|  |  |
| --- | --- |
| Design | Sequence |
| **1na0C3\_1****(SEC-MALS)** | **MNIAEAAYRVGNKAYKKGRYELAILAYILAILLDPNNAEAWYNLGNAYYKEGEYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAKQNLGNAKQKQGLEHHHHHH** |
| **1na0C3\_2****(SEC-MALS, SAXS)** | **MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAKQNLGNAKQKQGLEHHHHHH** |
| **2fo7C3\_1****(SEC-MALS)** | **MAERLYKLGNKAYKRGEYILALIAYVVALRDDPRSAEAWYNLGNAAYKSGEYDEAIEYYQKALELDPRSAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPRSAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPRSLEHHHHHH** |
| **2fo7C3\_12****(SEC-MALS)** | **MAEKAYNIGNAAYKEGEYRVAILAYMLALLADPRSAEALYNLGNAAYKEGDYKVAIAAYLLALDLDPRSAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPRSAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPRSLEHHHHHH** |
| **2fo7C3\_15****(SEC-MALS)** | **MALRWLLLGILAMLLGAEELAIEAYQKALELEPRSAMAWLALGAAYYKEGDYDEAIEYYQKALELDPRSAAAWALLGNAYYKQGDYDEAIEYYQKALENRPRSARAWYNLGNAYYKQGDYDEAIEYYQKALELDPRSLEHHHHHH** |
| **3ltjC3\_1****(SEC-MALS)** | **MTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVEPLIKALKDEEGLVRASAAIALGQIGDERAVEPLIKALKDERDLVRVAAAVALGRIGDERAVEPLIKALKDEEGEVREAAAIALGSIGGERVRAAMEKLAETGTGFARKVAVNYLETHKLEHHHHHH** |
| **3ltjC3\_1v2****(SEC-MALS, SAXS)** | **MTDPMKVILYIAMLELEKYIMRAAAAYALGKIGDERAVEPLIKALKDEDAIVRAAAADALGQIGDERAVEPLIKALKDEDGAVRVSAAVALGQIGDERAVEPLIKALKDEDAVVRVAAAIALGLIGDERAVEPLIKALKDEKGKVREAAALALGAIGGERVRAAMEKLAETGTGFARKVAVNYLETHKLEHHHHHH** |
| **3ltjC3\_11****(SEC-MALS, SAXS)** | **MRREETDPLAVVMYRLNLRDDSYYVRRAAAYALGKIGDERAVEPLIKALKDEDAWVRRAAADALGQIGDERAVEPLIKALKDEDGWVRQSAAVALGQIGDERAVEPLIKALKDEDWFVRAAAAAALGRIGDERAVEPLIKALKDEDEMVREIAALALGMIGGERVRAAMEKLAETGTGFARKVAVNYLETHKLEHHHHHH** |
| **HR4C3\_1****(SEC-MALS)** | **MDICELEARLVALLVLLAKRAGADEDLIAELVAVMIMIVILRLKKSGSSYEVICECVARIVAEIVEALKRSGTSEDEIAEIVARVISEVIRALKRSGSSYEVICECVARIVAEIVEALKRSGTSEDEIAEIVARVISEVIRTLKESGSSYEVIKECVQRIVEEIVEALKRSGTSEDEINEIVRRVKSEVERTLKESGSLEHHHHHH** |
| **HR4C3\_5****(SEC-MALS)** | **MDECEEKARRVAEKVERLKRSGTSEDEIAEEVAREISEVIRTLKESGSEYKVICRCVARIVAEIVEALKRSGTSEDEIAEIVARVISEVIRTLKESGSKYKIICICVAIIVAEIVAALKRSGTSEDEIAEIVARVISEVIRTLKESGSSYEVIKQCVQAIVQAIILALMKSGTEVEEILLIVLRVEEEVERTLKESGSLEHHHHHH** |
| **HR4C3\_5v2****(SEC-MALS, SAXS)** | **MDECEEKARRVAEKVERLKRSGTSEDEIAEEVAREISEVIRTLKESGSEYKVICRCVARIVAEIVEALKRSGTSEDEIAEIVARVISEVIRTLKESGSDYLIICVCVAIIVAEIVEALKRSGTSEDEIAEIVARVISEVIRTLKESGSSYEVIKECVQIIVLAIILALMKSGTEVEEILLILLRVKTEVRRTLKESGSLEHHHHHH** |
| **HR4C3\_7****(SEC-MALS)** | **MDECEKKARLVAILVIVAKALGAEEKLIALLVALEIVVVIIELKASGSSYEVICECVARIVAEIVEALKRSGTSEDEIAEIVAKVIAAVIIVLKELGSSYEVICECVARIVAEIVEALKRSGTSEDEIAEIVARVISEVIRTLKESGSSYEVIKECVQRIVEEIVEALKRSGTSEDEINEIVRRVKSEVERTLKESGSLEHHHHHH** |
| **HR7C3\_2****(SEC)** | **MEKRIARELCELAAERAAESNDEREARIAAIECLLVAERAGMPTKEAARSFCEAAARAAAESNDEEVAKIAAKACLEVAKQAGMPTKEAARSFCEAAARAAAESNDEEVAKIAAKACLEVAKQAGMPTKEAARSFCEAAKRAAKESNDEEVEKIAKKACKEVAKQAGMPLEHHHHHH** |
| HR7C3\_8 | MTEEDAARTCKKAARKAAESNDEEVAKQAAKDCLEVAKQAGMPTTIAAAIFCLAAARAAAESNDEEVAKIAAKACLEVAKQAGMPTKAAAIAFCIAAAMAAAESRDEEVAKIAAKACLEVAKQAGMPTKTAAALFMIAAIAAALRSEDEVVLAIAALAIAEVLKQAGMPLEHHHHHH |
| **HR7C3\_9****(SEC-MALS)** | **MTKEMAAVLCMVLALKAAESNDEEKAKKAAKLCLIMADEAGMPTKEAARSFCEAAAIAAAVSEDEEVAKIAAKACLEVAKQAGMPTKEAARSFCEAAASAAAILNEEEVAKIAAKACLEVAKQAGMPTKEAARSFCEAAKRAAKRSNDEEVEKIAKKACKEVAKQAGMPLEHHHHHH** |
| **HR10C3\_7****(SEC-MALS)** | **MSSEKEELRELLVAIVAVAAEDKGDDTEEAREAAREAFELVREAAERAGIDSSEVLTLAILLILIVVLIAADAGYDISEAARAAAEAFKRVAEAAKRAGITSSEVLELAIRLIKEVVVNAAIRGYDISEAARAAAEAFKRVAEAAKRAGITSSKILKMAIILIRVMVKMAKERGKDISEAARQAAEIFRKAAERMRGSLEHHHHHH** |
| **HR10C3\_7v2****(SEC-MALS)** | **MSSEKEELRKMLVALVVVAAKEKGDDTEEAREAAREAFELVREAAERAGIDSSVVLALAILLILLVVLAAQMAGYDISEAARAAAEAFKRVAEAAKRAGITSSEVLELAIRLIKRVVLNAQIRGYDISEAARAAAEAFKRVAEAAKRAGITSSLLLKMAIVLIRVLVELAQESGADISEAARKAAEIMRRAAEDMRGSLEHHHHHH** |
| **HR10C3\_8****(SEC)** | **MDECEEKARRVAEKVERLKRSGTSEDEIAEEVAREISEVIRTLKESGSEEVEICACVARIVAEIVEALKRSGTSEDEIAEIVARVISEVIRTLKESGSSYLVICMCVALIVAQIVEALKRSGTSRKEIAEIVARVISEVIRTLKESGSSYEVIKECVERIVRAIVLALRESGTRITEIMAIVLAVLKEVLRTLKESGSLEHHHHHH** |
| **HR10C3\_18****(SEC-MALS)** | **MKREKMELAKRLLKIVVENAKRKGDEEALAALAALLAFALVREAAERAGIDSSEVLELAIRLIKEVVENAQREGYRIALAALVAAMAFAVVAEAAKEAGITSSEVLELAIRLIKEVVENAQREGYEIVDAAMAAALAFARVAEAAKRAGITSSETLKRAIEEIRKRVEEAQREGNDISEAAEQAAEEFRKKAEELKLEHHHHHH** |
| **HR00C3****(SEC)** | **MKEEKIAKLISLLAELSKKLIEIVARAADNKTTEEAVDIAILLIAIIARLAIRLIEMLAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDIRMLKAILAIAELAAEAIKAIADLAKNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDLFMAIAIMAIAVLALLAIMAIADLAKNHTTEEFMAKAISAIAELAKKAIEAIYRLADNHTSPDLIELAILAIEIIALAAIIAIEELAENITTEEYKEKAKSAIDEIREKAKEAIKRLEDNRTLEHHHHHH** |
| **HR00C3\_3****(SEC-MALS)** | **MKERLIAKLISVLAEASKILIRIAAKAADKLEREAAVILAIVLIAVAAIAAIAAIALLAANLASEEFMARAISAIAELAKKAIEAIYRLADNHTEDEAMALAIEIIAILALLAIVAIALLAANHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMAKAIEAIAELAKEAIKAIAELAKNHTTEEFMAKAISAIAELAKKAIEAIYRLADNHTSPTYIEKAIEAIEKIARTAIKAIEDLAKNITTEEYKEKAKSAIDEIREKAKEAIKRLEDNRTLEHHHHHH** |
| **HR00C3\_44****(SEC)** | **MTEEKIAKEISRIAEESKKRIEELARKADNKTREAVVALAIAKIALLAREAIKRIEDLAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTKDVLMLVAIVAIAELAKEAIKAIADLAKNHTTEEFMARAISAIAELAKKAIEAIYRLADNHRLVAAMLLAIEAIAELAKEAIKAIADLAKNHTTEEFMAKAISAIAELAKKAIEAIYRLADNHRLPAAILLAALAILLIAVTAILAILILALNITTEEYKEKALSAIEEIVEKAEEAIDRLEDNLTLEHHHHHH** |
| **tpr1C3\_6****(SEC-MALS)** | **MAEAWKELGKVLEKLGRLEEAAVAYLLAVIDDPNDAEAWKELGKVLEKLGELDAAAVAYEAAIELDPNDAEAWKELGKVLEKLGRLRRAALAYIKAIALDPNDAEAWKELGKVAEKLGRLKIAARIYKKAIELDPNDLEHHHHHH** |
| **ank1C2\_1\*** | **MHHHHHHGSWGSSELGKRLIEAAENGNKDRVKDLIENGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQ** |
| **ank3C2\_1\*** | **MSELGKRLIEAAENGNKDRVKDLLENGADVNASDSDGKTPLHLAAENGHAKVVLLLLEQGADPNAKDSDGKTPLHLAAENGHAVVVALLLMHGADPNAKDSDGKTPLHLAAENGHEEVVILLLAMGADPNTSDSDGRTPLDLAREHGNEEVVKVLEDHGGWLEHHHHHH** |
| **1na0C3\_3\*** | **MNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAKQNLGNAKQKQGLEHHHHHH** |
| **1na0C3\_7\*** | **MNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAKQNLGNAKQKQGLEHHHHHH** |
| **HR00C3\_2\*** | **MIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEEFMAKAISAIAELAKKAIEAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKSAIDEIREKAKEAIKRLEDNRTLEHHHHHH** |
| **1na0C4\_1\*** | **MTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAKQNLGNAKQKQGLEHHHHHH** |
| **HR04C4\_1\*** | **MHHHHHHGSWGSDECEEKARRVAEKVERLKRSGTSEDEIAEEVAREISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS** |
| **2JFB (PDB ID)\*** | **MAVKGLGEVDQKYDGSKLRIGILHARWNRKIIDALVAGAVKRLQEFGVKEENIIIETVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIEGKMHNHGEDWGAAAVEMATKFN** |
| **2OBX (PDB ID)\*** | **MNQHSHKDYETVRIAVVRARWHADIVDQCVSAFEAEMADIGGDRFAVDVFDVPGAYEIPLHARTLAETGRYGAVLGTAFVVNGGIYRHEFVASAVIDGMMNVQLSTGVPVLSAVLTPHNYHDSAEHHRFFFEHFTVKGKEAARACVEILAAREKIAA** |
| **2B98 (PDB ID)\*** | **MTKKVGIVDTTFARVDMASIAIKKLKELSPNIKIIRKTVPGIKDLPVACKKLLEEEGCDIVMALGMPGKAEKDKVCAHEASLGLMLAQLMTNKHIIEVFVHEDEAKDDKELDWLAKRRAEEHAENVYYLLFKPEYLTRMAGKGLRQGFEDAGPARE** |

**Supplementary File 1A.** **Amino acid sequences for all designed trimers and *de novo* homo-oligomers used for two-component nanoparticle design.** Sequences include initiating methionines and His6-tags. Designed trimers that expressed solubly are denoted in bold, and experimental methods used for characterization are included in parentheses.

\*Components from previously described designed homo-oligomers in Fallas et al. (2017) or the Protein Data Bank (PDB ID).

|  |  |
| --- | --- |
| Design | Sequence |
| T33\_dn1A(1na0C3\_3)T33\_dn2B(1na0C3\_2) | MGNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYERALELDPENAEAALNLLEAKEKQGMEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYREAIKYYAKALTLDPKNAEAWYNLGNAVYKQGDYRIAILFYRAALKLDPNNAEAKQNLGNAKQKQGLEHHHHHH |
| **T33\_dn2A****(1na0C3\_3)****T33\_dn2B****(1na0C3\_2)** | **MGNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYKKALRLDPRNVDAIENLIEAEEKQG****MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYREAIRYYLRALKLDPENAEAWYNLGNALYKQGKYDLAIIAYQAALEEDPNNAEAKQNLGNAKQKQGLEHHHHHH** |
| T33\_dn3A(1na0C3\_7)T33\_dn3B(1na0C3\_2) | MGNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYKEAILYYIRALQLDPNNAEAWYNLGNAFYKKGDYRVAIILYRMALKLDPNNAEAKQNLGNAKQKQGDIHHHHHHMEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYEEAILYYLEALDLDPNNAEAAENLLNAVKKDE |
| **T33\_dn4A****(1na0C3\_7)****T33\_dn4B****(3ltjC3\_1)** | **MGNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYEKALELDPRNAEALKNLLEAKAKQD****MHHHHTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVEPLIKALKDEEGLVRASAAIALGQIGDERAVRPLIKALADERDLVRVAAAVALGRIGDERAVKPLIIVLLDEEGEVREAAAIALGSIGGERVRAAMEKLAERGRGFARKVAVNYLETHKLEHHHHHH** |
| **T33\_dn5A****1na0C3\_7****T33\_dn5B****(3ltjC3\_1)** | **MGNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYEKALELDPNNAEALKNLLEAIAEQD****MHHHHTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVEPLIKALKDEEGLVRASAAIALGQIGDERAVQPLIKALTDERDLVRVAAAVALGRIGDEKAVRPLIIVLKDEEGEVREAAAIALGSIGGERVRAAMEKLAERGTGFARKVAVNYLETHKLEHHHHHH** |
| **T33\_dn6A****(1na0C3\_2)****T33\_dn6B****(3ltjC3\_1)** | **MGEEAELAYLLGELAYKLGEYRIAIRAYRIALDEDPDNAEAWYNLGNAYYKQGDYREAILYYQMALRLDPNNAEAWYNLGNAYYKQGDYDRAIEYYQKALELDPNNAEAKQNLGNAKQKQGDIHHHHHH****MHHHHTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVEPLIKALKDEEGLVRASAAIALGQIGDKRAVRPLIRALKDERDLVREAAAVALGRIGDELAVEPLIKALKDEEGEVREAAAIALGSIGGEIVRMMMDKLAETGTGFARKVAVNYLETHK** |
| **T33\_dn7A****(1na0C3\_2)****T33\_dn7B****(3ltjC3\_1)** | **MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYRKALELDPENEEALENLLNAKQKQGDIHHHHHH****MHHHHTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVEPLIKALKDEEGLVRASAAIALGQIGDERAVEPLIKALKDERDLVRVAAAVALGRIGDERAVEPLIKALKDEEGEVREAAAIALGSIGGKRVRLAMLKLALEGTGFARKVAVNYLETHK** |
| T33\_dn8A(1na0C3\_2)T33\_dn8B(HR00C3\_2) | MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYRKALELDPENLEALLNLLNAKDKRGMIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAIRAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTERFMAKAILAIAVLAKKAIEAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEEAKSAIEIIRELARIAIRRLEDNRTLEHHHHHH |
| T33\_dn9A(1na0C3\_2)T33\_dn9B(HR00C3\_2) | MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPENLEAILNLGEAKLKQGMIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEKFMAEAIIVIALLAVLAIMAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKSAIDLIRQLADIIIRKLEDNRTLEHHHHHH |
| **T33\_dn10A****(1na0C3\_2)****T33\_dn10B****(HR00C3\_2)** | **MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYEKALELDPENLEALQNLLNAMDKQG****MIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEKFMARAIMAIAILAAKAIEAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKKIIDIIRKLAKMAIKKLEDNRTLEHHHHHH** |
| T33\_dn11A(1na0C3\_2)T33\_dn11B(HR00C3\_2) | MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYRKALELDKENIEALLNLLNAKEKQDMIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTERFMAKAILAIAILAAKAIEAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEEAKSAIEIIRLLAKAVIKRLQDNRTLEHHHHHH |
| **O32\_dn1A****(1na0C3\_3)****O32\_dn1B****(ank1C2\_1)** | **MGELAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIVAYVEALELDPNNAEAWYNLGNAYYKQGDYEEAIEYYQKALELDPNNAEAKQNLGNAKQKQG****MSRRGRLLIIAAENGNKDRVKDLIQRGADVNASDRRGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQLEHHHHHH** |
| O32\_dn2A(1na0C3\_2)O32\_dn2B(ank1C2\_1) | MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEARKNLIIADLKQEDIHHHHHHMSELGEALILAAERGKKDRVKDLIEEGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQ |
| **O32\_dn3A****(3ltjC3\_1)****O32\_dn3B****(ank1C2\_1)** | **MGHHHHHHGWHHHHTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVEPLIEALEDEEGLVRASAAIALGQIGDERAVEPLILALADERDLVRVAAAVALGRIGDERAVEPLIVMLRDEEGEVREAAAIALGSIGGERVRAAMEELAERGRGFARKVAVNYLETHK****MSELGKRLIEAAENGNKKRVKDLIENGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTKDEEGDTPLALALEHGNREVIKALLKQ** |
| O43\_dn1A(1na0C4\_1)O43\_dn1B(1na0C3\_3) | MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYLLAIVYYAKALILDPNNAEAKQNLGNAIQKQDMNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYLEAIAYYAKALLLDPNNAEARQNLGNAMQKSELEHHHHHH |
| O43\_dn2A(1na0C4\_1)O43\_dn2B(1na0C3\_3) | MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAILYYVKALVLDPNNAEAKQNLGNARQKQGMNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYLEAILYYVKALKLDPNNAEAKQNLGNAEQKKDLEHHHHHH |
| O43\_dn3A(1na0C4\_1)O43\_dn3B(1na0C3\_7) | MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIKYYQKALELDPNNAEAWYNLGNAYYKQGDYVIAIALYQLALELDPNNAEAKQNLGNAEQKEGDIHHHHHHMNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYLEAIEYYIKALELDPNNEEARQNLLNAAKKIE |
| **O43\_dn4A****(1na0C4\_1)****O43\_dn4B****(1na0C3\_7)** | **MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYEEAIEYYLKALELDPNNAEARQNLRNAMQKEG****MNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYLAAIIYYRRALELDPNNAEAKQNLGNAEQKEGLEHHHHHH** |
| O43\_dn5A(1na0C4\_1)O43\_dn5B(1na0C3\_7) | MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYREALRYYIKALKLDPNNAEAKQNLGNALEKRGMNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYLVAIIYYLEALELDPNNAEAKQNLGNAKQKEGLEHHHHHH |
| **O43\_dn6A****(1na0C4\_1)****O43\_dn6B****(1na0C3\_2)** | **MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYQEAIEYYARALRRDRRNKEAIENLINALQKED****MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGRYVRALIYYLRALLLDPENAEAWYNLGNAYYKKGDYDIAIVYYELALEDDPNNAEAKQLLGNAKQKQGLEHHHHHH** |
| O43\_dn7A(1na0C4\_1)O43\_dn7B(3ltjC3\_1) | MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYKKALRLDPNNEEAKQNLMNALQKQDMHHHHTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVEPLIKALKDEEGLVRASAAIALGQIGDERAVEPLIKALKDERDLVRVAAAVALGRIGDKKAVLPLIKALKDEEGEVREAAAIALGSIGGRLVRAMMELLAETGRGFARKVAVNYLETHKLEHHHHHH |
| O43\_dn8A(HR04C4\_1)O43\_dn8B(1na0C3\_3) | MGDECEEKARLLAELVETLKRSGTSEDEIAEDVARLISEMIRNLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGSMNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELEPNNAEAWYNLGNAYYKQGDYEEAIIYYLKALVLDPRNAEARQNLGNAKQKEGLEHHHHHH |
| O43\_dn9A(HR04C4\_1)O43\_dn9B(1na0C3\_3) | MGDECEELARIVAELVEKLKRSGTSEDEIAERVAREISEVIKLLKKSGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGSMNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPENAEAWYNLGNAYYKQGEYLEALLYYLKALILDPNNAEAKQNLGNARQKQGLEHHHHHH |
| O43\_dn10A(HR04C4\_1)O43\_dn10B(1na0C3\_3) | MGDECERKARLVAKIVELLKRSGTSEDEIAEEVARLISLVIKVLKKSGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGSMNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPENAEAWYNLGNAYYKQGDYAEAMLYYLKALLLDPNNAEAKQNLGNAEQKAGLEHHHHHH |
| O43\_dn11A(HR04C4\_1)O43\_dn11B(1na0C3\_7) | MGDECEEKAELVALLVEALKKLGTSEDEIAEEVAKEISRVIRRLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGSMNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPENAEAWYNLGNAYYKQGDYELAIIFYKVALALDPNNAEAKQNLGNAKQKQGLEHHHHHH |
| **O43\_dn12A****(HR04C4\_1)****O43\_dn12B****(1na0C3\_2)** | **MGDRCERRAKLVALKVELLKKDGTSEDEIAEEVAREISEVIRDLRKSGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS****MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNIKAELNLIIAEEKQGLEHHHHHH** |
| O43\_dn13A(HR04C4\_1)O43\_dn13B(1na0C3\_2) | MGDECEELARAVALVVEILKRSGTSEDEIAEEVARLISRVIRKLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGSMEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKKGDYLIAILYYLVALTLDPNNAEAKQNLGNAKQKDGLEHHHHHH |
| O43\_dn14A(HR04C4\_1)O43\_dn14B(1na0C3\_2) | MGDKCEEMAELVAQLVELLKESGTSEDEIAEKVARLISKVIRKLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGSMEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYMKALKLDPKNAEAWYNLGNAYYKQGDYLLAILIYEMALILDPNNAEAKQNLGNAKQKEGLEHHHHHH |
| O43\_dn15A(HR04C4\_1)O43\_dn15B(1na0C3\_2) | MGRKCELLARLVAMIVELLKESGTSEDEIAEEVAREISEVIRTLKEEGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGSMEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPRNAEAWYNLGNAYYKQGDYLMAILIYQLALMLDPNNAEAKQNLGNAKQKRGLEHHHHHH |
| O43\_dn16A(HR04C4\_1)O43\_dn16B(1na0C3\_2) | MGEDCEELAELVAELVERLKRRGTSEDEIAEEVARIISEVIRMLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGSMEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYKEAIKYYQKALKLDPNNAEAWYNLGNAYYKKGDYIMAILAYELALEEDPNNAEAKQNLGNAKQKQGLEHHHHHH |
| **O43\_dn17A****(HR04C4\_1)****O43\_dn17B****(1na0C3\_2)** | **MGDECEEKARRVALKVLKLRLRGTSEDEIAEEVAREISKVIETLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS****MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNEEAKIVLGLAKEEQELEHHHHHH** |
| **O43\_dn18A****(HR04C4\_1)****O43\_dn18B****(1na0C3\_2)** | **MDRCEELARRIAEVVERAKRAGTSEDEIAESVARVISLVIRALKLSGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGSGGWLEHHHHHH****MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPSNLDAAVNLGAATMLTS** |
| **I32\_dn1A****(1na0C3\_3)****I32\_dn1B****(ank1C2\_1)** | **MGNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELEPENAEALYNLGNAYYKQGEYDEAILYYLIALELDPNNAEAKQNLGNAKQKQGDIHHHHHH****MSRLGIRLIIAAIEGNKDRVKDLIENGADVNASDSVGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDRDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQ** |
| **I32\_dn2A****(1na0C3\_3)****I32\_dn2B****(ank1C2\_1)** | **MGDLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAILAYLKALELDPNNAEAWYNLGNAFYKQGDYRMAIKYYQKALELDPNNAEAKQNLGNAKQKQG****MSELGELLIVAAENGNKKMVRDLIKNGADVNASDEDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQLEHHHHHH** |
| I32\_dn3A(1na0C3\_3)I32\_dn3B(ank1C2\_1) | MGRLAKKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYAEAIVAYIKALELDPNNAEAWYNLGNALYKLGAYNAAIQVYQKALELDPNNAEAKQNLGNAKQKKGMKILGLALIAAARNGEKERVETLIEAGADVNASDDDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQLEHHHHHH |
| I32\_dn4A(1na0C3\_7)I32\_dn4B(ank1C2\_1) | MGKSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPKNAEAWYNLGNAAYKQGDYEEAIRYYLKALLLDDNNAEAWYNLGNAYYKQGDYREAIMLYQKALELDPNNAEAKQNLGNAKQKQGMSELGKLLIMAAELGNKRLVKELIENGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAEEGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQLEHHHHHH |
| I32\_dn5A(1na0C3\_7)I32\_dn5B(ank1C2\_1) | MGRSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYREAIRYYLKALALDPNNAEAWYNLGNAFYKQGDYNEAIEVYQKALELDPNNAEAKQNLGNAKQKQGMSELGRMLIEAAELGKKEIVKELIENGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQLEHHHHHH |
| **I32\_dn6A****(1na0C3\_2)****I32\_dn6B****(ank1C2\_1)** | **MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNDEADDNLLNADQKQDDIHHHHHH****MSRLGKKLIIAAERGNKDRVKDLIENGADVNASDEDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQ** |
| **I32\_dn7A****(1na0C3\_2)****I32\_dn7B****(ank1C2\_1)** | **MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPKNMEALLDLGNAKQKQKDIHHHHHH****MSELGKDLIVAAALGNKDRVKDLIENGADVNASDRRGATPLHMAALNGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQ** |
| **I32\_dn8A****(1na0C3\_2)****I32\_dn8B****(ank3C2\_1)** | **MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYLRAIAYYRKALELDPNNAEAKQNLGNAKQKIE****MELEGERLIEAAENGNKDRVKDLLENGALVNASDSDGKTPLHLAAENGHAKVVLLLLEQGAKPNAKDSDGKTPLHLAAENGHAVVVALLLMHGADPNAKDSDGKTPLHLAAENGHEEVVILLLAMGADPNTSDSDGRTPLDLAREHGNEEVVKVLEDHGGWLEHHHHALEHHHHHH** |
| I32\_dn9A(HR00C3\_2)I32\_dn9B(ank1C2\_1) | MGIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMADAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEQFMAIAIIAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEAFMALAILLIAELAKKAIEAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKARAAILEIREKAKEAIKRLEDNRTMHHHHHHSELGKRLIEAAENGNKKRVLELIENGADVNASDSDGRTPLHHAAENGHAEVVALLIELGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVETSDSRGRTPLMLAVEHGNIEVALALLKQGW |
| **I32\_dn10A****(HR00C3\_2)****I32\_dn10B****(ank1C2\_1)** | **MGHHHHHHWGIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEEFMAKAISAIARLAKKAILAIYKLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKSAIDEIREIAKIAIKTLEDNRT****MSEIGKRLIEAAENGNKERVKLLIELGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQ** |
| I53\_dn1A(2B98)I53\_dn1B(HR00C3\_2) | MGHHHHHHKKVGIVDTTFARVDMAIMAIIVLELRPRNIKIIRKTVPGIKDLPVACKKLLEEEGCDIVMALGMPGKAEKDKVCAHEASLGLMLAQLMTNKHIIEVFVHEDEAKDDRELDWLAKRRAEEHAENVYYLLFKPEYLTEMAGKGLRQGFEDAGPMIEEVVAEMIDILAESSKKSIRELAKAAKNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADKHKTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIMAILLLALLHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEEFMAKAISAIAELAKKAIEAIYLLADLHTPVLYEDKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKSAIDEIREKAKEAIKRLERNRE |
| I53\_dn2A(2JFB)I53\_dn2B(1na0C3\_2) | MGRYDGSKLRIGILHARWNRSIILALVLGAIERLLEFGVRAKNIIIETVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIDGKMHNHGEDWGAAAVEMATKFNMEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYRRALKLEPENAEAWYNLGNAYYKQGDYKEAIAYYLIALILDPNNAEAKQNLGNAEQKQDLEHHHHHH |
| I53\_dn3A(2JFB)I53\_dn3B(1na0C3\_2) | MGKYDGSKLRIGILHARWNRAIIIALVLGALKRLLEFGVKAKNIIIETVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIKGKMHNHGEDWGAAAVEMATKFNMEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQEALELDPENAEAWYNLGNAYYKQGDYKEALAYYLLALELDPNNAEAEQNLGNAEQKRDLEHHHHHH |
| I53\_dn4A(2JFB)I53\_dn4B(1na0C3\_2) | MGKYDGSKLRIGILHARWNVKIIIALILGAIKRLREFGVKRENIIIEIVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIEGKMHNHGEDWGAAAVEMATKFNMEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNLDAVMNLLEASLKQELEHHHHHH |
| **I53\_dn5A****(2JFB)****I53\_dn5A.1 (2JFB)****I53\_dn5B****(1na0C3\_2)** | **MGKYDGSKLRIGILHARWNAEIILALVLGALKRLQEFGVKRENIIIETVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIEGKMHNHGEDWGAAAVEMATKFN(LEHHHHHH)****MGKYDGSKLRIGILHARGNAEIILALVLGALKRLQEFGVKRENIIIETVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIRGSTPHFDYIADSTTHQLMKLNFELGIPVIFGVITADTDEQAEARAGLIEGKMHNHGEDWGAAAVEMATKFN(LEHHHHHH)****MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGRYREAIEYYQKALELDPNNAEAWYNLGNAYYERGEYEEAIEYYRKALRLDPNNADAMQNLLNAKMREELEHHHHHH** |
| **I53\_dn6A****(2JFB)****I53\_dn6B****(1na0C3\_2)** | **MGDYDGSKLRIGILHARKNTEIIVALVIGAVERLEEFGVKRENIIIEIVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIEGKMHNHGEDWGAAAVEMATKFN****MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYKKALRLDPDNAKALLNLIEAILKQKLEHHHHHH** |
| I53\_dn7A(2JFB)I53\_dn7B(3ltjC3\_1) | MGKYDGSKLRIGILHARWNRRIILALVIGAIIRLLEFGVKEDNIIIETVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIEGKMHNHGEDWGAAAVEMATKFNMHHHHTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVIPLLRALLDKEGLVRASAAIALGQIGDKRAVLILILALEDERDLVRVAAAVALGRIGDEKAVEPLIEALKDEEGEVREAAAIALGSIGGERVRAAMEKLAETGTGFARKVAVNYLETHKLEHHHHHH |
| **I53\_dn8A****(2OBX)****I53\_dn8B****(1na0C3\_2)** | **MGHHHHHHHKDYETVRIAVVRARWHADIVRQCVMAFMKEMMRIGGRRFAVEVFDVPGAYEIPLHARTLAETGRYGAVLGTAFVVNGGIYRHEFVASAVIDGMMNVQLSTGVPVLSAVLTPHNYHDSAEHHRFFFEHFTVKGKEAARACVEILAARERI****MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPENEEAIDNLLEARQKQE** |
| **I53\_dn9A****(2OBX)****I53\_dn9B****(HR00C3\_2)** | **MGHHHHHHHKDYETVRIAVVRARWHAEIVDVCVLAFEIEMLDIGGDRFAVDVFDVPGAYEIPLHARTLAETGRYGAVLGTAFVVNGGIYRHEFVASAVIDGMMNVQLSTGVPVLSAVLTPHNYHDSAEHHEFFFEHFTVKGKEAARACVEILAAREKI****MIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIAAIYRLADNHKTDKFMAAAIEAIALLATLAILAIALLASNHTTEEFMAKAIRAIAKLAKMAILVIYALAIMHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKSAIDEIREKAKEAIKRLEDKRE** |
| **I53\_dn10A****(2OBX)****I53\_dn10B****(HR00C3\_2)** | **MGHHHHHHHKDYETVRIAVVRARWHADIVDLCVIAFELEMLLIGGRRFAVDVFDVPGAYEIPLHARTLAETGRYGAVLGTAFVVNGGIYRHEFVASAVIDGMMNVQLSTGVPVLSAVLTPHNYHDSKRHHRFFAMHFIKKGKEAARACVEILAAREKI****MIEEVVAEMIDILAESSKKSIEELAKAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAILELALEHETDKFMAAAIEAIALLATLAILAIALLASNHTTEEFMAKAIEAIAQLAKLAIIAIYLLALLHESPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKSAIDEIREKAKEAIKRLEDKRE** |
| I53\_dn11A(2OBX)I53\_dn11B(HR00C3\_2) | MGHHHHHHHKDYETVRIAVVRARWHADIVDQCVSAFEREMAKIGGDRFAVDVFDVPGAYEIPLHARTLAETGRYGAVLGTAFVVNGGIYRHEFVASAVIDGMMNVQLSTGVPVLSAVLTPHEYHDSEIHHKIFFLLFTEKGKEAARACVEILAAREKIMIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEEFMAKAISAIAELAKKAIEAIYRLADDHTSPTYIEKAIEAIEKIAKKAIKAIEMLAKNITTEEYQEKARKAILEILEKALEAIRRLEDNRR |

**Supplementary File 1B.** **Amino acid sequences for all designed two-component nanoparticles.** Sequences include initiating methionines and His6-tags. Designs that expressed solubly and co-eluted from IMAC are denoted in bold. Input oligomers from Supplementary File 1A are included in parentheses.

|  |  |
| --- | --- |
| Antigen-fused component | Sequence |
| **BG505 SOSIP.v5.2(7S)**–**T33\_dn2A without N241/N289** | **MKRGLCCVLLLCGAVFVSPSQEIHARFRRGARAENLWVTVYYGVPVWKDAETTLFCASDAKAYETKKHNVWATHCCVPTDPNPQEIHLENVTEEFNMWKNNMVEQMHTDIISLWDQSLKPCVKLTPLCVTLQCTNVTNNITDDMRGELKNCSFNMTTELRDKKQKVYSLFYRLDVVQINENQGNRSNNSNKEYRLINCNTSAITQACPKVSFEPIPIHYCAPAGFAILKCKDKKFNGTGPCPSVSTVQCTHGIKPVVSTQLLLNGSLAEEEVIIRSENITNNAKNILVQFNTPVQINCTRPNNNTVKSIRIGPGQWFYYTGDIIGDIRQAHCNVSKATWNETLGKVVKQLRKHFGNNTIIRFANSSGGDLEVTTHSFNCGGEFFYCNTSGLFNSTWISNTSVQGSNSTGSNDSITLPCRIKQIINMWQRIGQAMYAPPIQGVIRCVSNITGLILTRDGGSTNSTTETFRPGGGDMRDNWRSELYKYKVVKIEPLGVAPTRCKRRVVGRRRRRRAVGIGAVSLGFLGAAGSTMGAASMTLTVQARNLLSGIVQQQSNLLRAPECQQHLLKDTHWGIKQLQARVLAVEHYLRDQQLLGIWGCSGKLICCTNVPWNSSWSNRNLSEIWDNMTWLQWDKEISNYTQIIYGLLEESQNQQEKNEQDLLELDKWASLWGSMGNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYKKALRLDPRNVDAIENLIEAEEKQGAS** |
| **BG505 SOSIP.v5.2(7S)**–**T33\_dn2A** | **MKRGLCCVLLLCGAVFVSPSQEIHARFRRGARAENLWVTVYYGVPVWKDAETTLFCASDAKAYETKKHNVWATHCCVPTDPNPQEIHLENVTEEFNMWKNNMVEQMHTDIISLWDQSLKPCVKLTPLCVTLQCTNVTNNITDDMRGELKNCSFNMTTELRDKKQKVYSLFYRLDVVQINENQGNRSNNSNKEYRLINCNTSAITQACPKVSFEPIPIHYCAPAGFAILKCKDKKFNGTGPCTNVSTVQCTHGIKPVVSTQLLLNGSLAEEEVIIRSENITNNAKNILVQLNESVQINCTRPNNNTVKSIRIGPGQWFYYTGDIIGDIRQAHCNVSKATWNETLGKVVKQLRKHFGNNTIIRFANSSGGDLEVTTHSFNCGGEFFYCNTSGLFNSTWISNTSVQGSNSTGSNDSITLPCRIKQIINMWQRIGQAMYAPPIQGVIRCVSNITGLILTRDGGSTNSTTETFRPGGGDMRDNWRSELYKYKVVKIEPLGVAPTRCKRRVVGRRRRRRAVGIGAVSLGFLGAAGSTMGAASMTLTVQARNLLSGIVQQQSNLLRAPECQQHLLKDTHWGIKQLQARVLAVEHYLRDQQLLGIWGCSGKLICCTNVPWNSSWSNRNLSEIWDNMTWLQWDKEISNYTQIIYGLLEESQNQQEKNEQDLLELDKWASLWGSMGNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYKKALRLDPRNVDAIENLIEAEEKQGAS** |
| **BG505 SOSIP.v5.2(7S)**–**T33\_dn10A**  | **MKRGLCCVLLLCGAVFVSPSQEIHARFRRGARAENLWVTVYYGVPVWKDAETTLFCASDAKAYETKKHNVWATHCCVPTDPNPQEIHLENVTEEFNMWKNNMVEQMHTDIISLWDQSLKPCVKLTPLCVTLQCTNVTNNITDDMRGELKNCSFNMTTELRDKKQKVYSLFYRLDVVQINENQGNRSNNSNKEYRLINCNTSAITQACPKVSFEPIPIHYCAPAGFAILKCKDKKFNGTGPCTNVSTVQCTHGIKPVVSTQLLLNGSLAEEEVIIRSENITNNAKNILVQLNESVQINCTRPNNNTVKSIRIGPGQWFYYTGDIIGDIRQAHCNVSKATWNETLGKVVKQLRKHFGNNTIIRFANSSGGDLEVTTHSFNCGGEFFYCNTSGLFNSTWISNTSVQGSNSTGSNDSITLPCRIKQIINMWQRIGQAMYAPPIQGVIRCVSNITGLILTRDGGSTNSTTETFRPGGGDMRDNWRSELYKYKVVKIEPLGVAPTRCKRRVVGRRRRRRAVGIGAVSLGFLGAAGSTMGAASMTLTVQARNLLSGIVQQQSNLLRAPECQQHLLKDTHWGIKQLQARVLAVEHYLRDQQLLGIWGCSGKLICCTNVPWNSSWSNRNLSEIWDNMTWLQWDKEISNYTQIIYGLLEESQNQQEKNEQGSGSGSGSGGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYEKALELDPENLEALQNLLNAMDKQG** |
| **BG505 SOSIP.v5.2(7S)**–**I53\_dn5B**  | **MKRGLCCVLLLCGAVFVSPSQEIHARFRRGARAENLWVTVYYGVPVWKDAETTLFCASDAKAYETKKHNVWATHCCVPTDPNPQEIHLENVTEEFNMWKNNMVEQMHTDIISLWDQSLKPCVKLTPLCVTLQCTNVTNNITDDMRGELKNCSFNMTTELRDKKQKVYSLFYRLDVVQINENQGNRSNNSNKEYRLINCNTSAITQACPKVSFEPIPIHYCAPAGFAILKCKDKKFNGTGPCTNVSTVQCTHGIKPVVSTQLLLNGSLAEEEVIIRSENITNNAKNILVQLNESVQINCTRPNNNTVKSIRIGPGQWFYYTGDIIGDIRQAHCNVSKATWNETLGKVVKQLRKHFGNNTIIRFANSSGGDLEVTTHSFNCGGEFFYCNTSGLFNSTWISNTSVQGSNSTGSNDSITLPCRIKQIINMWQRIGQAMYAPPIQGVIRCVSNITGLILTRDGGSTNSTTETFRPGGGDMRDNWRSELYKYKVVKIEPLGVAPTRCKRRVVGRRRRRRAVGIGAVSLGFLGAAGSTMGAASMTLTVQARNLLSGIVQQQSNLLRAPECQQHLLKDTHWGIKQLQARVLAVEHYLRDQQLLGIWGCSGKLICCTNVPWNSSWSNRNLSEIWDNMTWLQWDKEISNYTQIIYGLLEESQNQQEKNEQGSGSGSGSGGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGRYREAIEYYQKALELDPNNAEAWYNLGNAYYERGEYEEAIEYYRKALRLDPNNADAMQNLLNAKMREELEAS** |
| **HA**–**I53\_dn5B** | **MKAILVVLLYTFTTANADTLCIGYHANNSTDTVDTVLEKNVTVTHSVNLLEDKHNGKLCKLRGVAPLHLGKCNIAGWILGNPECESLSTASSWSYIVETSNSDNGTCFPGDFINYEELREQLSSVSSFERFEIFPKTSSWPNHDSNKGVTAACPHAGAKSFYKNLIWLVKKGNSYPKLNQSYINDKGKEVLVLWGIHHPSTTADQQSLYQNADAYVFVGTSRYSKKFKPEIATRPKVRDQEGRMNYYWTLVEPGDKITFEATGNLVVPRYAFTMERNAGSGIIISDTPVHDCNTTCQTPEGAINTSLPFQNIHPITIGKCPKYVKSTKLRLATGLRNVPSIQSRGLFGAIAGFIEGGWTGMVDGWYGYHHQNEQGSGYAADLKSTQNAIDKITNKVNSVIEKMNTQFTAVGKEFNHLEKRIENLNKKVDDGFLDIWTYNAELLVLLENERTLDYHDSNVKNLYEKVRNQLKNNAKEIGNGCFEFYHKCDNTCMESVKNGTYDYPKYSEEAKLNREKIDGVSAEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGRYREAIEYYQKALELDPNNAEAWYNLGNAYYERGEYEEAIEYYRKALRLDPNNADAMQNLLNAKMREEGGWELQHHHHHH** |
| **DS-Cav1**–**I53\_dn5B** | **MELLILKANAITTILTAVTFCFASGQNITEEFYQSTCSAVSKGYLSALRTGWYTSVITIELSNIKENKCNGTDAKVKLIKQELDKYKNAVTELQLLMQSTPATNNRARRELPRFMNYTLNNAKKTNVTLSKKRKRRFLGFLLGVGSAIASGVAVCKVLHLEGEVNKIKSALLSTNKAVVSLSNGVSVLTFKVLDLKNYIDKQLLPILNKQSCSISNIETVIEFQQKNNRLLEITREFSVNAGVTTPVSTYMLTNSELLSLINDMPITNDQKKLMSNNVQIVRQQSYSIMCIIKEEVLAYVVQLPLYGVIDTPCWKLHTSPLCTTNTKEGSNICLTRTDRGWYCDNAGSVSFFPQAETCKVQSNRVFCDTMNSLTLPSEVNLCNVDIFNPKYDCKIMTSKTDVSSSVITSLGAIVSCYGKTKCTASNKNRGIIKTFSNGCDYVSNKGVDTVSVGNTLYYVNKQEGKSLYVKGEPIINFYDPLVFPSDEFDASISQVNEKINQSLAFIRKSDELLSAIGGSAEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGRYREAIEYYQKALELDPNNAEAWYNLGNAYYERGEYEEAIEYYRKALRLDPNNADAMQNLLNAKMREEGGWELQHHHHHH** |

**Supplementary File 1C.** **Amino acid sequences for all antigen-fused trimeric nanoparticle components.** Sequences include initiating methionines and signal peptides.