# Supplementary Information

## Systematic evaluation IgG response of SARS-CoV-2 spike protein derived peptides for monitoring of COVID-19 patients

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**Supplementary Fig. 1.** Evaluation of the significant peptides by Cohort 2 –other peptides.
**Supplementary Fig. 2.** Performance of peptides and S1 for diagnosis in subgroups.
**Supplementary Fig.3.** Consistence between the commercial assay and our platform based on S or N protein.
**Supplementary Table 1** The peptides synthesized in this study.

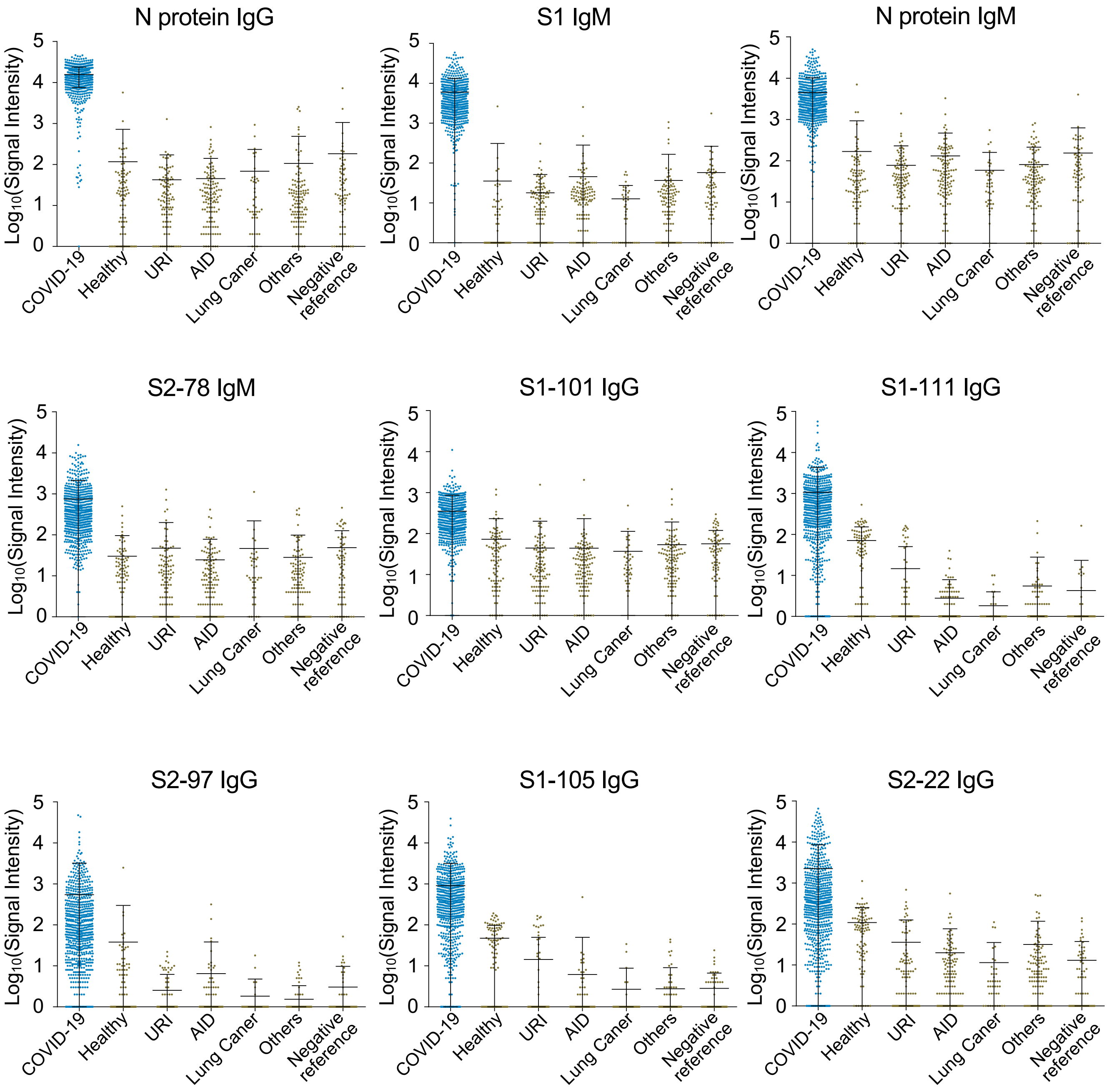

**Fig. S1. Evaluation of the significant peptides by Cohort 2 – other peptides.** Signal levels of the antibodies against the indicated peptides in COVID-19 patients (n=729), Healthy controls (n=92), upper respiratory infections (URI, n=104), patients with autoimmune diseases (AID, n=120), lung cancer patients (n=41), patients with other diseases (n=112) and negative reference samples (n=73) of Cohort 2.

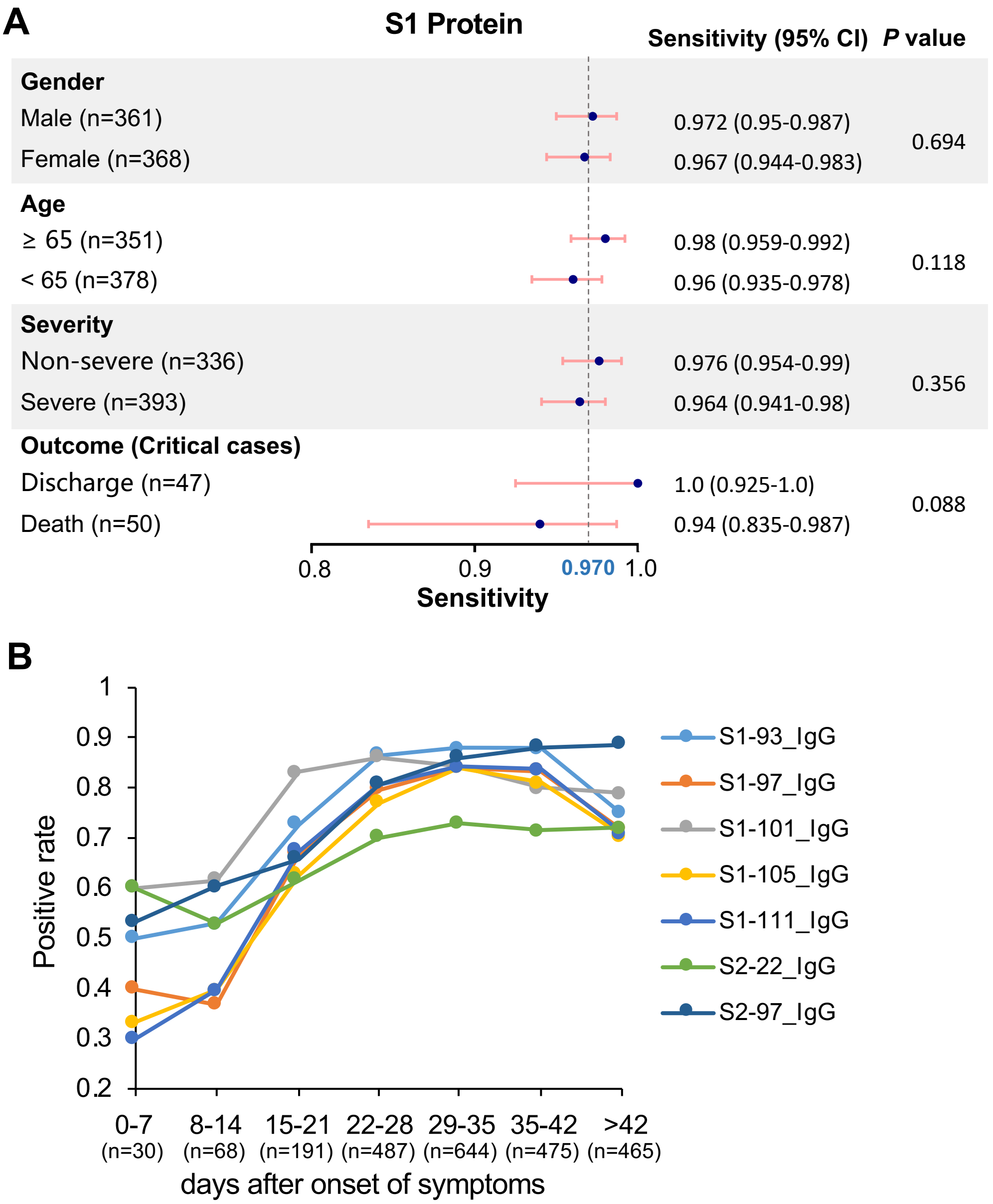

**Fig. S2. Performance of peptides and S1 for diagnosis in subgroups.** a. forest plot of sensitivities of S1 IgG in different subgroups, i.e., age, gender, severity and outcome. The dots indicate the sensitivities while the error bars indicate the 95% CI. The exact values are also provided. P values were calculated with $\chi 2$ test. The dashed line (0.970) indicates the overall sensitivity of all the patients. b. Graph of positive rates of IgG antibodies against the indicated peptides versus days after symptom onset in 2,360 serum samples from 784 patients.

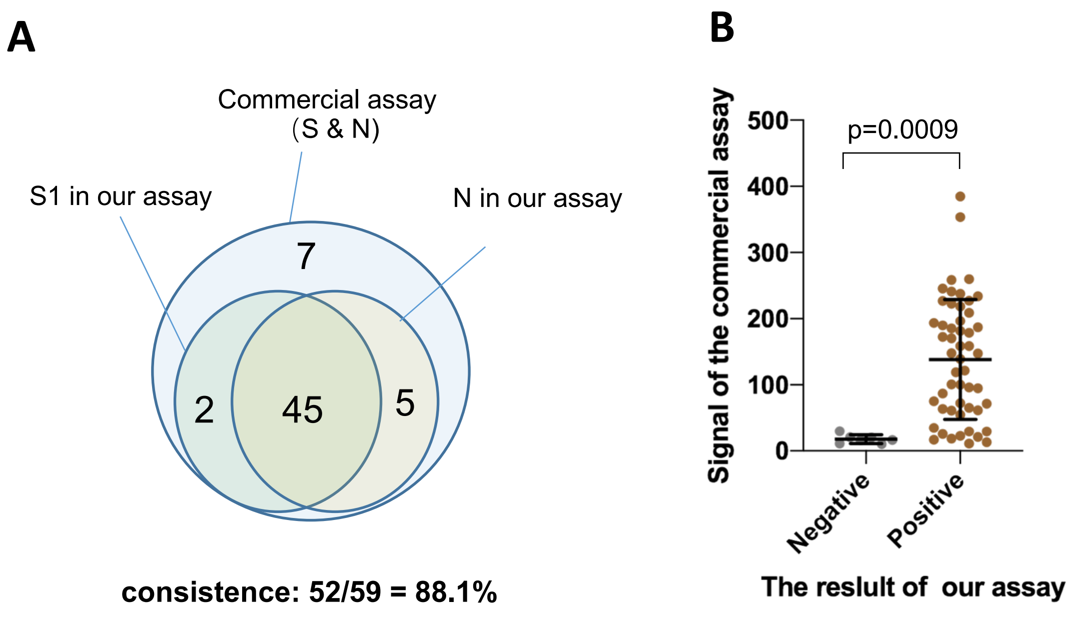

**Fig. S3. Consistence between the commercial assay and our platform based on S or N protein. A.** the results and comparison of the 59 antibody positive asymptomatic patients. In combination S and N response, 52 positive based on our platform and the consistence with the commercial assay is 88.1% (52/59). **B.** Comparison of signal level of the commercial assay between the two groups divided based on our data, either false negative or true positive.

**Table S1. The peptides synthesized in this study**

| NO. | Peptide ID | Sart Position | Amino acid sequence | End Position | Note |
|---|---|---|---|---|---|
| 1 | S1-1 | 1 | MFVFLVLLPLVS | 12 | N/A |
| 2 | S1-2 | 7 | LLPLVSSQCVNL | 18 | |
| 3 | S1-3 | 13 | SQCVNLTTRTQL | 24 | N/A |
| 4 | S1-4 | 19 | TTRTQLPPAYTN | 30 | |
| 5 | S1-5 | 25 | PPAYTNSFTRGV | 36 | |
| 6 | S1-6 | 31 | SFTRGVYYPDKV | 42 | |
| 7 | S1-7 | 37 | YYPDKVFRSSVL | 48 | |
| 8 | S1-8 | 43 | FRSSVLHSTQDL | 54 | |
| 9 | S1-9 | 49 | HSTQDLFLPFFS | 60 | |
| 10 | S1-10 | 55 | FLPFFSNVTWFH | 66 | N/A |
| 11 | S1-11 | 61 | NVTWFHAIHVSG | 72 | |
| 12 | S1-12 | 67 | AIHVSGTNGTKR | 78 | |
| 13 | S1-13 | 73 | TNGTKRFDNPVL | 84 | |
| 14 | S1-14 | 79 | FDNPVLPFNDGV | 90 | |
| 15 | S1-15 | 85 | PFNDGVYFASTE | 96 | |
| 16 | S1-16 | 91 | YFASTEKSNIIR | 102 | |
| 17 | S1-17 | 97 | KSNIIRGWIFGT | 108 | |
| 18 | S1-18 | 103 | GWIFGTTLDSKT | 114 | |
| 19 | S1-19 | 109 | TLDSKTQSLLIV | 120 | |
| 20 | S1-20 | 115 | QSLLIVNNATNV | 126 | |
| 21 | S1-21 | 121 | NNATNVVIKVCE | 132 | |
| 22 | S1-22 | 127 | VIKVCEFQFCND | 138 | |
| 23 | S1-23 | 133 | FQFCNDPFLGVY | 144 | |
| 24 | S1-24 | 139 | PFLGVYYHKNNK | 150 | |
| 25 | S1-25 | 145 | YHKNNKSWMESE | 156 | |
| 26 | S1-26 | 151 | SWMESEFRVYSS | 162 | |
| 27 | S1-27 | 157 | FRVYSSANNCTF | 168 | |
| 28 | S1-28 | 163 | ANNCTFEYVSQP | 174 | |
| 29 | S1-29 | 169 | EYVSQPFLMDLE | 180 | |
| 30 | S1-30 | 175 | FLMDLEGKQGNF | 186 | |
| 31 | S1-31 | 181 | GKQGNFKNLREF | 192 | |
| 32 | S1-32 | 187 | KNLREFVFKNID | 198 | N/A |
| 33 | S1-33 | 193 | VFKNIDGYFKIY | 204 | N/A |
| 34 | S1-34 | 199 | GYFKIYSKHTPI | 210 | |
| 35 | S1-35 | 205 | SKHTPINLVRDL | 216 | N/A |
| 36 | S1-36 | 211 | NLVRDLPQGFSA | 222 | |
| 37 | S1-37 | 217 | PQGFSALEPLVD | 228 | N/A |
| 38 | S1-38 | 223 | LEPLVDLPIGIN | 234 | |
| 39 | S1-39 | 229 | LPIGINITRFQT | 240 | |
| 40 | S1-40 | 235 | ITRFQTLLALHR | 246 | N/A |
| 41 | S1-41 | 241 | LLALHRSYLTPG | 252 | |
| 42 | S1-42 | 247 | SYLTPGDSSSGW | 258 | |
| 43 | S1-43 | 253 | DSSSGWTAGAAA | 264 | |
| 44 | S1-44 | 259 | TAGAAAYYVGYL | 270 | |
| 45 | S1-45 | 265 | YYVGYLQPRTFL | 276 | |
| 46 | S1-46 | 271 | QPRTFLLKYNEN | 282 | N/A |
| 47 | S1-47 | 277 | LKYNENGTITDA | 288 | |
| 48 | S1-48 | 283 | GTITDAVDCALD | 294 | |
| 49 | S1-49 | 289 | VDCALDPLSETK | 300 | |
| 50 | S1-50 | 295 | PLSETKCTLKSF | 306 | |
| 51 | S1-51 | 301 | CTLKSFTVEKGI | 312 | |
| 52 | S1-52 | 307 | TVEKGIYQTSNF | 318 | |
| 53 | S1-53 | 313 | YQTSNFRVQPTE | 324 | |
| 54 | S1-54 | 319 | RVQPTESIVRFP | 330 | |
| 55 | S1-55 | 325 | SIVRFPNITNLC | 336 | |
| 56 | S1-56 | 331 | NITNLCPFGEVF | 342 | |
| 57 | S1-57 | 337 | PFGEVFNATRFA | 348 | |
| 58 | S1-58 | 343 | NATRFASVYAWN | 354 | |
| 59 | S1-59 | 349 | SVYAWNRKRISN | 360 | |
| 60 | S1-60 | 355 | RKRISNCVADYS | 366 | |
| 61 | S1-61 | 361 | CVADYSVLYNSA | 372 | N/A |
| 62 | S1-62 | 367 | VLYNSASFSTFK | 378 | |
| 63 | S1-63 | 373 | SFSTFKCYGVSP | 384 | |
| 64 | S1-64 | 379 | CYGVSPTKLNDL | 390 | |

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|---|---|---|---|---|---|
| 65 | S1-65 | 385 | TKLNDLCFTNVY | 396 |  |
| 66 | S1-66 | 391 | CFTNVYADSFVI | 402 |  |
| 67 | S1-67 | 397 | ADSFVIRGDEVR | 408 |  |
| 68 | S1-68 | 403 | RGDEVRQIAPGQ | 414 |  |
| 69 | S1-69 | 409 | QIAPGQTGKIAD | 420 |  |
| 70 | S1-70 | 415 | TGKIADYNYKLP | 426 |  |
| 71 | S1-71 | 421 | YNYKLPDDFTGC | 432 |  |
| 72 | S1-72 | 427 | DDFTGCVIAWNS | 438 |  |
| 73 | S1-73 | 433 | VIAWNSNNLDSK | 444 |  |
| 74 | S1-74 | 439 | NNLDSKVGGNYN | 450 |  |
| 75 | S1-75 | 445 | VGGNYNYLYRLF | 456 | N/A |
| 76 | S1-76 | 451 | YLYRLFRKSNLK | 462 |  |
| 77 | S1-77 | 457 | RKSNLKPFERDI | 468 |  |
| 78 | S1-78 | 463 | PFERDISTEIYQ | 474 |  |
| 79 | S1-79 | 469 | STEIYQAGSTPC | 480 |  |
| 80 | S1-80 | 475 | AGSTPCNGVEGF | 486 |  |
| 81 | S1-81 | 481 | NGVEGFNCYFPL | 492 |  |
| 82 | S1-82 | 487 | NCYFPLQSYGFQ | 498 |  |
| 83 | S1-83 | 493 | QSYGFQPTNGVG | 504 |  |
| 84 | S1-84 | 499 | PTNGVGYQPYRV | 510 |  |
| 85 | S1-85 | 505 | YQPYRVVVLSFE | 516 |  |
| 86 | S1-86 | 511 | VVLSFELLHAPA | 522 |  |
| 87 | S1-87 | 517 | LLHAPATVCGPK | 528 |  |
| 88 | S1-88 | 523 | TVCGPKKSTNLV | 534 |  |
| 89 | S1-89 | 529 | KSTNLVKNKCVN | 540 |  |
| 90 | S1-90 | 535 | KNKCVNFNFNGL | 546 |  |
| 91 | S1-91 | 541 | FNFNGLTGTGVL | 552 |  |
| 92 | S1-92 | 547 | TGTGVLTESNKK | 558 |  |
| 93 | S1-93 | 553 | TESNKKFLPFQQ | 564 |  |
| 94 | S1-94 | 559 | FLPFQQFGRDIA | 570 |  |
| 95 | S1-95 | 565 | FGRDIADTTDAV | 576 |  |
| 96 | S1-96 | 571 | DTTDAVRDPQTL | 582 |  |
| 97 | S1-97 | 577 | RDPQTLEILDIT | 588 |  |
| 98 | S1-98 | 583 | EILDITPCSFGG | 594 |  |
| 99 | S1-99 | 589 | PCSFGGVSVITP | 600 |  |
| 100 | S1-100 | 595 | VSVITPGTNTSN | 606 |  |
| 101 | S1-101 | 601 | GTNTSNQVAVLY | 612 |  |
| 102 | S1-102 | 607 | QVAVLYQDVNCT | 618 |  |
| 103 | S1-103 | 613 | QDVNCTEVPVAI | 624 |  |
| 104 | S1-104 | 619 | EVPVAIHADQLT | 630 |  |
| 105 | S1-105 | 625 | HADQLTPTWRVY | 636 |  |
| 106 | S1-106 | 631 | PTWRVYSTGSNV | 642 |  |
| 107 | S1-107 | 637 | STGSNVFQTRAG | 648 | N/A |
| 108 | S1-108 | 643 | FQTRAGCLIGAE | 654 |  |
| 109 | S1-109 | 649 | CLIGAEHVNNSY | 660 |  |
| 110 | S1-110 | 655 | HVNNSYECDIPI | 666 |  |
| 111 | S1-111 | 661 | ECDIPIGAGICA | 672 |  |
| 112 | S1-112 | 667 | GAGICASYQTQT | 678 |  |
| 113 | S1-113 | 673 | SYQTQTNSPRRA | 684 |  |
| 114 | S1-114 | 679 | NSPRRARGGGGS | 685 |  |
| 115 | S2-1 | 686 | SVASQSIIAYTM | 697 | N/A |
| 116 | S2-2 | 692 | IIAYTMSLGAEN | 703 | N/A |
| 117 | S2-3 | 698 | SLGAENSVAYSN | 709 |  |
| 118 | S2-4 | 704 | SVAYSNNSIAIP | 715 |  |
| 119 | S2-5 | 710 | NSIAIPTNFTIS | 721 |  |
| 120 | S2-6 | 716 | TNFTISVTTEIL | 727 |  |
| 121 | S2-7 | 722 | VTTEILPVSMTK | 733 |  |
| 122 | S2-8 | 728 | PVSMTKTSVDCT | 739 |  |
| 123 | S2-9 | 734 | TSVDCTMYICGD | 745 |  |
| 124 | S2-10 | 740 | MYICGDSTECSN | 751 |  |
| 125 | S2-11 | 746 | STECSNLLLQYG | 757 |  |
| 126 | S2-12 | 752 | LLLQYGSFCTQL | 763 |  |
| 127 | S2-13 | 758 | SFCTQLNRALTG | 769 | N/A |
| 128 | S2-14 | 764 | NRALTGIAVEQD | 775 |  |
| 129 | S2-15 | 770 | IAVEQDKNTQEV | 781 |  |
| 130 | S2-16 | 776 | KNTQEVFAQVKQ | 787 |  |
| 131 | S2-17 | 782 | FAQVKQIYKTPP | 793 |  |

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|---|---|---|---|---|---|
| 132 | S2-18 | 788 | IYKTPPIKDFGG | 799 |  |
| 133 | S2-19 | 794 | IKDFGGFNFSQI | 805 |  |
| 134 | S2-20 | 800 | FNFSQILPDPSK | 811 |  |
| 135 | S2-21 | 806 | LPDPSKPSKRSF | 817 |  |
| 136 | S2-22 | 812 | PSKRSFIEDLLF | 823 |  |
| 137 | S2-23 | 818 | IEDLLFNKVTLA | 829 |  |
| 138 | S2-24 | 824 | NKVTLADAGFIK | 835 |  |
| 139 | S2-25 | 830 | DAGFIKQYGDCL | 841 |  |
| 140 | S2-26 | 836 | QYGDCLGDIAAR | 847 |  |
| 141 | S2-27 | 842 | GDIAARDLICAQ | 853 |  |
| 142 | S2-28 | 848 | DLICAQKFNGLT | 859 |  |
| 143 | S2-29 | 854 | KFNGLTVLPPLL | 865 |  |
| 144 | S2-30 | 860 | VLPPLLTDEMIA | 871 |  |
| 145 | S2-31 | 866 | TDEMIAQYTSAL | 877 |  |
| 146 | S2-32 | 872 | QYTSALLAGTIT | 883 |  |
| 147 | S2-33 | 878 | LAGTITSGWTFG | 889 |  |
| 148 | S2-34 | 884 | SGWTFGAGAALQ | 895 |  |
| 149 | S2-35 | 890 | AGAALQIPFAMQ | 901 |  |
| 150 | S2-36 | 896 | IPFAMQMAYRFN | 907 |  |
| 151 | S2-37 | 902 | MAYRFNGIGVTQ | 913 |  |
| 152 | S2-38 | 908 | GIGVTQNVLYEN | 919 |  |
| 153 | S2-39 | 914 | NVLYENQKLIAN | 925 |  |
| 154 | S2-40 | 920 | QKLIANQFNSAI | 931 |  |
| 155 | S2-41 | 926 | QFNSAIGKIQDS | 937 |  |
| 156 | S2-42 | 932 | GKIQDSLSSTAS | 943 |  |
| 157 | S2-43 | 938 | LSSTASALGKLQ | 949 |  |
| 158 | S2-44 | 944 | ALGKLQDVVNQN | 955 |  |
| 159 | S2-45 | 950 | DVVNQNAQALNT | 961 |  |
| 160 | S2-46 | 956 | AQALNTLVKQLS | 967 |  |
| 161 | S2-47 | 962 | LVKQLSSNFGAI | 973 |  |
| 162 | S2-48 | 968 | SNFGAISSVLND | 979 |  |
| 163 | S2-49 | 974 | SSVLNDILSRLD | 985 |  |
| 164 | S2-50 | 980 | ILSRLDKVEAEV | 991 |  |
| 165 | S2-51 | 986 | KVEAEVQIDRLI | 997 |  |
| 166 | S2-52 | 992 | QIDRLITGRLQS | 1003 |  |
| 167 | S2-53 | 998 | TGRLQSLQTYVT | 1009 |  |
| 168 | S2-54 | 1004 | LQTYVTQQLIRA | 1015 |  |
| 169 | S2-55 | 1010 | QQLIRAAEIRAS | 1021 |  |
| 170 | S2-56 | 1016 | AEIRASANLAAT | 1027 |  |
| 171 | S2-57 | 1022 | ANLAATKMSECV | 1033 |  |
| 172 | S2-58 | 1028 | KMSECVLGQSKR | 1039 |  |
| 173 | S2-59 | 1034 | LGQSKRVDFCGK | 1045 |  |
| 174 | S2-60 | 1040 | VDFCGKGYHLMS | 1051 |  |
| 175 | S2-61 | 1046 | GYHLMSFPQSAP | 1057 |  |
| 176 | S2-62 | 1052 | FPQSAPHGVVFL | 1063 |  |
| 177 | S2-63 | 1058 | HGVVFLHVTYVP | 1069 |  |
| 178 | S2-64 | 1064 | HVTYVPAQEKNF | 1075 |  |
| 179 | S2-65 | 1070 | AQEKNFTTAPAI | 1081 |  |
| 180 | S2-66 | 1076 | TTAPAICHDGKA | 1087 |  |
| 181 | S2-67 | 1082 | CHDGKAHFPREG | 1093 |  |
| 182 | S2-68 | 1088 | HFPREGVFVSNG | 1099 |  |
| 183 | S2-69 | 1094 | VFVSNGTHWFVT | 1105 |  |
| 184 | S2-70 | 1100 | THWFVTQRNFYE | 1111 |  |
| 185 | S2-71 | 1106 | QRNFYEPQIITT | 1117 |  |
| 186 | S2-72 | 1112 | PQIITTDNTFVS | 1123 |  |
| 187 | S2-73 | 1118 | DNTFVSGNCDVV | 1129 |  |
| 188 | S2-74 | 1124 | GNCDVVIGIVNN | 1135 | N/A |
| 189 | S2-75 | 1130 | IGIVNNTVYDPL | 1141 |  |
| 190 | S2-76 | 1136 | TVYDPLQPELDS | 1147 |  |
| 191 | S2-77 | 1142 | QPELDSFKEELD | 1153 |  |
| 192 | S2-78 | 1148 | FKEELDKYFKNH | 1159 |  |
| 193 | S2-79 | 1154 | KYFKNHTSPDVD | 1165 |  |
| 194 | S2-80 | 1160 | TSPDVDLGDISG | 1171 |  |
| 195 | S2-81 | 1166 | LGDISGINASVV | 1177 |  |
| 196 | S2-82 | 1172 | INASVVNIQKEI | 1183 |  |
| 197 | S2-83 | 1178 | NIQKEIDRLNEV | 1189 |  |
| 198 | S2-84 | 1184 | DRLNEVAKNLNE | 1195 |  |

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|---|---|---|---|---|---|
| 199 | S2-85 | 1190 | AKNLNESLIDLQ | 1201 | |
| 200 | S2-86 | 1196 | SLIDLQELGKYE | 1207 | |
| 201 | S2-87 | 1202 | ELGKYEQYIKWP | 1213 | |
| 202 | S2-88 | 1208 | QYIKWPWYIWLG | 1219 | |
| 203 | S2-89 | 1214 | WYIWLGFIAGLI | 1225 | N/A |
| 204 | S2-90 | 1220 | FIAGLIAIVMVT | 1231 | N/A |
| 205 | S2-91 | 1226 | AIVMVTIMLCCM | 1237 | N/A |
| 206 | S2-92 | 1232 | IMLCCMTSCCSC | 1243 | N/A |
| 207 | S2-93 | 1238 | TSCCSCLKGCCS | 1249 | |
| 208 | S2-94 | 1244 | LKGCCSCGSCCK | 1255 | N/A |
| 209 | S2-95 | 1250 | CGSCCKFDEDDS | 1261 | |
| 210 | S2-96 | 1256 | FDEDDSEPVLKG | 1267 | |
| 211 | S2-97 | 1262 | EPVLKGVKLHYT | 1273 | |