|  |  |
| --- | --- |
| 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).

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| Design | Sequence |
| T33\_dn1A  (1na0C3\_3)  T33\_dn2B  (1na0C3\_2) | MGNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYERALELDPENAEAALNLLEAKEKQG  MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYREAIKYYAKALTLDPKNAEAWYNLGNAVYKQGDYRIAILFYRAALKLDPNNAEAKQNLGNAKQKQGLEHHHHHH |
| **T33\_dn2A**  **(1na0C3\_3)**  **T33\_dn2B**  **(1na0C3\_2)** | **MGNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYKKALRLDPRNVDAIENLIEAEEKQG**  **MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYREAIRYYLRALKLDPENAEAWYNLGNALYKQGKYDLAIIAYQAALEEDPNNAEAKQNLGNAKQKQGLEHHHHHH** |
| T33\_dn3A  (1na0C3\_7)  T33\_dn3B (1na0C3\_2) | MGNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYKEAILYYIRALQLDPNNAEAWYNLGNAFYKKGDYRVAIILYRMALKLDPNNAEAKQNLGNAKQKQGDIHHHHHH  MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYEEAILYYLEALDLDPNNAEAAENLLNAVKKDE |
| **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) | MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYRKALELDPENLEALLNLLNAKDKRG  MIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAIRAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTERFMAKAILAIAVLAKKAIEAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEEAKSAIEIIRELARIAIRRLEDNRTLEHHHHHH |
| T33\_dn9A  (1na0C3\_2)  T33\_dn9B  (HR00C3\_2) | MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPENLEAILNLGEAKLKQG  MIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEKFMAEAIIVIALLAVLAIMAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKSAIDLIRQLADIIIRKLEDNRTLEHHHHHH |
| **T33\_dn10A**  **(1na0C3\_2)**  **T33\_dn10B**  **(HR00C3\_2)** | **MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYEKALELDPENLEALQNLLNAMDKQG**  **MIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEKFMARAIMAIAILAAKAIEAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKKIIDIIRKLAKMAIKKLEDNRTLEHHHHHH** |
| T33\_dn11A  (1na0C3\_2)  T33\_dn11B  (HR00C3\_2) | MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYRKALELDKENIEALLNLLNAKEKQD  MIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTERFMAKAILAIAILAAKAIEAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEEAKSAIEIIRLLAKAVIKRLQDNRTLEHHHHHH |
| **O32\_dn1A**  **(1na0C3\_3)**  **O32\_dn1B**  **(ank1C2\_1)** | **MGELAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIVAYVEALELDPNNAEAWYNLGNAYYKQGDYEEAIEYYQKALELDPNNAEAKQNLGNAKQKQG**  **MSRRGRLLIIAAENGNKDRVKDLIQRGADVNASDRRGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQLEHHHHHH** |
| O32\_dn2A  (1na0C3\_2)  O32\_dn2B  (ank1C2\_1) | MGEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEARKNLIIADLKQEDIHHHHHH  MSELGEALILAAERGKKDRVKDLIEEGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQ |
| **O32\_dn3A**  **(3ltjC3\_1)**  **O32\_dn3B**  **(ank1C2\_1)** | **MGHHHHHHGWHHHHTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVEPLIEALEDEEGLVRASAAIALGQIGDERAVEPLILALADERDLVRVAAAVALGRIGDERAVEPLIVMLRDEEGEVREAAAIALGSIGGERVRAAMEELAERGRGFARKVAVNYLETHK**  **MSELGKRLIEAAENGNKKRVKDLIENGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTKDEEGDTPLALALEHGNREVIKALLKQ** |
| O43\_dn1A  (1na0C4\_1)  O43\_dn1B  (1na0C3\_3) | MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYLLAIVYYAKALILDPNNAEAKQNLGNAIQKQD  MNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYLEAIAYYAKALLLDPNNAEARQNLGNAMQKSELEHHHHHH |
| O43\_dn2A  (1na0C4\_1)  O43\_dn2B  (1na0C3\_3) | MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAILYYVKALVLDPNNAEAKQNLGNARQKQG  MNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPNNAEAWYNLGNAYYKQGDYLEAILYYVKALKLDPNNAEAKQNLGNAEQKKDLEHHHHHH |
| O43\_dn3A  (1na0C4\_1)  O43\_dn3B  (1na0C3\_7) | MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIKYYQKALELDPNNAEAWYNLGNAYYKQGDYVIAIALYQLALELDPNNAEAKQNLGNAEQKEGDIHHHHHH  MNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYLEAIEYYIKALELDPNNEEARQNLLNAAKKIE |
| **O43\_dn4A**  **(1na0C4\_1)**  **O43\_dn4B**  **(1na0C3\_7)** | **MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYEEAIEYYLKALELDPNNAEARQNLRNAMQKEG**  **MNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYLAAIIYYRRALELDPNNAEAKQNLGNAEQKEGLEHHHHHH** |
| O43\_dn5A  (1na0C4\_1)  O43\_dn5B  (1na0C3\_7) | MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYREALRYYIKALKLDPNNAEAKQNLGNALEKRG  MNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYLVAIIYYLEALELDPNNAEAKQNLGNAKQKEGLEHHHHHH |
| **O43\_dn6A**  **(1na0C4\_1)**  **O43\_dn6B**  **(1na0C3\_2)** | **MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYQEAIEYYARALRRDRRNKEAIENLINALQKED**  **MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGRYVRALIYYLRALLLDPENAEAWYNLGNAYYKKGDYDIAIVYYELALEDDPNNAEAKQLLGNAKQKQGLEHHHHHH** |
| O43\_dn7A  (1na0C4\_1)  O43\_dn7B  (3ltjC3\_1) | MGTLARVAYILGAIAYAQGEYDIAITAYQVALDLDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYKKALRLDPNNEEAKQNLMNALQKQD  MHHHHTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVEPLIKALKDEEGLVRASAAIALGQIGDERAVEPLIKALKDERDLVRVAAAVALGRIGDKKAVLPLIKALKDEEGEVREAAAIALGSIGGRLVRAMMELLAETGRGFARKVAVNYLETHKLEHHHHHH |
| O43\_dn8A  (HR04C4\_1)  O43\_dn8B  (1na0C3\_3) | MGDECEEKARLLAELVETLKRSGTSEDEIAEDVARLISEMIRNLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS  MNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELEPNNAEAWYNLGNAYYKQGDYEEAIIYYLKALVLDPRNAEARQNLGNAKQKEGLEHHHHHH |
| O43\_dn9A  (HR04C4\_1)  O43\_dn9B  (1na0C3\_3) | MGDECEELARIVAELVEKLKRSGTSEDEIAERVAREISEVIKLLKKSGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS  MNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPENAEAWYNLGNAYYKQGEYLEALLYYLKALILDPNNAEAKQNLGNARQKQGLEHHHHHH |
| O43\_dn10A  (HR04C4\_1)  O43\_dn10B  (1na0C3\_3) | MGDECERKARLVAKIVELLKRSGTSEDEIAEEVARLISLVIKVLKKSGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS  MNLAEKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYDEAIEAYQKALELDPENAEAWYNLGNAYYKQGDYAEAMLYYLKALLLDPNNAEAKQNLGNAEQKAGLEHHHHHH |
| O43\_dn11A  (HR04C4\_1)  O43\_dn11B  (1na0C3\_7) | MGDECEEKAELVALLVEALKKLGTSEDEIAEEVAKEISRVIRRLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS  MNSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYDEAIEYYQKALELDPENAEAWYNLGNAYYKQGDYELAIIFYKVALALDPNNAEAKQNLGNAKQKQGLEHHHHHH |
| **O43\_dn12A**  **(HR04C4\_1)**  **O43\_dn12B**  **(1na0C3\_2)** | **MGDRCERRAKLVALKVELLKKDGTSEDEIAEEVAREISEVIRDLRKSGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS**  **MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNIKAELNLIIAEEKQGLEHHHHHH** |
| O43\_dn13A  (HR04C4\_1)  O43\_dn13B  (1na0C3\_2) | MGDECEELARAVALVVEILKRSGTSEDEIAEEVARLISRVIRKLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS  MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKKGDYLIAILYYLVALTLDPNNAEAKQNLGNAKQKDGLEHHHHHH |
| O43\_dn14A  (HR04C4\_1)  O43\_dn14B  (1na0C3\_2) | MGDKCEEMAELVAQLVELLKESGTSEDEIAEKVARLISKVIRKLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS  MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYMKALKLDPKNAEAWYNLGNAYYKQGDYLLAILIYEMALILDPNNAEAKQNLGNAKQKEGLEHHHHHH |
| O43\_dn15A  (HR04C4\_1)  O43\_dn15B  (1na0C3\_2) | MGRKCELLARLVAMIVELLKESGTSEDEIAEEVAREISEVIRTLKEEGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS  MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPRNAEAWYNLGNAYYKQGDYLMAILIYQLALMLDPNNAEAKQNLGNAKQKRGLEHHHHHH |
| O43\_dn16A  (HR04C4\_1)  O43\_dn16B  (1na0C3\_2) | MGEDCEELAELVAELVERLKRRGTSEDEIAEEVARIISEVIRMLKESGSSYEVICECVARIVAEIVEALKRSGTSAVEIAKIVARVISEVIRTLKESGSSYEVICECVARIVAEIVEALKRSGTSAAIIALIVALVISEVIRTLKESGSSFEVILECVIRIVLEIIEALKRSGTSEQDVMLIVMAVLLVVLATLQLSGS  MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYKEAIKYYQKALKLDPNNAEAWYNLGNAYYKKGDYIMAILAYELALEEDPNNAEAKQNLGNAKQKQGLEHHHHHH |
| **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) | MGRLAKKMYKAGNAMYRKGQYTIAIIAYTLALLKDPNNAEAWYNLGNAAYKKGEYAEAIVAYIKALELDPNNAEAWYNLGNALYKLGAYNAAIQVYQKALELDPNNAEAKQNLGNAKQKKG  MKILGLALIAAARNGEKERVETLIEAGADVNASDDDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQLEHHHHHH |
| I32\_dn4A  (1na0C3\_7)  I32\_dn4B  (ank1C2\_1) | MGKSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPKNAEAWYNLGNAAYKQGDYEEAIRYYLKALLLDDNNAEAWYNLGNAYYKQGDYREAIMLYQKALELDPNNAEAKQNLGNAKQKQG  MSELGKLLIMAAELGNKRLVKELIENGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAEEGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQLEHHHHHH |
| I32\_dn5A  (1na0C3\_7)  I32\_dn5B  (ank1C2\_1) | MGRSAEAMYKMGNAAYKQGDYILAIIAYLLALEKDPNNAEAWYNLGNAAYKQGDYREAIRYYLKALALDPNNAEAWYNLGNAFYKQGDYNEAIEVYQKALELDPNNAEAKQNLGNAKQKQG  MSELGRMLIEAAELGKKEIVKELIENGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQLEHHHHHH |
| **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) | MGIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMADAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEQFMAIAIIAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEAFMALAILLIAELAKKAIEAIYRLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKARAAILEIREKAKEAIKRLEDNRT  MHHHHHHSELGKRLIEAAENGNKKRVLELIENGADVNASDSDGRTPLHHAAENGHAEVVALLIELGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVETSDSRGRTPLMLAVEHGNIEVALALLKQGW |
| **I32\_dn10A**  **(HR00C3\_2)**  **I32\_dn10B**  **(ank1C2\_1)** | **MGHHHHHHWGIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEEFMAKAISAIARLAKKAILAIYKLADNHTSPTYIEKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKSAIDEIREIAKIAIKTLEDNRT**  **MSEIGKRLIEAAENGNKERVKLLIELGADVNASDSDGRTPLHHAAENGHAEVVALLIEKGADVNAKDSDGRTPLHHAAENGHDEVVLILLLKGADVNAKDSDGRTPLHHAAENGHKRVVLVLILAGADVNTSDSDGRTPLDLAREHGNEEVVKALEKQ** |
| I53\_dn1A  (2B98)  I53\_dn1B  (HR00C3\_2) | MGHHHHHHKKVGIVDTTFARVDMAIMAIIVLELRPRNIKIIRKTVPGIKDLPVACKKLLEEEGCDIVMALGMPGKAEKDKVCAHEASLGLMLAQLMTNKHIIEVFVHEDEAKDDRELDWLAKRRAEEHAENVYYLLFKPEYLTEMAGKGLRQGFEDAGP  MIEEVVAEMIDILAESSKKSIRELAKAAKNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADKHKTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIMAILLLALLHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEEFMAKAISAIAELAKKAIEAIYLLADLHTPVLYEDKAIEAIEKIARKAIKAIEMLAKNITTEEYKEKAKSAIDEIREKAKEAIKRLERNRE |
| I53\_dn2A  (2JFB)  I53\_dn2B  (1na0C3\_2) | MGRYDGSKLRIGILHARWNRSIILALVLGAIERLLEFGVRAKNIIIETVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIDGKMHNHGEDWGAAAVEMATKFN  MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYRRALKLEPENAEAWYNLGNAYYKQGDYKEAIAYYLIALILDPNNAEAKQNLGNAEQKQDLEHHHHHH |
| I53\_dn3A  (2JFB)  I53\_dn3B  (1na0C3\_2) | MGKYDGSKLRIGILHARWNRAIIIALVLGALKRLLEFGVKAKNIIIETVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIKGKMHNHGEDWGAAAVEMATKFN  MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQEALELDPENAEAWYNLGNAYYKQGDYKEALAYYLLALELDPNNAEAEQNLGNAEQKRDLEHHHHHH |
| I53\_dn4A  (2JFB)  I53\_dn4B  (1na0C3\_2) | MGKYDGSKLRIGILHARWNVKIIIALILGAIKRLREFGVKRENIIIEIVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIEGKMHNHGEDWGAAAVEMATKFN  MEEAELAYLLGELAYKLGEYRIAIRAYRIALKRDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNAEAWYNLGNAYYKQGDYDEAIEYYQKALELDPNNLDAVMNLLEASLKQELEHHHHHH |
| **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) | MGKYDGSKLRIGILHARWNRRIILALVIGAIIRLLEFGVKEDNIIIETVPGSFELPYGSKLFVEKQKRLGKPLDAIIPIGVLIKGSTMHFEYICDSTTHQLMKLNFELGIPVIFGVLTCLTDEQAEARAGLIEGKMHNHGEDWGAAAVEMATKFN  MHHHHTDPLAVILYIAILKAEKSIARAKAAEALGKIGDERAVEPLIKALKDEDALVRAAAADALGQIGDERAVIPLLRALLDKEGLVRASAAIALGQIGDKRAVLILILALEDERDLVRVAAAVALGRIGDEKAVEPLIEALKDEEGEVREAAAIALGSIGGERVRAAMEKLAETGTGFARKVAVNYLETHKLEHHHHHH |
| **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) | MGHHHHHHHKDYETVRIAVVRARWHADIVDQCVSAFEREMAKIGGDRFAVDVFDVPGAYEIPLHARTLAETGRYGAVLGTAFVVNGGIYRHEFVASAVIDGMMNVQLSTGVPVLSAVLTPHEYHDSEIHHKIFFLLFTEKGKEAARACVEILAAREKI  MIEEVVAEMIDILAESSKKSIEELARAADNKTTEKAVAEAIEEIARLATAAIQLIEALAKNLASEEFMARAISAIAELAKKAIEAIYRLADNHTTDTFMARAIAAIANLAVTAILAIAALASNHTTEEFMARAISAIAELAKKAIEAIYRLADNHTTDKFMAAAIEAIALLATLAILAIALLASNHTTEEFMAKAISAIAELAKKAIEAIYRLADDHTSPTYIEKAIEAIEKIAKKAIKAIEMLAKNITTEEYQEKARKAILEILEKALEAIRRLEDNRR |

**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.