

Gly Thr Ala Cys Cys Cys Gly Thr Cys Thr Gly Thr Cys Cys Thr
8390 8395 8400

Cys Thr Cys Cys Thr Gly Cys Gly Thr Thr Ala Thr Cys Gly Ala
8405 8410 8415

Ala Ala Ala Ala Thr Thr Cys Thr Cys Thr Cys Thr Ala Ala Thr
8420 8425 8430

Ala Gly Cys Thr Thr Gly Ala Thr Gly Thr Gly Thr Thr Thr Thr
8435 8440 8445

Ala Ala Cys Cys Thr Cys Cys Thr Gly Thr Cys Cys Cys Thr Cys
8450 8455 8460

Ala Gly Thr Thr Thr Thr Ala Cys Thr Gly Gly Ala Ala Cys Thr
8465 8470 8475

Thr Thr Cys Thr Ala Gly Ala Thr Gly Gly Cys Ala Ala Gly Gly
8480 8485 8490

Ala Thr Thr Thr Thr Ala Ala Ala Ala Ala Ala Thr Thr Thr Ala
8495 8500 8505

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Ala Ala  Cys Ala Thr Thr Ala  Cys Cys Cys Ala Gly  Thr Ala Gly
    8510                 8515                 8520

Thr Cys  Cys Thr Thr Thr Gly  Cys Thr Cys Thr Cys  Thr Thr Thr
    8525                 8530                 8535

Thr Cys  Thr Ala Cys Thr Cys  Thr Gly Ala Gly Gly  Ala Cys Thr
    8540                 8545                 8550

Gly Ala  Gly Ala Cys Thr Gly  Ala Cys Thr Thr Thr  Ala Gly Gly
    8555                 8560                 8565

Cys Ala  Cys Thr Cys Cys Ala  Gly Ala Ala Thr Thr  Cys Cys Cys
    8570                 8575                 8580

Thr Gly  Gly Ala Cys Thr Cys  Ala Ala Ala Thr Gly  Ala Ala Thr
    8585                 8590                 8595

Gly Ala  Cys Cys Ala Thr Gly  Cys Thr Gly Ala Gly  Gly Cys Cys
    8600                 8605                 8610

Cys Ala  Thr Gly Ala Ala Gly  Ala Gly Gly Thr Thr  Cys Gly Ala
    8615                 8620                 8625

Thr Gly  Thr Gly Thr Ala Thr  Thr Gly Thr Thr Gly  Ala Ala Thr
    8630                 8635                 8640

Gly Ala  Gly Cys Thr Ala Gly  Ala Ala Cys Thr Thr  Thr Ala Ala
    8645                 8650                 8655

Ala Thr  Ala Ala Ala Thr Ala  Ala Gly Cys Ala Thr  Ala Thr Ala
    8660                 8665                 8670

Cys Ala  Cys Thr Thr Cys Ala  Gly Cys Ala Thr Gly  Ala Ala Gly
    8675                 8680                 8685

Thr Gly  Cys Gly Cys Ala Gly  Ala Gly Cys Ala Gly  Ala Thr Ala
    8690                 8695                 8700

Ala Gly  Thr Thr Gly Ala Ala  Cys Gly Thr Ala Gly  Cys Ala Thr
    8705                 8710                 8715

Cys Ala  Cys Thr Gly Thr Gly  Gly Thr Thr Cys Cys  Thr Thr Cys
    8720                 8725                 8730

Thr Gly  Thr Gly Gly Ala Cys  Ala Cys Cys Thr Thr  Thr Cys Ala
    8735                 8740                 8745

Cys Ala  Thr Thr Ala Thr Thr  Cys Ala Ala Ala Gly  Gly Ala Ala
    8750                 8755                 8760

Gly Cys  Ala Ala Thr Ala Ala  Ala Gly Gly Thr Ala  Ala Ala Ala
    8765                 8770                 8775

Cys Ala  Cys Ala Ala Thr Cys  Ala Thr Thr Thr Cys  Ala Thr Thr
    8780                 8785                 8790

Ala Gly  Gly Ala Thr Thr Ala  Ala Thr Thr Thr Thr  Thr Ala Thr
    8795                 8800                 8805

Thr Gly  Thr Gly Gly Ala Ala  Gly Thr Thr Thr Thr  Thr Cys Thr
    8810                 8815                 8820

Thr Thr  Thr Cys Ala Gly Cys  Thr Ala Ala Thr Gly  Ala Ala Thr
    8825                 8830                 8835

Ala Ala  Cys Ala Thr Gly Thr  Cys Ala Ala Cys Ala  Thr Thr Thr
    8840                 8845                 8850

Cys Thr  Ala Gly Cys Cys Ala  Ala Thr Thr Thr Cys  Ala Gly Ala
    8855                 8860                 8865

Ala Cys  Thr Ala Gly Cys Thr  Gly Thr Ala Ala Thr  Cys Thr Thr
    8870                 8875                 8880

Thr Thr  Ala Ala Thr Thr Ala  Ala Ala Ala Ala Cys  Cys Ala Thr
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    8885                8890                8895

Ala Gly  Ala Thr Cys Thr Gly  Ala Gly Ala Gly Thr  Thr Cys Ala
    8900                8905                8910

Thr Ala  Cys Thr Thr Gly Ala  Gly Thr Cys Ala Thr  Ala Thr Thr
    8915                8920                8925

Thr Ala  Ala Thr Cys Cys Thr  Thr Ala Ala Ala Thr  Cys Cys Cys
    8930                8935                8940

Thr Thr  Thr Cys Thr Thr Thr  Cys Cys Cys Thr Cys  Thr Gly Thr
    8945                8950                8955

Cys Thr  Cys Thr Thr Thr Cys  Thr Cys Thr Cys Thr  Thr Thr Cys
    8960                8965                8970

Thr Ala  Ala Ala Ala Gly Cys  Thr Gly Thr Gly Ala  Ala Thr Cys
    8975                8980                8985

Ala Thr  Thr Thr Thr Ala Thr  Ala Ala Ala Thr Thr  Ala Gly Gly
    8990                8995                9000

Ala Thr  Thr Ala Ala Gly Ala  Ala Cys Thr Gly Thr  Cys Thr Gly
    9005                9010                9015

Gly Thr  Ala Cys Cys Ala Thr  Thr Gly Thr Thr Ala  Ala Thr Ala
    9020                9025                9030

Thr Cys  Cys Cys Thr Thr Thr  Thr Gly Gly Cys Thr  Gly Thr Gly
    9035                9040                9045

Ala Gly  Gly Ala Ala Ala Thr  Gly Gly Cys Ala Cys  Ala Ala Ala
    9050                9055                9060

Thr Ala  Ala Thr Thr Thr Cys  Ala Thr Cys Cys Thr  Ala Ala Thr
    9065                9070                9075

Ala Thr  Thr Cys Ala Thr Thr  Cys Ala Gly Ala Thr  Thr Thr Ala
    9080                9085                9090

Thr Gly  Ala Gly Cys Cys Ala  Gly Thr Ala Thr Thr  Cys Ala Thr
    9095                9100                9105

Cys Ala  Cys Ala Ala Cys Ala  Ala Thr Cys Thr Thr  Ala Ala Ala
    9110                9115                9120

Ala Cys  Thr Cys Thr Thr Gly  Ala Ala Ala Gly Gly  Ala Thr Ala
    9125                9130                9135

Gly Ala  Ala Ala Cys Thr Gly  Thr Ala Thr Gly Ala  Cys Ala Ala
    9140                9145                9150

Ala Gly  Thr Gly Ala Gly Thr  Cys Ala Thr Ala Gly  Thr Cys Thr
    9155                9160                9165

Thr Thr  Gly Thr Gly Ala Thr  Gly Thr Gly Ala Thr  Gly Thr Cys
    9170                9175                9180

Thr Gly  Cys Ala Ala Gly Gly  Gly Thr Gly Gly Gly  Thr Gly Gly
    9185                9190                9195

Gly Ala  Gly Ala Gly Ala Cys  Thr Ala Cys Thr Gly  Ala Ala Thr
    9200                9205                9210

Gly Ala  Cys Cys Ala Gly Thr  Cys Thr Cys Ala Thr  Thr Cys Thr
    9215                9220                9225

Gly Cys  Thr Thr Thr Cys Thr  Gly Ala Gly Cys Thr  Gly Ala Ala
    9230                9235                9240

Thr Cys  Ala Thr Thr Thr Thr  Gly Cys Ala Ala Ala  Thr Ala Gly
    9245                9250                9255

Ala Ala  Ala Ala Cys Ala Ala  Thr Thr Cys Ala Thr  Ala Gly Ala
    9260                9265                9270
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Thr Thr Thr Ala Thr Ala Gly Ala Thr Gly Gly Thr Cys Ala Thr
9275 9280 9285

Ala Ala Cys Ala Thr Ala Ala Ala Thr Ala Gly Gly Ala Ala Ala
9290 9295 9300

Thr Gly Gly Ala Ala Gly Ala Gly Ala Gly Thr Ala Ala Cys Ala
9305 9310 9315

Gly Ala Gly Thr Cys Ala Ala Ala Thr Ala Ala Thr Ala Cys Cys
9320 9325 9330

Thr Cys Thr Ala Thr Thr Thr Ala Ala Ala Ala Ala Ala Thr Thr
9335 9340 9345

Ala Cys Thr Thr Thr Thr Thr Gly Ala Ala Ala Cys Ala Thr Ala
9350 9355 9360

Ala Cys Ala Cys Thr Thr Gly Ala Thr Gly Ala Ala Cys Ala Gly
9365 9370 9375

Thr Cys Thr Thr Thr Ala Thr Thr Thr Thr Gly Ala Ala Thr Thr
9380 9385 9390

Ala Gly Ala Ala Ala Thr Gly Ala Ala Ala Thr Thr Ala Ala Thr
9395 9400 9405

Cys Thr Ala Cys Thr Gly Cys Cys Thr Ala Ala Thr Ala Ala Thr
9410 9415 9420

Ala Cys Ala Thr Ala Thr Ala Thr Thr Thr Thr Gly Ala Thr Ala
9425 9430 9435

Cys Thr Thr Gly Cys Thr Gly Thr Ala Thr Gly Thr Cys Thr Thr
9440 9445 9450

Thr Ala Thr Ala Thr Ala Thr Thr Thr Thr Cys Ala Thr Thr Thr
9455 9460 9465

Thr Thr Thr Cys Cys Thr Ala Thr Thr Gly Gly Thr Thr Ala Thr
9470 9475 9480

Gly Thr Thr Thr Cys Thr Thr Thr Thr Ala Ala Ala Ala Ala Ala
9485 9490 9495

Thr Thr Cys Thr Cys Thr Cys Ala Thr Gly Thr Ala Ala Thr Thr
9500 9505 9510

Thr Gly Ala Cys Cys Thr Thr Thr Ala Thr Cys Thr Thr Cys Ala
9515 9520 9525

Thr Ala Gly Cys Thr Ala Thr Thr Thr Cys Thr Ala Gly Cys Thr
9530 9535 9540

Thr Thr Gly Gly Cys Thr Thr Gly Thr Thr Thr Gly Ala Cys Ala
9545 9550 9555

Ala Thr Thr Gly Cys Gly Thr Gly Thr Gly Thr Gly Thr Thr Thr
9560 9565 9570

Gly Thr Gly Thr Gly Thr Gly Gly Ala Gly Ala Ala Gly Gly Ala
9575 9580 9585

Gly Gly Gly Gly Ala Cys Thr Ala Cys Thr Thr Gly Thr Ala Thr
9590 9595 9600

Gly Gly Ala Ala Ala Cys Thr Thr Gly Ala Gly Ala Gly Ala Ala
9605 9610 9615

Gly Ala Ala Gly Gly Thr Cys Cys Cys Thr Thr Thr Cys Cys Thr
9620 9625 9630

Cys Thr Thr Gly Ala Ala Ala Ala Thr Thr Cys Thr Thr Ala Ala
9635 9640 9645

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Thr Ala  Gly Thr Ala Thr Ala  Ala Thr Cys Cys Thr  Gly Cys Ala
    9650                 9655                 9660

Thr Thr  Thr Thr Gly Cys Ala  Thr Gly Gly Thr Cys  Gly Gly Thr
    9665                 9670                 9675

Cys Thr  Cys Cys Thr Thr Thr  Thr Gly Thr Thr Ala  Cys Thr Thr
    9680                 9685                 9690

Thr Thr  Cys Ala Thr Cys Thr  Thr Ala Cys Thr Ala  Gly Ala Ala
    9695                 9700                 9705

Thr Thr  Ala Gly Cys Ala Ala  Thr Ala Thr Gly Gly  Ala Gly Ala
    9710                 9715                 9720

Gly Thr  Cys Thr Thr Thr Cys  Thr Cys Thr Gly Ala  Gly Thr Cys
    9725                 9730                 9735

Ala Gly  Ala Thr Thr Thr Ala  Ala Cys Cys Thr Thr  Thr Ala Ala
    9740                 9745                 9750

Thr Cys  Thr Thr Thr Ala Ala  Ala Thr Gly Thr Ala  Ala Gly Ala
    9755                 9760                 9765

Thr Thr  Gly Ala Thr Thr Thr  Ala Cys Cys Thr Thr  Ala Thr Thr
    9770                 9775                 9780

Thr Cys  Cys Thr Thr Ala Thr  Thr Thr Thr Cys Thr  Thr Thr Gly
    9785                 9790                 9795

Ala Gly  Ala Cys Ala Ala Ala  Gly Thr Ala Thr Thr  Thr Gly Thr
    9800                 9805                 9810

Cys Ala  Ala Ala Ala Cys Ala  Ala Thr Thr Ala Thr  Ala Thr Gly
    9815                 9820                 9825

Ala Ala  Ala Ala Gly Thr Ala  Ala Ala Cys Thr Ala  Thr Thr Cys
    9830                 9835                 9840

Thr Ala  Gly Thr Thr Thr Gly  Ala Gly Thr Gly Thr  Gly Thr Thr
    9845                 9850                 9855

Thr Cys  Thr Thr Gly Ala Gly  Thr Thr Thr Thr Ala  Gly Ala Ala
    9860                 9865                 9870

Cys Thr  Thr Thr Ala Gly Gly  Ala Cys Thr Cys Thr  Thr Cys Thr
    9875                 9880                 9885

Thr Ala  Cys Ala Thr Thr Cys  Thr Thr Ala Thr Ala  Thr Thr Thr
    9890                 9895                 9900

Ala Thr  Cys Cys Ala Thr Thr  Ala Ala Ala Cys Thr  Cys Ala Ala
    9905                 9910                 9915

Cys Ala  Ala Thr Thr Thr Ala  Gly Thr Ala Ala Gly  Gly Gly Gly
    9920                 9925                 9930

Gly Ala  Thr Ala Thr Ala Ala  Thr Ala Cys Ala Ala  Ala Thr Ala
    9935                 9940                 9945

Ala Ala  Ala Thr Thr Gly Gly  Gly Ala Ala Gly Cys  Thr Ala Ala
    9950                 9955                 9960

Thr Thr  Thr Thr Thr Cys Thr  Ala Ala Cys Thr Gly  Gly Thr Thr
    9965                 9970                 9975

Thr Ala  Gly Thr Ala Gly Ala  Gly Gly Ala Cys Ala  Gly Thr Ala
    9980                 9985                 9990

Gly Thr  Ala Thr Ala Thr Gly   Ala Ala Gly Ala Ala   Gly Ala Cys
    9995                 10000                10005

Ala Thr   Ala Thr Ala Thr Thr   Ala Cys Ala Thr Thr   Thr Ala Ala
    10010                 10015                 10020

Thr Ala   Cys Ala Ala Cys Gly   Thr Gly Thr Thr Gly   Gly Ala Thr
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    10025               10030               10035

Thr Ala Ala Ala Ala Ala Ala Thr Ala Gly Thr Thr Ala Cys Ala
    10040               10045               10050

Gly Cys Ala Ala Thr Ala Cys Cys Thr Thr Cys Ala Gly Cys Thr
    10055               10060               10065

Gly Thr Thr Ala Cys Ala Ala Gly Gly Thr Gly Gly Gly Ala Ala
    10070               10075               10080

Ala Ala Gly Thr Ala Ala Gly Gly Cys Gly Cys Ala Gly Ala Thr
    10085               10090               10095

Thr Ala Thr Thr Thr Thr Gly Gly Ala Gly Gly Gly Ala Ala Gly
    10100               10105               10110

Gly Thr Ala Thr Thr Ala Ala Ala Ala Cys Cys Ala Thr Gly Ala
    10115               10120               10125

Cys Gly Thr Gly Thr Thr Gly Ala Thr Gly Gly Gly Ala Thr Cys
    10130               10135               10140

Thr Gly Thr Cys Cys Ala Gly Cys Cys Thr Gly Ala Gly Cys Cys
    10145               10150               10155

Ala Gly Ala Cys Ala Cys Cys Ala Ala Ala Gly Cys Ala Gly Gly
    10160               10165               10170

Thr Thr Cys Cys Ala Thr Gly Gly Cys Ala Ala Cys Thr Thr Gly
    10175               10180               10185

Gly Cys Cys Ala Cys Gly Thr Cys Cys Cys Thr Gly Cys Gly Cys
    10190               10195               10200

Cys Thr Thr Thr Ala Ala Ala Gly Ala Gly Gly Ala Ala Gly Gly
    10205               10210               10215

Gly Cys Cys Thr Ala Thr Thr Gly Thr Thr Thr Gly Gly Cys Cys
    10220               10225               10230

Thr Thr Cys Ala Cys Cys Ala Ala Ala Thr Gly Ala Cys Thr Thr
    10235               10240               10245

Cys Ala Cys Cys Thr Gly Gly Gly Ala Thr Cys Thr Thr Gly Thr
    10250               10255               10260

Thr Ala Thr Thr Thr Ala Cys Thr Gly Ala Ala Thr Gly Thr Thr
    10265               10270               10275

Thr Thr Thr Thr Gly Ala Ala Thr Gly Gly Ala Thr Gly Gly Ala
    10280               10285               10290

Thr Gly Ala Ala Ala Thr Thr Cys Cys Thr Gly Ala Gly Ala Ala
    10295               10300               10305

Cys Ala Thr Gly Cys Thr Cys Thr Gly Gly Gly Cys Cys Ala Gly
    10310               10315               10320

Cys Thr Thr Thr Ala Thr Gly Ala Ala Cys Ala Gly Thr Ala Thr
    10325               10330               10335

Gly Thr Thr Thr Ala Ala Thr Cys Thr Thr Ala Thr Thr Gly Thr
    10340               10345               10350

Ala Gly Thr Cys Thr Thr Ala Thr Gly Ala Ala Ala Gly Ala Ala
    10355               10360               10365

Gly Thr Gly Thr Thr Ala Thr Thr Thr Thr Cys Ala Thr Cys Thr
    10370               10375               10380

Thr Ala Cys Ala Gly Ala Thr Ala Gly Gly Gly Ala Thr Ala Gly
    10385               10390               10395

Ala Gly Thr Thr Thr Thr Thr Gly Cys Thr Ala Thr Thr Gly Gly
    10400               10405               10410
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Cys Thr  Thr Thr Thr Cys Ala  Ala Ala Cys Cys Ala  Thr Gly Gly
    10415                10420                10425

Thr Cys  Thr Cys Thr Thr Thr  Gly Thr Gly Ala Thr  Thr Gly Thr
    10430                10435                10440

Ala Ala  Gly Thr Ala Ala Thr  Thr Ala Ala Thr Thr  Gly Thr Gly
    10445                10450                10455

Thr Cys  Thr Thr Cys Cys Ala  Gly Ala Thr Thr Thr  Gly Thr Thr
    10460                10465                10470

Ala Gly  Thr Gly Thr Thr Thr  Ala Gly Ala Ala Thr  Ala Cys Ala
    10475                10480                10485

Gly Thr  Thr Cys Ala Thr Gly  Gly Cys Cys Ala Gly  Ala Ala Thr
    10490                10495                10500

Thr Thr  Cys Ala Gly Ala Thr  Gly Gly Ala Cys Gly  Gly Thr Gly
    10505                10510                10515

Thr Gly  Gly Cys Ala Thr Ala  Ala Ala Thr Thr Thr  Gly Ala Ala
    10520                10525                10530

Cys Ala  Gly Ala Ala Ala Thr  Ala Gly Thr Gly Ala  Thr Thr Thr
    10535                10540                10545

Thr Thr  Ala Ala Ala Ala Ala  Thr Ala Gly Thr Thr  Thr Ala Ala
    10550                10555                10560

Ala Cys  Thr Thr Cys Cys Cys  Ala Gly Ala Gly Cys  Cys Thr Thr
    10565                10570                10575

Thr Ala  Cys Thr Gly Thr Gly  Cys Thr Cys Ala Gly  Cys Ala Ala
    10580                10585                10590

Ala Gly  Thr Thr Ala Gly Thr  Cys Thr Cys Thr Cys  Ala Thr Cys
    10595                10600                10605

Thr Thr  Thr Thr Cys Thr Thr  Cys Thr Ala Cys Cys  Cys Cys Thr
    10610                10615                10620

Thr Thr  Ala Thr Thr Gly Cys  Ala Thr Cys Cys Thr  Thr Thr Thr
    10625                10630                10635

Thr Thr  Ala Thr Thr Thr Ala  Gly Ala Ala Ala Ala  Thr Ala Thr
    10640                10645                10650

Thr Thr  Gly Thr Cys Ala Thr  Gly Ala Ala Thr Thr  Ala Ala Thr
    10655                10660                10665

Ala Cys  Gly Ala Ala Ala Cys  Ala Ala Thr Thr Cys  Thr Thr Thr
    10670                10675                10680

Ala Ala  Thr Ala Thr Thr Thr  Thr Ala Gly Gly Gly  Ala Thr Thr
    10685                10690                10695

Gly Cys  Thr Thr Thr Cys Thr  Gly Ala Ala Gly Ala  Ala Cys Thr
    10700                10705                10710

Cys Ala  Ala Ala Gly Ala Thr  Thr Thr Thr Thr Ala  Ala Ala Ala
    10715                10720                10725

Gly Gly  Cys Ala Thr Ala Thr  Thr Thr Ala Ala Ala  Ala Ala Thr
    10730                10735                10740

Thr Ala  Ala Gly Ala Gly Cys  Ala Gly Gly Ala Cys  Ala Thr Ala
    10745                10750                10755

Ala Thr  Thr Ala Ala Gly Ala  Ala Thr Ala Ala Ala  Thr Ala Cys
    10760                10765                10770

Cys Ala  Thr Ala Thr Ala Ala  Gly Ala Ala Thr Gly  Gly Gly Ala
    10775                10780                10785
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Thr Ala  Ala Ala Cys Cys Thr  Cys Ala Ala Ala Gly  Ala Thr Ala
    10790                10795                10800

Gly Ala  Gly Thr Cys Thr Gly  Thr Ala Ala Ala Gly  Ala Thr Gly
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Cys Ala  Gly Ala Ala Thr Ala  Ala Gly Cys Thr Ala  Ala Gly Gly
    10820                10825                10830

Cys Ala  Thr Gly Cys Ala Gly  Ala Ala Ala Ala Thr  Ala Cys Ala
    10835                10840                10845

Ala Ala  Gly Ala Gly Ala Ala  Thr Gly Ala Thr Thr  Ala Ala Ala
    10850                10855                10860

Ala Gly  Gly Ala Thr Gly Thr  Thr Thr Ala Ala Ala  Ala Ala Gly
    10865                10870                10875

Thr Thr  Ala Gly Thr Thr Ala  Gly Gly Cys Cys Cys  Thr Thr Thr
    10880                10885                10890

Cys Ala  Ala Gly Gly Ala Ala  Ala Thr Thr Thr Gly  Ala Gly Ala
    10895                10900                10905

Thr Ala  Gly Gly Cys Thr Cys  Ala Cys Thr Ala Thr  Thr Thr Ala
    10910                10915                10920

Ala Gly  Gly Ala Cys Ala Thr  Ala Gly Thr Gly Thr  Ala Ala Gly
    10925                10930                10935

Ala Thr  Gly Ala Ala Ala Ala  Gly Ala Ala Ala Ala  Ala Ala Ala
    10940                10945                10950

Thr Thr  Thr Ala Gly Ala Ala  Ala Ala Ala Ala Ala  Ala Gly Cys
    10955                10960                10965

Ala Gly  Ala Thr Gly Gly Ala  Cys Cys Thr Gly Gly  Gly Cys Cys
    10970                10975                10980

Thr Ala  Thr Thr Thr Thr Ala  Thr Gly Thr Thr Ala  Ala Thr Gly
    10985                10990                10995

Thr Thr  Ala Ala Thr Cys Thr  Thr Cys Thr Thr Cys  Thr Cys Cys
    11000                11005                11010

Ala Ala  Gly Thr Gly Ala Gly  Ala Thr Thr Gly Thr  Cys Ala Ala
    11015                11020                11025

Thr Cys  Ala Ala Thr Ala Ala  Thr Thr Gly Thr Cys  Thr Gly Ala
    11030                11035                11040

Gly Thr  Gly Thr Cys Thr Cys  Ala Thr Thr Gly Ala  Gly Ala Ala
    11045                11050                11055

Ala Ala  Thr Ala Ala Ala Gly  Ala Cys Cys Ala Ala  Gly Gly Thr
    11060                11065                11070

Ala Gly  Ala Cys Ala Ala Ala  Gly Ala Gly Ala Thr  Ala Cys Ala
    11075                11080                11085

Ala Ala  Gly Ala Ala Ala Gly  Cys Ala Cys Thr Thr  Ala Gly Cys
    11090                11095                11100

Cys Ala  Gly Ala Cys Ala Cys  Ala Thr Cys Thr Ala  Gly Ala Ala
    11105                11110                11115

Ala Thr  Gly Thr Gly Thr Thr  Thr Ala Thr Ala Ala  Thr Gly Ala
    11120                11125                11130

Ala Ala  Cys Thr Cys Cys Thr  Cys Thr Thr Thr Cys  Cys Thr Thr
    11135                11140                11145

Gly Ala  Ala Ala Thr Cys Ala  Cys Thr Thr Gly Thr  Cys Cys Cys
    11150                11155                11160

Cys Cys  Thr Thr Thr Thr Thr  Thr Gly Ala Cys Cys  Cys Cys Cys
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    11165               11170               11175

Thr Gly Thr Ala Thr Thr Thr Thr Ala Ala Ala Ala Thr Ala Thr
    11180               11185               11190

Ala Ala Ala Ala Thr Ala Thr Thr Thr Ala Ala Cys Thr Thr Thr
    11195               11200               11205

Gly Thr Ala Ala Ala Thr Thr Thr Cys Thr Thr Gly Cys Cys Ala
    11210               11215               11220

Ala Cys Cys Ala Gly Cys Cys Cys Ala Thr Cys Thr Cys Gly Cys
    11225               11230               11235

Ala Gly Ala Gly Thr Ala Cys Ala Thr Thr Thr Cys Thr Ala Cys
    11240               11245               11250

Thr Cys Thr Thr Cys Ala Thr Cys Cys Cys Cys Thr Cys Ala Gly
    11255               11260               11265

Thr Cys Thr Thr Cys Ala Cys Ala Thr Cys Cys Gly Thr Cys Thr
    11270               11275               11280

Cys Ala Gly Gly Cys Thr Cys Thr Gly Thr Gly Thr Thr Thr Thr
    11285               11290               11295

Cys Ala Gly Thr Thr Cys Thr Gly Cys Thr Gly Thr Gly Thr Cys
    11300               11305               11310

Cys Thr Thr Cys Ala Thr Ala Cys Thr Cys Ala Cys Gly Gly Gly
    11315               11320               11325

Gly Gly Thr Cys Thr Cys Thr Gly Cys Ala Thr Thr Gly Thr Thr
    11330               11335               11340

Gly Cys Cys Ala Cys Ala Gly Cys Thr Gly Cys Thr Cys Thr Cys
    11345               11350               11355

Gly Thr Thr Cys Gly Gly Thr Cys Cys Cys Thr Gly Ala Cys Thr
    11360               11365               11370

Gly Thr Thr Gly Cys Ala Ala Cys Thr Gly Cys Cys Thr Thr Cys
    11375               11380               11385

Thr Ala Cys Cys Thr Gly Ala Thr Cys Cys Cys Ala Thr Cys Thr
    11390               11395               11400

Gly Thr Ala Thr Cys Ala Gly Thr Thr Thr Gly Cys Thr Ala Gly
    11405               11410               11415

Gly Gly Cys Thr Gly Cys Cys Ala Thr Ala Ala Cys Ala Gly Ala
    11420               11425               11430

Thr Thr Ala Cys Cys Gly Thr Ala Gly Ala Cys Thr Gly Ala Gly
    11435               11440               11445

Thr Gly Gly Cys Thr Cys Ala Ala Ala Cys Ala Ala Cys Ala Gly
    11450               11455               11460

Ala Ala Ala Thr Thr Gly Ala Thr Thr Thr Thr Cys Thr Cys Ala
    11465               11470               11475

Thr Ala Gly Thr Thr Cys Thr Gly Thr Ala Gly Ala Cys Thr Ala
    11480               11485               11490

Gly Ala Ala Gly Thr Cys Cys Ala Ala Gly Ala Thr Ala Cys Ala
    11495               11500               11505

Gly Cys Thr Gly Thr Cys Thr Gly Cys Ala Thr Gly Thr Cys Thr
    11510               11515               11520

Gly Gly Thr Cys Thr Thr Thr Cys Thr Gly Cys Gly Gly Cys Cys
    11525               11530               11535

Thr Cys Thr Thr Cys Gly Gly Gly Gly Thr Thr Thr Gly Cys Ala
    11540               11545               11550
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Gly Cys  Ala Gly Cys Cys Ala  Cys Cys Thr Thr Ala  Cys Ala Cys
    11555                11560                11565

Ala Thr  Gly Gly Thr Cys Ala  Cys Cys Thr Cys Thr  Cys Thr Gly
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Thr Gly  Cys Ala Cys Ala Cys  Ala Thr Cys Cys Thr  Gly Ala Thr
    11585                11590                11595

Cys Thr  Cys Thr Thr Cys Thr  Thr Cys Thr Thr Gly  Thr Ala Ala
    11600                11605                11610

Gly Gly  Gly Cys Ala Cys Cys  Ala Thr Thr Cys Ala  Gly Ala Thr
    11615                11620                11625

Thr Thr  Gly Gly Thr Thr Ala  Gly Gly Gly Cys Cys  Cys Ala Cys
    11630                11635                11640

Thr Cys  Thr Ala Gly Thr Ala  Ala Cys Ala Gly Cys  Cys Cys Cys
    11645                11650                11655

Ala Thr  Thr Thr Thr Gly Ala  Cys Thr Thr Ala Ala  Thr Cys Cys
    11660                11665                11670

Thr Thr  Cys Thr Thr Thr Ala  Gly Ala Gly Gly Cys  Cys Cys Cys
    11675                11680                11685

Ala Thr  Cys Thr Cys Cys Ala  Ala Ala Thr Ala Gly  Thr Ala Ala
    11690                11695                11700

Thr Thr  Thr Thr Cys Thr Gly  Ala Gly Gly Thr Ala  Cys Thr Gly
    11705                11710                11715

Gly Gly  Gly Cys Thr Thr Cys  Ala Gly Gly Cys Thr  Thr Cys Ala
    11720                11725                11730

Gly Thr  Gly Thr Ala Thr Gly  Ala Ala Thr Thr Thr  Gly Gly Gly
    11735                11740                11745

Gly Thr  Gly Gly Gly Gly Gly  Thr Ala Cys Ala Gly  Thr Thr Cys
    11750                11755                11760

Ala Gly  Cys Cys Cys Ala Cys  Ala Gly Cys Ala Cys  Cys Ala Gly
    11765                11770                11775

Thr Gly  Ala Gly Thr Cys Ala  Ala Cys Thr Gly Gly  Ala Thr Ala
    11780                11785                11790

Thr Thr  Gly Thr Thr Cys Cys  Thr Thr Gly Gly Cys  Ala Gly Ala
    11795                11800                11805

Gly Thr  Ala Thr Cys Thr Thr  Thr Cys Cys Ala Gly  Ala Gly Ala
    11810                11815                11820

Gly Cys  Ala Gly Cys Thr Cys  Thr Gly Ala Thr Cys  Thr Thr Gly
    11825                11830                11835

Thr Thr  Ala Thr Cys Cys Cys  Thr Cys Thr Ala Thr  Thr Thr Ala
    11840                11845                11850

Gly Ala  Ala Ala Ala Ala Cys  Thr Thr Cys Ala Thr  Gly Gly Ala
    11855                11860                11865

Cys Ala  Gly Thr Cys Thr Ala  Gly Thr Cys Cys Cys  Cys Thr Gly
    11870                11875                11880

Gly Thr  Thr Cys Cys Cys Ala  Cys Ala Thr Thr Gly  Cys Thr Thr
    11885                11890                11895

Ala Cys  Ala Gly Ala Thr Gly  Thr Gly Gly Gly Cys  Ala Cys Thr
    11900                11905                11910

Gly Thr  Ala Gly Ala Ala Ala  Gly Thr Cys Thr Ala  Thr Gly Ala
    11915                11920                11925
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Gly Ala Ala Thr Thr Ala Cys Ala Gly Ala Gly Ala Ala Thr Ala
11930 11935 11940

Gly Gly Ala Ala Gly Thr Thr Ala Cys Cys Ala Gly Cys Ala Gly
11945 11950 11955

Ala Thr Gly Ala Gly Thr Gly Ala Thr Thr Gly Thr Cys Thr Thr
11960 11965 11970

Ala Thr Ala Thr Ala Thr Cys Ala Gly Ala Ala Ala Gly Thr Gly
11975 11980 11985

Gly Gly Ala Thr Ala Ala Ala Gly Gly Thr Ala Thr Thr Thr Thr
11990 11995 12000

Cys Thr Gly Gly Ala Ala Ala Cys Thr Cys Thr Ala Gly Ala Thr
12005 12010 12015

Ala Gly Cys Thr Ala Gly Gly Ala Ala Gly Cys Cys Thr Gly Ala
12020 12025 12030

Thr Gly Thr Ala Gly Gly Thr Cys Cys Thr Thr Gly Ala Ala Ala
12035 12040 12045

Ala Ala Ala Ala Thr Cys Cys Ala Ala Gly Gly Gly Ala Cys Thr
12050 12055 12060

Thr Gly Ala Gly Ala Ala Thr Ala Cys Gly Gly Ala Gly Ala Ala
12065 12070 12075

Ala Ala Gly Ala Ala Gly Ala Thr Ala Ala Cys Ala Thr Ala Gly
12080 12085 12090

Ala Ala Ala Ala Thr Ala Gly Thr Ala Ala Ala Thr Ala Gly Gly
12095 12100 12105

Cys Thr Cys Gly
12110

<210> SEQ ID NO 7
<211> LENGTH: 1621
<212> TYPE: PRT
<213> ORGANISM: bovine

<400> SEQUENCE: 7

Gly Gly Cys Thr Cys Ala Gly Cys Gly Thr Cys Cys Cys Thr Cys Cys
1 5 10 15

Cys Cys Thr Cys Cys Cys Gly Cys Ala Gly Gly Gly Gly Cys Ala Gly
20 25 30

Thr Gly Ala Cys Ala Cys Cys Cys Thr Gly Ala Gly Cys Thr Gly Thr
35 40 45

Cys Cys Thr Gly Gly Gly Gly Ala Cys Cys Cys Thr Gly Ala Gly Gly
50 55 60

Gly Ala Gly Gly Cys Ala Gly Ala Gly Ala Gly Cys Cys Ala Gly Gly
65 70 75 80

Ala Gly Gly Ala Gly Ala Gly Cys Gly Gly Gly Ala Cys Cys Cys Ala
85 90 95

Gly Cys Ala Gly Ala Gly Cys Ala Gly Gly Ala Gly Gly Cys Cys Cys
100 105 110

Gly Gly Gly Cys Cys Thr Thr Cys Thr Thr Cys Cys Thr Cys Ala Thr
115 120 125

Gly Gly Gly Gly Cys Cys Thr Gly Ala Gly Gly Gly Gly Gly Ala Gly
130 135 140

Ala Gly Thr Cys Gly Gly Thr Cys Thr Gly Gly Gly Ala Gly Gly Ala
145 150 155 160

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Gly Gly Ala Gly Gly Cys Cys Cys Thr Gly Cys Ala Gly Gly Gly Cys
                165                 170                 175

Thr Gly Thr Thr Cys Thr Gly Ala Gly Ala Gly Cys Cys Cys Ala Gly
            180                 185                 190

Ala Ala Gly Gly Gly Cys Cys Gly Gly Cys Thr Gly Ala Gly Cys Cys
        195                 200                 205

Ala Cys Cys Gly Cys Cys Cys Gly Ala Cys Cys Cys Thr Cys Ala Gly
    210                 215                 220

Gly Ala Gly Cys Thr Gly Gly Cys Cys Gly Ala Gly Ala Ala Gly Cys
225                 230                 235                 240

Ala Cys Cys Ala Gly Ala Ala Gly Ala Cys Cys Cys Thr Gly Cys Ala
                245                 250                 255

Gly Cys Thr Gly Cys Thr Gly Cys Gly Gly Ala Ala Gly Cys Ala Gly
            260                 265                 270

Cys Ala Gly Ala Cys Cys Ala Thr Cys Ala Thr Cys Cys Thr Gly Gly
        275                 280                 285

Ala Thr Gly Ala Cys Gly Ala Gly Cys Thr Gly Ala Thr Cys Cys Ala
    290                 295                 300

Gly Thr Gly Gly Ala Ala Gly Cys Gly Gly Cys Gly Gly Cys Ala Gly
305                 310                 315                 320

Cys Ala Gly Cys Thr Gly Gly Cys Gly Gly Gly Gly Ala Ala Cys Gly
                325                 330                 335

Gly Ala Gly Gly Gly Cys Cys Cys Cys Cys Cys Gly Ala Gly Gly Gly
            340                 345                 350

Cys Ala Gly Cys Cys Thr Gly Gly Ala Thr Gly Thr Gly Cys Thr Ala
        355                 360                 365

Cys Ala Gly Thr Cys Cys Thr Gly Gly Thr Ala Cys Cys Ala Gly Gly
    370                 375                 380

Gly Gly Thr Gly Gly Gly Gly Gly Gly Cys Gly Gly Gly Gly Ala Gly
385                 390                 395                 400

Gly Gly Gly Cys Ala Gly Gly Cys Ala Gly Cys Ala Gly Ala Gly Thr
                405                 410                 415

Gly Gly Thr Gly Cys Thr Gly Cys Cys Ala Gly Cys Thr Gly Cys Thr
            420                 425                 430

Gly Thr Thr Thr Gly Cys Gly Cys Cys Cys Ala Cys Gly Thr Cys Thr
        435                 440                 445

Ala Cys Ala Thr Gly Ala Gly Cys Ala Gly Cys Thr Gly Gly Cys Thr
    450                 455                 460

Cys Cys Cys Thr Cys Thr Gly Thr Cys Thr Gly Gly Gly Cys Gly Cys
465                 470                 475                 480

Gly Gly Gly Thr Cys Thr Thr Ala Thr Cys Cys Cys Ala Cys Cys Ala
                485                 490                 495

Gly Thr Gly Gly Thr Gly Thr Gly Thr Thr Thr Gly Gly Thr Gly Cys
            500                 505                 510

Thr Gly Ala Cys Ala Cys Cys Gly Gly Thr Gly Thr Cys Cys Cys Thr
        515                 520                 525

Thr Thr Cys Thr Gly Thr Gly Cys Cys Cys Cys Thr Cys Cys Cys
    530                 535                 540

Cys Thr Gly Gly Gly Ala Gly Gly Ala Thr Gly Cys Thr Gly Gly Gly
545                 550                 555                 560
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Gly Thr Gly Gly Gly Gly Cys Cys Ala Gly Gly Thr Gly Gly Cys Ala
                565                 570                 575

Ala Ala Gly Thr Gly Gly Cys Gly Cys Thr Cys Ala Gly Gly Cys Thr
            580                 585                 590

Gly Gly Thr Thr Gly Gly Ala Cys Cys Cys Cys Ala Gly Thr Cys Ala
        595                 600                 605

Gly Thr Gly Thr Cys Gly Cys Thr Cys Cys Thr Cys Cys Thr Gly Gly
    610                 615                 620

Gly Thr Gly Thr Thr Thr Cys Thr Cys Thr Gly Gly Thr Thr Thr Thr
625                 630                 635                 640

Thr Thr Thr Gly Gly Ala Ala Gly Gly Cys Ala Gly Gly Gly Cys Ala
                645                 650                 655

Thr Cys Thr Cys Thr Gly Cys Thr Gly Thr Gly Cys Cys Cys Ala Gly
            660                 665                 670

Thr Gly Cys Ala Cys Ala Gly Gly Cys Gly Ala Gly Gly Thr Gly Gly
        675                 680                 685

Cys Thr Cys Gly Gly Gly Cys Ala Cys Cys Ala Gly Gly Cys Cys Thr
    690                 695                 700

Thr Cys Cys Thr Gly Gly Gly Gly Gly Thr Gly Gly Ala Gly Cys Thr
705                 710                 715                 720

Gly Gly Gly Thr Gly Thr Gly Gly Gly Cys Cys Thr Thr Gly Thr Cys
                725                 730                 735

Cys Cys Cys Gly Cys Cys Thr Gly Gly Gly Cys Gly Cys Cys Thr Gly
            740                 745                 750

Cys Cys Ala Gly Cys Thr Thr Cys Thr Gly Gly Cys Cys Thr Gly Gly
        755                 760                 765

Ala Gly Gly Ala Cys Gly Gly Gly Gly Gly Thr Gly Ala Ala Gly Cys
    770                 775                 780

Cys Cys Gly Thr Gly Thr Cys Cys Thr Thr Cys Cys Cys Thr Thr Gly
785                 790                 795                 800

Gly Gly Cys Cys Cys Thr Gly Gly Gly Gly Cys Thr Cys Gly Gly Gly
                805                 810                 815

Thr Thr Cys Ala Gly Gly Thr Gly Thr Gly Ala Gly Ala Ala Gly Thr
            820                 825                 830

Thr Gly Gly Cys Gly Gly Ala Gly Ala Thr Thr Ala Thr Cys Thr Gly
        835                 840                 845

Gly Cys Ala Gly Ala Ala Cys Cys Gly Gly Cys Ala Gly Cys Ala Gly
    850                 855                 860

Ala Thr Cys Cys Gly Cys Ala Gly Ala Gly Cys Cys Gly Ala Gly Cys
865                 870                 875                 880

Ala Cys Cys Thr Cys Thr Gly Cys Cys Ala Gly Cys Ala Gly Cys Thr
                885                 890                 895

Gly Cys Cys Cys Ala Thr Cys Cys Cys Cys Gly Gly Cys Cys Cys Cys
            900                 905                 910

Gly Thr Gly Gly Ala Gly Gly Ala Gly Ala Thr Gly Cys Thr Gly Gly
        915                 920                 925

Cys Thr Gly Ala Gly Gly Thr Cys Ala Ala Cys Gly Cys Cys Ala Cys
    930                 935                 940

Cys Ala Thr Cys Ala Cys Thr Gly Ala Cys Ala Thr Cys Ala Thr Cys
945                 950                 955                 960

Thr Cys Ala Gly Cys Cys Cys Thr Gly Gly Thr Gly Ala Cys Cys Gly
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                965                 970                 975

Ala Gly Gly Thr Gly Ala Cys Thr Cys Cys Thr Gly Gly Cys Cys Ala
            980                 985                 990

Cys Gly Cys Cys Cys Cys Gly Cys  Thr Cys Cys Cys Ala  Thr Cys Thr
        995                 1000                1005

Gly Gly  Thr Thr Gly Cys Cys  Cys Thr Gly Gly Gly  Thr Thr Gly
    1010                 1015                 1020

Gly Gly  Gly Gly Cys Ala Gly  Cys Ala Gly Gly Gly  Thr Cys Thr
    1025                 1030                 1035

Thr Thr  Gly Cys Ala Gly Ala  Thr Gly Gly Gly Gly  Ala Gly Cys
    1040                 1045                 1050

Thr Cys  Thr Gly Gly Cys Thr  Thr Ala Ala Ala Thr  Cys Cys Thr
    1055                 1060                 1065

Thr Cys  Ala Gly Thr Thr Thr  Cys Thr Gly Cys Cys  Thr Cys Ala
    1070                 1075                 1080

Cys Ala  Cys Cys Cys Thr Cys  Cys Thr Cys Cys Cys  Ala Thr Cys
    1085                 1090                 1095

Cys Cys  Thr Cys Thr Cys Cys  Ala Thr Cys Cys Cys  Cys Thr Gly
    1100                 1105                 1110

Thr Thr  Gly Cys Thr Ala Thr  Gly Gly Cys Cys Thr  Cys Thr Thr
    1115                 1120                 1125

Gly Cys  Thr Gly Thr Cys Gly  Ala Cys Cys Thr Cys  Ala Cys Cys
    1130                 1135                 1140

Cys Ala  Gly Thr Ala Thr Thr  Thr Cys Thr Cys Gly  Thr Gly Gly
    1145                 1150                 1155

Ala Cys  Ala Cys Thr Ala Cys  Ala Cys Gly Gly Gly  Cys Ala Thr
    1160                 1165                 1170

Thr Thr  Gly Thr Cys Thr Cys  Cys Thr Gly Cys Ala  Ala Cys Thr
    1175                 1180                 1185

Cys Cys  Thr Thr Thr Cys Ala  Gly Cys Thr Gly Cys  Thr Gly Ala
    1190                 1195                 1200

Gly Thr  Thr Cys Cys Thr Thr  Thr Thr Ala Cys Thr  Gly Cys Cys
    1205                 1210                 1215

Thr Cys  Cys Cys Thr Thr Cys  Cys Cys Gly Cys Cys  Ala Gly Cys
    1220                 1225                 1230

Thr Cys  Cys Cys Cys Thr Gly  Ala Cys Thr Cys Ala  Cys Ala Gly
    1235                 1240                 1245

Thr Gly  Gly Cys Cys Cys Cys  Ala Gly Gly Gly Ala  Gly Gly Gly
    1250                 1255                 1260

Thr Gly  Gly Ala Cys Thr Gly  Thr Cys Cys Gly Cys  Ala Ala Ala
    1265                 1270                 1275

Cys Cys  Cys Thr Cys Cys Cys  Thr Thr Cys Ala Cys  Cys Thr Gly
    1280                 1285                 1290

Cys Thr  Cys Ala Gly Cys Cys  Thr Gly Gly Thr Gly  Cys Ala Ala
    1295                 1300                 1305

Gly Gly  Cys Ala Gly Cys Cys  Thr Cys Cys Cys Cys  Ala Cys Gly
    1310                 1315                 1320

Thr Gly  Gly Ala Ala Gly Gly  Thr Gly Gly Gly Gly  Cys Cys Ala
    1325                 1330                 1335

Gly Ala  Gly Thr Cys Cys Thr  Gly Thr Cys Cys Cys  Cys Thr Gly
    1340                 1345                 1350
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-continued

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Ala Ala  Gly Thr Gly Thr Cys  Thr Cys Cys Thr Gly  Thr Cys Cys
    1355                1360                1365

Cys Thr  Thr Gly Thr Gly Thr  Cys Thr Cys Cys Gly  Cys Ala Gly
    1370                1375                1380

Cys Ala  Cys Cys Thr Thr Cys  Ala Thr Cys Ala Thr  Cys Gly Ala
    1385                1390                1395

Gly Ala  Ala Gly Cys Ala Gly  Cys Cys Cys Cys Cys  Thr Cys Ala
    1400                1405                1410

Gly Gly  Thr Cys Cys Thr Gly  Ala Ala Gly Ala Cys  Cys Cys Ala
    1415                1420                1425

Gly Ala  Cys Cys Ala Ala Gly  Thr Thr Cys Gly Cys  Gly Gly Cys
    1430                1435                1440

Cys Ala  Cys Cys Gly Thr Gly  Cys Gly Cys Cys Thr  Gly Cys Thr
    1445                1450                1455

Gly Gly  Thr Gly Gly Gly Thr  Gly Gly Gly Ala Ala  Gly Cys Thr
    1460                1465                1470

Gly Ala  Ala Cys Gly Thr Gly  Cys Ala Cys Ala Thr  Gly Ala Ala
    1475                1480                1485

Cys Cys  Cys Cys Cys Cys Cys  Cys Ala Gly Gly Thr  Gly Ala Ala
    1490                1495                1500

Gly Gly  Cys Cys Ala Cys Cys  Ala Thr Cys Ala Thr  Cys Ala Gly
    1505                1510                1515

Cys Gly  Ala Gly Cys Ala Gly  Cys Ala Gly Gly Cys  Cys Ala Ala
    1520                1525                1530

Gly Thr  Cys Ala Cys Thr Gly  Cys Thr Cys Ala Ala  Gly Ala Ala
    1535                1540                1545

Cys Gly  Ala Gly Ala Ala Cys  Ala Cys Cys Cys Gly  Cys Ala Ala
    1550                1555                1560

Gly Thr  Ala Thr Gly Cys Thr  Gly Cys Cys Cys Gly  Cys Thr Cys
    1565                1570                1575

Cys Thr  Thr Cys Ala Thr Cys  Thr Gly Cys Cys Cys  Thr Cys Cys
    1580                1585                1590

Cys Cys  Cys Ala Gly Cys Thr  Cys Ala Gly Cys Cys  Thr Cys Thr
    1595                1600                1605

Gly Cys  Thr Cys Thr Gly Thr  Ala Gly Cys Thr Gly  Gly
    1610                1615                1620
```

What is claimed is:

1. A collection of at least two of isolated polynucleotide molecule species selected from the group consisting of (1) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 1296 of SEQ ID NO:1; (2) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 213 of SEQ ID NO:2; (3) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 8504 of SEQ ID NO:3; (4) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 154963 of SEQ ID NO:4; (5) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 577 of SEQ ID NO:5; (6) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 23 of SEQ ID NO:6; (7) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 11646 of SEQ ID NO:6; and (8) an isolated polynucleotide comprising at least 12 consecutive nucleotides surrounding position of 12195 of SEQ ID NO:7.

2. The collection according to claim **1**, comprising at least three species.

3. The collection of claim **2**, comprising all eight species.

4. The collection of claim **1**, wherein the nucleotide species are on a solid support.

5. The collection of claim **1**, wherein the nucleotide species are arranged in an addressable array.

6. The collection of claim **4**, wherein the nucleotide species are arranged in an array on a solid support.

7. The collection of claim **6**, wherein the array is made of silicon, glass, plastic, or paper.

8. The method of claim **6**, wherein the array is formed into wells on plates, slides, sheets, membranes, fibers, chips, dishes, and beads.

9. The collection of claim **6**, wherein array is treated, coated or derivatized to facilitate the immobilization of the nucleotide molecules.

10. A method for genotyping a bovine cell, comprising obtaining a nucleic acid sample from said cell and determining the identity of the nucleotide of eight SNP positions in the cell, wherein the eight SNP positions are (1) position 1296 of SEQ ID NO:1; (2) position 213 of SEQ ID NO:2; (3) position 8504 of SEQ ID NO:3; (4) position 154963 of SEQ ID NO:4; (5) position 577 of SEQ ID NO:5; (6) position of 23 SEQ ID NO:6; (7) position 11646 of SEQ ID NO:6; and (8) position 12195 of SEQ ID NO:7, the method, comprising

(1) Determining the identity of a nucleotide at each of the eight SNP positions, and

(2) comparing the identity to the nucleotide identity at a corresponding position of in SEQ ID NOs: 1-7, respectively.

11. The method according to claim **10**, wherein the bovine cell is an adult cell, an embryo cell, a sperm, an egg, a fertilized egg, or a zygote.

12. The method according to claim **10**, wherein the identity of the nucleotide is determined by sequencing or a relevant fragment of the respective gene isolated from the cell.

13. A method according to claim **12**, wherein relevant fragment of the respective gene is isolated from the cell via amplification by the polymerase chain reaction (PCR) of genomic DNA of the cell, or by RT-PCR of the mRNA of the cell.

14. A method according to claim **10**, wherein both copies of the respective gene in the cell are genotyped.

15. A method for progeny testing of cattle, the method comprising collecting a nucleic acid sample from said progeny, and genotyping said nucleic sample according to claim **10**.

16. A method for selectively breeding of cattle using a multiple ovulation and embryo transfer procedure (MOET), the method comprising superovulating a female animal, collecting eggs from said superovulated female, in vitro fertilizing said eggs from a suitable male animal, implanting said fertilized eggs into other females allowing for an embryo to develop, and genotyping said developing embryo according to claim **10**, and terminating pregnancy if said developing embryo does not all have a corresponding desired polymorphic nucleotide as shown in Table 1A.

17. A method according to claim **16**, wherein pregnancy is terminated if the embryo is not homozygous with regard to all of the corresponding desired polymorphic nucleotide.

18. A method for selectively breeding dairy cattle, comprising selecting a bull that is homozygous with regard to all desired polymorphic nucleotides as shown in Table 1A and using its semen for fertilizing a female animal.

19. A method according to claim **18**, wherein the female animal is in vitro fertilized.

20. A method according to claim **18**, wherein MOET procedure is used.

21. A method according to claim **18**, wherein said female animal is also homozygous with regard to all desired polymorphic nucleotides as shown in Table 1A.

22. A method for testing a dairy cattle for its fertility, comprising genotyping its cells according to claim **13**, wherein a cattle homozygous with regard to all desired polymorphic nucleotides as shown in Table 1A indicates that the cattle has fertility rate.

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