Online Supporting Information A. This benchmark dataset S includes 523 Gram-positive bacterial protein sequences (519 different proteins), classified into 4 subcellular locations. Among the 519 different proteins, 515 belong to one location; and 4 to two locations. Both the accession numbers and sequences are given. None of the proteins has \geq 25% sequence identity to any other in the same subset (subcellular location). See the text of the paper for further explanation.

(1) \mathbb{S}_1 : 174 cell membrane proteins

>P23453

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>P07373

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>P12921

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>P19579

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>A6QIG2

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>P35594

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>P0A3G5

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>P39755

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>P33379

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>P0C0N4

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>Q2FV54

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>P0A4D8

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>P35865

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>09CD58

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>P46922

>P46105

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>031652

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>Q07833

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>P33251

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>034894

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>P53663

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>P35165

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>008429

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>P12667

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>P13485

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>P33116

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>Q07428

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>05HK00

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>P33113

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>P42177

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>P0A4Y0

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>P37948

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>P20166

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>P14677

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>P22094

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>P25051

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>P26829

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>P0A4N3

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>005523

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>P54178

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>P68782

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>P40411

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>P24011

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>052351

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>P65563

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>P43439

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>Q93QY7

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>P35166

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>Q45479

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>099027

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>P12669

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>P82599

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>P37105

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>Q01467

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>P54544

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>P30345

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>P45829

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>P46339

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>P45706

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>P39141

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>P42086

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>P31141

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>Q02113

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>P50847

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>P08656

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>P16449

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>P35160

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>P42432

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>P54493

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>P72058

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>09L523

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>033654

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>P46921

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>P75409

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>P37608

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>09X3P3

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>069282

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>Q02251

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>P26235

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>P24943

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>P54104

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>010900

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>079VE8

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>P22821

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>P81594

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>P28611

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>Q50367

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>P15363

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>P23648

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>P31306

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>P39128

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>P0A334

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>P37386

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>P30195

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>P28628

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>008362

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>P96710

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>P49022

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>P50012

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>P25959

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>P28612

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>P54571

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>P24012

>P42237

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>P35596

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>034360

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>P21608

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>P50738

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>P54582

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>P29761

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>09ZFB5

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>P21625

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>P39603

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>A6QH29

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>P33247

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>P20487

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>P0A4N1

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>P25953

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>P36948

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>052866

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PSLIMVVVARNITRKKQGKAFGFIGSIVALGEGLGPSIGGIIAHYIHWSYLLILPMITIV
TIPFLIKVMVPGKSTKNTLDIVGIVLMSISIICFMLFTTNYNWTFLILFTIFFVIFIKHI
SRVSNPFINPKLGKNIPFMLGLFSGGLIFSIVAGFISMVPYMMKTIYHVNVATIGNSVIF
PGTMSVIVFGYFGGFLVDRKGSLFVFILGSLSISISFLTIAFFVEFSMWLTTFMFIFVMG
GLSFTKTVISKIVSSSLSEEEVASGMSLLNFTSFLSEGTGIAIVGGLLSLQLINRKLVLE
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>P39694

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>P50002

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>Q9ZBM2

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MKNIKIVRILKHDEAIRIEHRISELYSDEFGVVYAGNHLIFNWYQRLYLSRNILISKKSK SRKGLIQMIFIIGICTVFLIIYGIWEQRCHQKRLNSIPIRVNINGIRGKSTVTRLITGVV QEAKYKTVGKTTGTSARMIYWFTDEEQPIKRRKEGPNIGEQRRVVKEAADLEAEALICEC MAVQPDYQIIFQNKMIQANVGVIVNVLEDHMDVMGPTLDEVAEAFTATIPYNGHLVTIES EYLDYFKEVAEERNTKVIVADNSRISEEFLRKFDYMVFPDNASLALAVAEALGIDEETAF RGMLNAHPDPGAMRITRFADQSKPAFFVNGFAANDPSSTLRIWERVDDFGYSNLAPIVIM NCRPDRVDRTEQFARDVLPYIKAEIVIAIGETTAPITSAFEKGDIPTQEYWNLEGWSTSE IMSRMRPYLKNRIVYGVGNIHGAAEPLIDMIMEEQIGKKQAKVI

>P39793

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>P12012

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IMSVATIIDLLQETIGFADNGVLAFIRLIGNASTAMIISLLVAVYTMGIKRNIPVKTVMD
SCSTAISQIGMMLLIIGGGGAFKQVLINGGVGDYVADLFKGTALSPIILAWLIAAILRIS
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>P39570

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KIGRGQLQ

>004959

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 ${\tt MNPANYLYLSVLLFTIGASGVLLRRNAIVMFMCVELMLNAVNLAFVTFARMHGHLDAQMI} \\ {\tt AFFTMVVAACEVVVGLAIIMTIFRTRKSASVDDANLLKG}$

>P65561

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VAVLFILGLSAIGVYGIVLGGWASGSTYPLLGGVRSTAQVISYEVAMGLSFATVFLMAGT
MSTSQIVAAQDGVWYAFLLLPSFVIYLISMVGETNRAPFDLPEAEGELVAGFHTEYSSLK
FAMFMLAEYVNMTTVSALAATLFFGGWHAPWPLNMWASANTGWWPLIWFTAKVWGFLFIY
FWLRATLPRLRYDQFMALGWKLLIPVSLVWVMVAAIIRSLRNQGYQYWTPTLVFSSIVVA
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>P42252

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>P25958

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>P54559

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ALLSDMTEEKTRLLVFNLRYAAINIGVVFGPVLGLYFGSSQSTTPFLVPAVIYGLYGIVL
ALQFKKHPSLSAPAQSRNMSVREAFMVTQKDYLFTIALVGITLCTFGYSQFSSTFPQYMA
QNPLIGNGTKLYGLMLTLNAIVVLATQFPIVHFAKRFSPLCSLMLGNVMVSISMAIFTVS
HGVPSIVMIVITFTIGEVLLFSMMDLYVDQIAKPGLKGTYFGAIGFPQLGNVIGPWVGGI
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>P95246

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AGVSWKVYQNKLLGALNNTVVGYNGLVNDFKQAADPRSNLARFGISPTYPLDFAADVRNN
RLPKVSWVLPGFLLSEHPAFPVNVGAVAIVDALRILLSNPAVWEKTALIVNYDENGGFFD
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 $\label{thm:likelik} \mbox{HTSTLKLIRARFGVPVPNLTAWRDATVGDMTSTFNFAAPPNPSKPNLDHPRLNALPKLPQ} \\ \mbox{CVPNAVLGTVTKTAIPYRVPFPQSMPTQETAPTRGIPSGLC}$

>P46349

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>P43440

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LGDSLLADQTNVYLIMVVSALIIAGGLGFIVWRDILSYHRVKKITLHSKVALSVTALLLI
GGFILFLITERNGLTLVKGTFTERLANTFFMSVTPRTAGYYSIDYLQMSHAGLILTMFLM
YIGGTSGSTAGGLKTTTLGILLIQMHAMFKGKTRAEAFGRTIRQAAVLRALTLFFVTLSL
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>034853

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>P54146

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FGAWLVFGVLWFTFVYAPLAHWVFAIDDPESGYVGGWMKNVLEFHDFAGGTAVHMNAGAS
GLALAIVLGRRHSMAVRPHNLPLILIGAGLIVAGWFGFNGGTAGGANFLASYVVVTSLIA
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AIIVTLTYAFGVTWLIATILNKFMTLRITSEAEYEGIDRAEHAESAYHLNSNGIGMATRT
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(2) \mathbb{S}_2 : 18 cell wall proteins

>Q02114

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>P13692

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>P38536

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GATTFSDDKSISDWARNVVANAAKLGIVNGEPNNVFAPKGNATRAEAAAIIYGLLEKSGN

>P09333

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>P35825

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>P0C0P9

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TATNDNSVKIVYRTTDGTQVGSNTWVTSTDGTKAGSKVSDKAADQTALEAYINANKPSGY
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>Q59634

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>Q06852

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>P35829

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>P06546

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EVISKIDTDKKKITNRDNDKFNDLDGKEEGKDFLVFLNGKPAKFSDLKEGMVYSVYYADG
DEDKLLVFATDTVVEGKVDKVVSRNNNDYRLTIGDKTYRVYEGATFSDDGNKDVQDIDKD
HWDLVDSLDDETVKLYLDASGRVRHIETKDAIDDRKQKAIVTRSATFNTSKDTWDFRVLT
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AKFKDVADENDLSVIYTVNDKDEVEAIFVVEGDGLTGDAHYGQVIDFGRKGGKDTIRVWE KDGDKVVEKEYKLDGDQDDLKDEDIRRNDFIAFTVDSNDEVVVDDVVEVVNKNAKGMLAE VTDEKGMKDANIDKMVVGLVSDVRKDTITYKDADDNKKKASIKSATVYFDLYDDFGEADG VNEGDYVVMIDSGDISGTKYDYVLIVSDAKTVRKDKLEDDAEAFLKQEPSEKPDPDTKWD ALPSKVEGKFTSAGPVKLYRATVELNSKVKAEDVDAIEFYFNGKKVEPSLLNFKDGVITI GYNTEDKVTSSKIKVTNKNGKDSDEATVTFVEA

>P55111

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>032083

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>055242

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>P0A5B7

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${\tt ILTVSVAVSEGKPTEKHIQIRSTN}$

>P54423

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KLFDNLYSFELPKDEKQNGAYTASAKRVKSAAATLSKMSNVEFAEPVQEYKSLANDIQYP
YQWPLKNNGENGGVKNADVKYEPANTLLSKRKLNDTLIAVVDTGVDSTLADLKGKVRTDL
GHNFVGRNNNAMDDQGHGTHVAGIIAAQSDNGYSMTGLNAKAKIIPVKVLDSAGSGDTEQ
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GLLFAQNPKLKRTEVEDMLKKTADDISFESVDGGEEELYDDYGDPIEIPKTPGVDWHSGY
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NIATQKQDQVLYLKATKGDAKTSYKVVVVKGKPSGTPKVNAVKTKDTAVKGKANSKAMIR
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>P36921

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>Q8GFE2

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(3) \mathbb{S}_3 : 208 cytoplasm proteins

>P47437

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EGILCSYIDINPFSRQIIEKTEVADAIIIDHVSNDHDWNQYLSFLSLDDVIFDVKTPTNR
ADLHSLIFLAKELGVLLKTKTFLKQKSSVVNHDFFKFPLNLKNKLKANYFGGLFLRQINQ
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VGLDDKQYEIEPGDIVVCDEKGIIALVGIIGSKRTMVQPTTTNIFFEVVNCNSETIKQTA
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DINKLKPIGITSSFNFEKSSYFNTFNALTKLRKKLQTLGFHNVITYQLTDQKSAKTFNLF
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VVFNEQIGFIGLIKESLLNNYDLNNKPIYCLEINLDRMLSSLNRIEKNYLGYSKLQPVCK
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>Q8G7W9

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KDIVCPNCGIRGQWTEPRDFNMMLRTHLGPVEDENSLHYLRPETAQGIFVDFKNVMTSSR
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>P39802

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>Q828D2

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>Q88Z97

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>P42450

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>P59934

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>053079

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>Q82K53

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>Q8XMP3

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>Q53778

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>P07515

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>P28618

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>P50589

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>P27623

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>P59959

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>053441

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>Q8G864

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>P81102

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>Q46338

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>Q59280

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>P77949

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>P56968

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>P26379

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>034777

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>P39071

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>02G1N7

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>P50846

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>Q7NAT8

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>Q9Z4Q7

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>P26380

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>P46712

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>P68575

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>P20805

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>P0A0C1

>Q46337

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>02FZE2

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>P45855

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>P16400

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>006539

>P56220

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>P06632

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>Q9S4K9

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>09ZN78

>P38037

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>P0A4V0

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>P54322

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>P11931

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>P19080

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>P13267

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>P80734

>003377

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>Q9F0R1

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>Q04942

 ${\tt MPSLLLIEDDDAIRTALELSLTRQGHRVATAASGEDGLKLLREQRPDLIVLDVMLPGIDG} \\ {\tt FEVCRRIRRTDQLPIILLTARNDDIDVVVGLESGADDYVVKPVQGRVLDARIRAVLRRGE} \\ {\tt RESTDSASFGSLVIDRSAMTVTKNGEDLQLTPTELRLLLELSRRPGQALSRQQLLRLVWE} \\ {\tt HDYLGDSRLVDACVQRLRAKVEDVPSSPTLIRTVRGVGYRLDPPQ} \\ {\tt Constant of the property of$

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>086963

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>Q98R33

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>031749

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>Q8Y960

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>P28598

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>A5U654

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>P96614

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>P45870

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>P40859

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>P32397

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>P0A3Q0

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>A5U697

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>034767

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>P0A672

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>P55179

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>Q8EWP5

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>P46807

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>09X895

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>Q9KWG2

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>032271

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>Q83FF5

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>Q5FIJ4

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>P38645

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>053078

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>P00512

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>047N75

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>P81101

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>P32081

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>Q7TWW7

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>050515

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>010744

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>P46713

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>P39804

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>P0A5T0

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>059118

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>P42014

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>P19368

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>059111

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>P24301

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>P71756

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>011010

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>032885

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>P00469

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>P16304

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>07A338

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>Q45588

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>P41019

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>P37487

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>P0A5P0

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>P46815

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>P11018

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>P59076

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>P13375

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>P75361

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>P34024

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>P0A5S6

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>053077

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>A1R7K6

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>P46033

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>P53627

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>Q831U3

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>P37552

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>P22346

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>P0A512

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>034559

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>Q97EB7

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>P45618

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>P21938

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>P39127

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>P34020

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>031760

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>P26900

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>P81100

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>P17893

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>008352

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>P0A574

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>P12876

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>P06535

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>P11540

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>Q933K8

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>P0A0I7

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>P27580

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>P22326

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>P40875

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>P23532

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>Q59331

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>P35154

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>P60611

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>P29094

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>P39043

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>033702

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>P29958

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>P45702

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>P0C1U8

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>P39597

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>P11001

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>003424

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>P82594

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>P0A312

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>034344

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>P80696

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>P81715

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>P09401

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>P82593

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>P15555

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>031097

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>P10547

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>005622

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>P15698

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>P00691

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>P22222

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>046134

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>P30234

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>P26831

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>P0A564

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>P80172

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>008002

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>P0C046

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>Q5YLG1

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>P11701

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>Q2FWV6

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>P07883

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>P40943

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>P09879

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>P39790

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>P0C0J0

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>P68802

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>P08954

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>A5HZZ9

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>P20910

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>A6QG59

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>Q8VL79

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>044052

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>P02968

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>Q45070

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>P0A5P8

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>P29767

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>POCO16

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>P60158

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>P17670

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>P22637

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>P37957

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>P09616

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>P34020

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>09KWM4

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 $\label{thm:constraint} $$\operatorname{MLVMTEYLLSAGICMAIVSILLIGMAISNVSKGQYAKRFFFFATSCLVLTLVVVSSLSSS}$$ ANASQTDNGVNRSGSEDPTVYSATSTKKLHKEPATLIKAIDGDTVKLMYKGQPMTFRLLL $$\operatorname{VDTPETKHPKKGVEKYGPEASAFTKKMVENAKKIEVEFDKGQRTDKYGRGLAYIYADGKMVNEALVRQGLAKVAYVYKPNNTHEQHLRKSEAQAKKEKLNIWSEDNADSGQ}$

>P10424

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>P0A618

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>P85147

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>P29141

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>P0A566

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>034310

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>P39046

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>P42983

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>P0C2S1

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>P01552

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>053728

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>P35804

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>P39045

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>P16397

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>09K6W0

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>Q2FZL3

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>P16169

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>Q0TV31

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>P45741

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>P39652

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>P43131

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>09RLV9

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>P10335

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>Q2QBT0

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>P00649

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>P39116

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>P0A5P2

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>P0C1D7

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>P15917

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>P54422

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