Supporting online material

Materials and Methods

Gene synthesis, mutagenesis and screening. A gene encoding IFP1.0 with codons optimized for *Escherichia coli* was synthesized by overlap extension PCR (*S1*). Genetic libraries were constructed by saturation and random mutagenesis as described (*S2*) and DNA shuffling (*S3*). IFP1.0 and mutants were cloned into a modified pBAD vector containing the heme oxygenase-1 gene from cyanobacteria. Libraries were expressed and screened as described (*S2*). A 676 nm laser was used for FACS screening of large libraries, with 710 – 900 nm emission filter.

Protein expression and characterization. IFPs in the modified pBAD vector were expressed in *E. coli* strain TOP10. Protein purification, fluorescence characterization and photobleaching experiments were done as described (*S2*). For quantum yield determinations, the integral of the emission spectrum (corrected for the wavelength-dependence of detection sensitivity) of a solution of IFP in PBS was compared with the analogous integral for an equally absorbing solution of Cy5 in PBS, whose quantum yield was assumed to be 0.27 (*S4*). For extinction coefficient determination, the holoprotein concentration was calculated based on the assumption that the extinction coefficient of holoprotein at 388 nm was equal to that of free BV, which was measured to be 39,900 M^{-1} cm^{-1} in PBS. This is based on the result that the absorbance by the Q band (670 – 700 nm) decreased by ~ 10 fold after denaturation while the absorbance at 388 nm did not change.

Chimera construction and imaging. DNA encoding IFP1.0 with codons optimized for mammals was synthesized by overlap extension PCR (*S1*). Other IFPs were created by QuickChange Multi site-directed mutagenesis. AKT1's PH domain was fused to the c-terminus of IFP1.4 to generate chimeras IFP1.4-PH^{AKT1}. All the IFPs and chimera were cloned into pcDNA3.1 vector. HEK293A cells were transfected with IFP cDNAs using Fugene, then imaged 24-48 hr later on a Zeiss Axiovert microscope with redshifted Cy5.5 filter set (Chroma) and a cooled CCD camera (Photometrics, Tucson, AZ), controlled by MetaFluor 2.75 software (Universal Imaging, West Chester, PA).

Adenovirus construction. To create adenoviruses expressing IFP1.1 or mKate and GFP, a transcription unit comprising the IFP1.1 or mKate coding sequence, the poliovirus IRES, and GFP was constructed by assembly PCR, cloned into pENTR1a (Invitrogen), and transferred into pAd-CMV-DEST (Invitrogen) by Gateway recombinase (Invitrogen). Viruses were produced in HEK293 cells by transfection followed by one round of amplification, purified by anion exchange chromatography (FastTrap purification kit, Millipore), resuspended in HBSS + 10% glycerol, and stored in aliquots at -80ºC. Titers as assessed on HEK293 cells by GFP fluorescence were 5×10^{10} infectious units (IU) per mL for each virus.

Mouse imaging. The University of California San Diego Institutional Animal Care and Use Committee approved the protocol. Albino C57BL/6 mice (Jackson Labs) were injected with 2×10^9 infectious units of adenovirus via tail vein. After 5 days, belly fur was removed using a depilatory cream. Mice were imaged on a spectral imager (Maestro,

Cambridge Research Instruments). The IFP channel was excited with a 650/50 nm (center wavelength/full width at half maximum) bandpass filter with a 700 nm long pass filter in series with the imager's tunable emission filter at 710/40 nm. The mKate channel was 590/24 nm bandpass for excitation and 620/20 in series with 630/40 nm for emission. Images for GFP were acquired with 467/45nm excitation and a 515 nm long pass filter in series with the imager's 530/40 nm for emission. Images were taken with 3 seconds exposure. Images for Fig. 3A were acquired before BV and 1 hr after injection of 250 nanomoles of BV, then scaled so that the brightest pixels after BV administration would display at maximum intensity. mKate and GFP images were first scaled with the same parameters as the IFP images, then the mKate images were further brightened 5-fold to make them visible. For fluorescence time course measurement, background-subtracted images of averaged liver intensity of the same region over liver at different time points after 250 nmole biliverdin injection was divided by the fluorescence intensity after 1 hour (Image J, NIH).

For spectral deconvolution, an image cube was collected on the Maestro with excitation at 620/20 nm and emission at 650-800 nm taking an image every 10 nm. Fluorescence region and autofluorescence regions were identified and spectrally unmixed using the instrument's software, revealing true fluorescent protein signal (displayed in red) and autofluorescence (displayed in grey).

For fluorescence molecular tomographic imaging (FMT), an Ad5I infected mouse was anesthetized with ketamine and midazolam, then injected IV with 250 nmole biliverdin in 10% DMSO. One hour later, the mouse was placed in a FMT 2500 imaging system (VisEn Medical, Bedford MA) and imaged in channel 1 with Prosense 680

settings. Images were reconstructed and windowed (106 – 167 nM apparent concentrations depicted in blue to red pseudocolors) to show the 3D distribution of fluorescence viewed from two different angles (Fig. S9).

After sacrifice, the mice were dissected and imaged using both IFP and mKate filter sets at 3 levels during dissection: with the skin on, with the skin removed, and then with the peritoneum and rib cage removed. Using Image J software, regions of 80x300 pixels were selected from below the liver up to the mid thorax. These regions were analyzed by plotting the profile. The values were normalized by dividing each pixel by the average of the last 30 vertical pixels over the thorax. These data represent contrast of liver to adjacent thoracic background.

Liver histology. Livers were frozen for cryohistology to compare fluorescence protein signal strength and relative expression. Sections were cut at 10 μm and then imaged on a fluorescence stereomicroscope (Lumar, Zeiss). Filter sets used were ex 470/40 nm and em 525/50 nm for GFP, ex 560/25 nm and em 607/36 for mKate, and ex 665/45 and em 725/50 for IFP. Images were acquired at 15s exposures for IFP and mKate channels and 3s exposure for the GFP channel, then displayed with intensity enhancements of 2, 1, and 1 respectively. Therefore the relative gains for the IFP, mKate, and GFP channels were 10, 5, and 1 respectively.

SOM Text

Evolution of IFP1.4. Random mutagenesis of IFP1.1 with fluorescence activated cell sorting using a 676 nm laser resulted in IFP1.2 with 32% increase in quantum yield (QY),

due to an additional M54V mutation. However, the parent of IFP1.2, *Dr*CBD, was previously shown to be a dimer. Multiple angle light scattering at 785 nm (Dawn 8+, Wyatt Technology, Santa Barbara CA) of IFP1.2 gave an apparent molecular weight 80 kDa, about twice the predicted monomeric size of 36.5 kDa, suggesting that IFP1.2 was also a dimer. To monomerize IFP1.2, Leu311 was rationally mutated to a lysine since it is in the hydrophobic dimer interface based on the crystal structure of *Dr*CBD (Fig. S3). Size exclusion chromatography (SEC) showed that the resulted mutant (named as IFP1.3) was eluted later than IFP1.2 (Fig. S3B), suggesting that IFP1.3 is possibly a monomer. SEC of IFP1.2/IFP1.3 mixture confirmed the result (Fig. S3B). However, the QY of IFP1.3 was slightly decreased (8%). Another round of random mutagenesis and screening generated IFP1.4 with increased brightness. SEC (Fig. S2) and multiple angle light scattering at 12 μM concentration (apparent molecular weight 41.5 kDa ± 10%) confirmed that IFP1.4 is monomeric. A sequence alignment of IFP1.4 with *Dr*CBD is shown below with internal mutations shaded in blue. The S2A mutation (shaded in red) is to optimize the Kozak sequence when expressed in mammalian cells, and the C-terminal hexahistidine motif is to enable immobilized metal ion affinity chromatography.

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DrCBD           MSRDPLPFFPPLYLGGPEITTENCEREPIHIPGSIQPHGALLTADGHSGEVLQMSLNAAT 60
IFP1.4          MARDPLPFFPPLYLGGPEITTENCEREPIHIPGSIQPHGALLTADGHSGEVLQVSLNAAT 60

DrCBD           FLGQEPTVLRGQTLAALLPEQWPALQAALPPGCPDALQYRATLDWPAAGHLSLTVHRVGE 120
IFP1.4          FLGQEPTVLRGQTLAALLPEQWPALQAALPPGCPDALQYRATLDWPAAGHLSLTVHRVAE 120

DrCBD           LLILEFEPTEAWDSTGPHALRNAMFALESAPNLRALAEVATQTVRELTGFDRVMLYKFAP 180
IFP1.4          LLILEFEPTEAWDSIGPHALRNAMFALESAPNLRALAEVATQTVRELTGFDRVMLYKFAP 180

DrCBD           DATGEVIAEARREGLHAFLGHRFPASDIPAQARALYTRHLLRLTADTRAAAVPLDPVLNP 240
IFP1.4          DATGEMIAEARREGMQAFLGHRFPASHTPAQARALYTRHLLRLTADTRAAAVPLDPVLNP 240

DrCBD           QTNAPTPLGGAVLRATSPMHMQYLRNMGVGSSLSVSVVVGGQLWGLIACHHQTPYVLPPD 300
IFP1.4          QTNAPTPLGGAVLRATSPMHMQYLRNMGVGSSLSVSVVVGGQLWGLIVCHHQTPYVLPPD 300

DrCBD           LRTTLEYLGRLLSLQVQVKEA         321
IFP1.4          LRTTLEELGRKLSGQVQRKEAEFHHHHHH 329
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Increase of cellular IFP fluorescence by exogenous BV. HEK293A cells were transiently transfected with IFP1.4 in one 10-cm dish and incubated for 24 hours, trypsinized and replated into 5 wells of 6-well plate with ~ 400,000 cells per well. After another 24 hours incubation, different amounts of BV (final concentrations 5, 10, 20, 40 μM) were added, followed by 90 minutes incubation. Then cells were trypsinized and washed with PBS and resuspended for fluorescence measurement by a 96-well plate reader with monochromators (Safire, TECAN). Untransfected HEK293A cells with additions of exogenous BV were used as controls. Infrared fluorescence of transfected HEK293A cells increased upon the increase of added exogenous BV concentration and was saturated at 20 μM, while the untransfected cells did not show infrared fluorescence either with or without BV (Fig. S6A). Addition of exogenous BV rapidly (within 10 minutes) led to infrared fluorescence of matured P2 cortical neurons, two weeks after transfection of IFP1.1 (Fig. S6B), which were practically nonfluorescent before addition of BV.

Half-life of IFP1.4. Cycloheximide (30 μg/ml final concentration) was added to HEK293A cells 24 hours after transfection of IFP1.4. Infrared fluorescence was fitted with single exponential decay assuming first-order decay kinetics of protein degradation (*S5*) (Figs. S7 and S8). The half-life of IFP1.4 in HEK293A cells with or without exogenous BV was calculated to be 4.44 and 3.61 hours, whose average is 4.03 ± 0.41 hours.

Multiple sequence alignment. 130 bacteriophytochrome-like sequences from NCBI database are aligned using *Dr*CBD as the query (*S6*). Readers are suggested to zoom in to read the alignment.

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Query          1     MSRDplpffppylyggpEITTENCEREPIHIPGSIQPHGALLTADGHSGEVLQMSLNAAT  60
NP_285374      1     ............................................................  60
YP_488045      30                           .D.............V.IALAEPDLRPVSV.A.IEA  66
YP_569534      29                           .D.............M.IALAEPELRPVSV.A.IQA  65
YP_533633      28                           .D........K.....M..AFVEPELRPVSV.V.VEA  64
NP_442237      20                             ..TAHL.....LVVVLQEPDLTIS.I.A.CTG  51
ZP_01628825    12                        .DISR.NK.............V.FALKEPDLTI..V.D.IFN  53
NP_486939      11                       QVDLS..SK.......L.....V..VLQEVDLTI..V.N.TFN  53
YP_321522      12                        VDLS..NK.......L.....V..ALQEIDLTI..V.N.TFN  53
YP_488044      7                        DVDLT..D..............-..I.FNDDLRAVAV.S.I..  48
ZP_01459223    7                        .LDLSQ.D.....LL.G..S..V..AFR.PDRLLEVV.A..QA  49
NP_948356      28                            .D........A.....Y.FVVSETDLRIASV.A.VED  64
YP_569533      7                        DVDLT..D......C.....-..I.FNDELK.VAV.S.IGN  48
YP_779569      10                       .ADLTD.D........A.....-..I.FTDDLDTVAA.A.LPD  51
ZP_01623500    17                              DQ...Q.S.QV....I..VLEEP.LKI..V.K.TQS  52
YP_324352      10                        .NVTSLKEA...LS.Q.....V..VLEEPDLKI..V.N.TWS  51
NP_948355      15                           .DD.......A.....L..ALAADM-TIVAG.D.LPE  50
NP_487197      10                        .NVTSLKEA...LS.Q.....V..VLEEPGLKI..V.N.TWG  51
YP_779570      28                           .DK.............VVFVLLERELRIVSV.A.VEK  64
ZP_01630443    10                        .NVNSLKEA...LFKH.....V..VLEEPDLKI..I.N.TWS  51
YP_001894923   15                            D.A....Q...G.....F.FSISA-T.TL..V.A.T..  51
YP_001863766   19                                ....SSQ.....V..VLEEPELKI..V.T.TLK  51
YP_001174646   14                              DR.AD.............F..VVSEPDLRIQ.A.E.VRD  52
ZP_01461267    12                       .VDLT..D........A.....V..VLSEPGLVLTHA.E..PA  54
ZP_01730981    10                       D.NLQRL.ELQ..LW.KT....V.FVL.ESNLKIV.T.S.TSQ  52
NP_354963      9                          DS.GA.......A..E.....VLSAREFS.V.A.D.L.N  47
YP_608942      13                           .R.AQ...QV........F..VL.NT.LRI..A.E.TER  51
YP_001668195   12                           .R.AQ....L.S......F..VL.ATDLR...A.E.VEH  50
YP_001769101   16                             .D......L.T.....F..AVQ.PDLRIV.I.D.VPD  52
YP_001748669   19                           .R.AQ...QV........F..VL.EQDLRI..A.D.VER  57
NP_744505      19                           .R.AQ...QV........F..VL.ATDLR...A.E.VEH  57
NP_945475      15                        VDLSS.D..LVQY.EA......M..V.EQ.DR..HA.A.C.A  56
YP_001268649   12                           .R.AQ...QV........F..VL.ATDLC...A.E.VEH  50
NP_791725      10                       .VLLA..AD...QF..A.....L.F.LKEPELTI..V.A.VQS  52
YP_569510      15                        VDLST.D..LVQY.EA......M..V.DQ.HLIMHA.A.C.E  56
YP_347894      15                            ..AD...RF..A.....L...LSEPDLSII.I.A.VE.  52
YP_001864851   16                             .HD.K.............I..ALSTQL-.IV.V.N.TQV  52
YP_660007      6                        DV.LD..HK.............V..LFEPETLILQYC.E.V.D  48
YP_236574      10                       .VLLA..AD...QF..A.....L.F.LAEPELTI..V.A.VQ.  52
NP_792460      15                       .AALAE.A....R...A.....V..SVA.DPLCIE.V.A.C.K  57
YP_275602      10                       .VLLA..AD...QF..A.....L.F.LEEPNLTI..V.A.VQS  52
YP_262277      15                             ..AD...RS..A.....V...LSEPELRIQ.I.A.VEA  52
ZP_01050418    25                       K.DLT..DK....LL.QV.S.AY.FVI.VLNKQLVRA.E.VFD  67
ZP_01623038    12                        .DLT..D.....Q.....V...FQEIDLTI..A.Q..ID  53
ZP_01094090    8                        KVDLD..D..............V..AF.PQ.LVLRYW.Q...M  50
YP_235462      20                       .AALAE.A....RV..A.....V..SVA.DPLCIE.V.A.C..  62
YP_780275      18                            .....E..LA..........VVSEPEHRII.A.A...D  55
YP_001900695   26                                          A..SR.V..CLSEPDLRIH.V.E.LEA  52
YP_861991      10                       KVDLSS..K....I.TS.A..VIVAY.RK.SKIT.IGE.CKE  52
ZP_02008304    26                                A..SR.V..CLSEPDLRIQ.V.E.LE.  52
YP_001242244   14                         .LA.....Q..LA.......I..AVKEPDNL.I.A.T...A  54
YP_676783      12                        VNLQ..DQ.............F.IAITKETW.IRFC.E.VID  53
YP_570910      21                             .D..A..LA..........AVTPEDLQIVHAGGET.A  57
YP_001203744   14                         .LA.....Q..LA.......I..AVKEPDNV.I.A.I...E  54
YP_001196150   12                        V.LT..DQ.......Q.....F.IGLT-NDWIIDYCTS.ISS  52
ZP_01061101    12                       .VSLT..DK.....L.K..H..F.VAC.ASNHTYC.D.ISA  54
ZP_01884257    5                        QVDLT..DK.....K..SQ.F.IAV.IQ.YQ.TYV.D.ISA  47
YP_531190      17                             .....E..LA..........VVSEPDHC.I.A.A...E  54
YP_487638      24                             ....A..L............ALAPDDLRIVHA.GDTTL  60
YP_001135775   22                        .DLD..A.........V..R.V.VVVREPEF..R.V.A.VEE  63
YP_001361736   20                       DL.-~-..........A.....V..AVERGDHR.VVA.A...G  60
YP_001196265   12                        V.LT...H.............F.IGL.SDL-KIDFCTA.ISL  52
YP_715500      20                             .D.....L....V....V..AVRADDDT.V.V.A.I.E  58
ZP_01227360    24                             .D..............M..V..RGTLD.VA---G.GD  57
NP_252806      7                        V.LA...D....V..A.......V.LRA-D.M..AA.E.IQA  47
YP_789005      7                        V.LA...D....V..A.......IALRA-D.M..AA.E.IQA  47
YP_001417343   20                            .D.....R..A.....L..V..SRT---.KVVAA.GD  53
ZP_00973293    7                        V.LA...D....V..A.......IALRA-D.M..AA.E.IQA  47
ZP_02055103    182                           .............NAVM.A..AA.L.I.AF.A...D  218
YP_001641522   182                           .............NAVM.A..AA.L.I.AF.A...D  218
ZP_00967488    7                        V.LA...D....V..A.......V.LRA-D.M..AA.E.IQA  47
YP_570862      18                            ...Q.Q..LA..........VISEPDHR.I.A.A...E  55
YP_001239104   30                             .D....RT..A.....L..GL.PEELRITHAGGDV.G  66
ZP_01439288    24                            ..D.....LL.AV.DF..-F.V.VSFDWLIQRV.A.IES  60
YP_245299      13                             .A.....L....Y.V...VI.PAD.RIV.A.TT..D  49
NP_639488      13                             .A.....L....Y.V...VI.PAD.RIV.A.TT..D  49
YP_487589      18                            ...Q.Q..LA..........VISEPDHRIV.A.A...E  55
YP_001770032   151                       .DPDL.A.....V..A....AV..AC.AATLT.AAC.A...E  192
YP_001238408   4                        QVNLT..D.....V...V..F.F..ALVSDF-TICMA.E..PD  45
YP_485786      15                            .D........A......F.A.RVDTSV.THA.A.LDE  51
YP_001346361   7                        V.LA...D....V..A.......ALRA-D.M..AA.E.IQA  47
YP_198931      13                             .A.....L....Y.V...VIEPAD.RIV.A.ST..E  49
YP_366123      13                             .A........L....Y.V...VIEPAD.RIV.A.ST..D  49
NP_355125      12                            ..D........Y.....C.IAC.NAMRM..RH.E.CGE  49
NP_644587      13                             .AQ.......L...Y.V...VIEPAD.RIV.A.ST..D  49
ZP_01302507    17                        VDLS..D......L.AV..F.F.....WL----.ARA.A.S.Q  57
YP_001170431   10                             ..T...AT..A.......V..QAD..L.AHA.A.L.E  46
YP_001204102   5                        VNLT..D.....V...V..F.F..ALVSDF-TICMA.E..PD  45
YP_971319      14                         .LD..D..........D....VAF..-D.V.RYA.A..ED  53
ZP_01017885    17                            ..D.....QL.H..SF.F.FCLSS-DWSI.KV.E.VNQ  53
ZP_01157401    11                       .V.L...A.....VL.R...F.C.IAVS..A------.A.TDD  52
YP_742336      14                          .A.A...V....AV..S.C.VSL.QRLRRL..A.A.LHR  52
ZP_00998358    24                             ..D.....KL.AV.SY.C.VVLSA-DWI..HA.A.VKS  60
NP_946341      4                        KVDLTS.D..........C.C..AC.AQAVRITRI.E..GA  46
YP_611325      16                         .LDS.DS....LS.L..NT...IVQ.PET.LIIGA.E..HL  56
YP_001749437   6                        DVNLT..D....Q.........C..AC.ASASL..RH.V.TSQ  48
YP_192038      26                            S.D.....R.DA...Y.L..VV.ST.LKIIG---G.GD  60
YP_001668821   6                        QVNLT..D....QT........C..AC.ASATV..RH.V..PD  48
ZP_01545930    3                        QVDLT..D.....LL.KV.SF.F.I-.TTPDWIISHV.R.VSQ  44
YP_001523831   11                            ..D..............C.IACTPDA.HI.CH.A...D  48
NP_745504      6                        QVNLT..D....Q.........C..AC.ASATV..RH.V..PQ  48
YP_345327      13                             ..M...AT..A.......M..RAD..R.AHA.V.LGE  49
YP_001520152   5                        .LAIS..D...V....R..IF...IAT.K.LESITHV.S.ISD  47
YP_001267717   7                         VNLT..D....Q.........C..AC.ASATV..RH.V..PQ  48
YP_345384      62                            ..M...AT..A.......M..RAD..R.AHA.V.LGE  98
YP_001372987   7                         VNLT..D..............M.VM.QSGQNL.FA.A.IPC  48
ZP_01011420    19                            ..D.....LL.RV.SY...V-.LSPDWVIQHA.E.LG.  55
ZP_01864718    7                        DVDLT..D.....RL.H..AF...IAVNA-DWFLA.R.A.LQS  48
YP_769292      12                             ..D.....QL..V..F.F..AVSS-DWI.MRA.A.L.E  48
ZP_00208733    13                            QG..S.RL.LS.E...F....RL.P-D.Q.SHA.A.CGA  50
ZP_01726549    7                        QLNFDR..D......EL..GY.Y.FALEEQ....KIV.D.IS.  49
NP_946838      30                                      L..A....A...ALAPADLTIVHAAGAT.S  59
YP_745313      24                             .D.....M..A.....F.I-.VSRLWN.THV.A.I.D  59
ZP_01041311    13                             .D.....NIAAV.SF.GM.VTNSE-WVIS.R.V.C.K  48
ZP_01748188    18                            ..D.....QL.RV.SY....AVTT-DWI.QHA.E.LGD  54
ZP_01109672    11                           .R..D......E.V.SY.F.IAFSYDDLNISIV.E.CE.  49
ZP_01884592    12                             .GSL.LQHINL..DY.Y..IL.IEDLK.I.A.E.TDA  48
YP_677848      11                             .GSL..SFVNQ..DY.F..VC.P-ALI...V.D..EA  46
ZP_01110306    12                            Q...D.A..LIE.V.SF.VVIAINPDTKK.QVF.E.IKD  50
ZP_01109728    15                             .DK....LL.K..NQ.FMVIV.-KA.V.THL.E.LEH  50
YP_427322      17                             .DQ....V..LV....F.VVL.SK..RIA.VTPGIEA  53
ZP_00514108    20                                       .........V..VI.IKTFTII.V.E.TKR  48
ZP_01043109    10                       .EAMK..AK..VQA.QCV.EN.M..AV.KRG.QIIAV.D.SDA  53
ZP_01051640    19                            ...NN...EWIE.V.S..V..AF.FD.LI.THA.K.LD.  57
ZP_01736013    12                              .KKRLQET.F...Q.V..AL.SQFF-IQHC.E.VDE  46
ZP_01446334    18                             D.D.....QL.RV.SY....-.LSTDWI.QHA.E.LEA  54
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Query          61    FLGQEPTVLRGQTLAALLPEQWPALQAALPPGCPDALQYRATLDWPAAGHLSLTVHRVGE  120
NP_285374      61    ..............................................................  120
YP_488045      67    V..LS.EAVLAEP.S.H.SADSA..SGD.AAAN.LHVEF---.TSSGTRTFNGIL..HDS  128
YP_569534      66    MI.IP.ETALAEP.S.YMT.SFAL.R...SDDD.IR.EF-L.KSA.I.--FNGIL..HDG  128
YP_533633      65    .T..S.EAVLS.SI...MTASFER.T.V.--AS..LAAFNPI.TSKGVRVCNGIM..HDG  127
NP_442237      52    I..RS.ED.L.R..GEVFDS.IDPI.SR.TA.QISS.NPSKL--.ARVMGDDFVI..NSD  115
ZP_01628825    54    LF.LH.EE.LNKN.NYF.ETDQIS.ESLVQEDL.IVNPIEL.INLKNEPNFDGII..SHG  116
NP_486939      54    I..RH.EQ.LN.H.SC..E..LSL.KDC.---AQED..IINP.EFIIKS.FDVIA..SNN  116
YP_321522      54    L..RH.EQ.LN.H.SC..E..INL..DC.TQ---ED..IINP.EFIIKS.FDVIA..SNG  116
YP_488044      49    .ADLG.DD.L.RS....DADSQAR.RS.MAS.S.V.IRL.RR-----DAEFTGLW..H.G  109
ZP_01459223    50    L..RP.ET.L..PVGRV..A..EP.V.V..A.A-----...L.------------.ESDG  102
NP_948356      65    L.R.P.AS.LNVPI.HY.TAASA..TH..HG.D.A.INI.LDVVT.DGERFNGIL..HDS  127
YP_569533      49    .VDL..GE.L..S.K..DSDSHMR.RK.MAS.S.I.IRLH--------..FTGLW..H.G  109
YP_779569      52    .A.LH.SQILQRPI.E..DDESAH.RRS..D.VAGS.LPIRFAQRRE.EFTG.W-..HDG  113
ZP_01623500    53    VF.IS.EQMLEK..ED...F.IERI.TG.---FQ.N.D.NP.KI.IRIRGDEVV...NSD  116
YP_324352      52    I..IKTEDILQKK.ED..DS.IERI..G.SS.N.TKIWI.KKG.DY.V--FDAVF..NT.  115
NP_948355      51    LT.LAIGA.I.RSA.DVFD.THNR.TI..AE.A.I.VGFTMRK.AGFV.----SW..HDQ  112
NP_487197      52    I..INAENILQKK.ED..DS.IERI.SG.SS.N.TKIWI.KKG.DY.V--FDAVF..NT.  115
YP_779570      65    L..VP.EAVLAAP.SSF.SDSSL..ST..SKEDIA.ANPIRIELHT...ERQFNL..HDS  127
ZP_01630443    52    IF.IH.ENILQTK.ED...F.IERIKTGISE.N.TKIWV.RKG.EY.V--FDAVF..NS.  115
YP_001894923   52    LF.LPAEHAL..PI.QIVGDE.AEREEGI.LYVGSMNDP..NVAGSP.APFAVI...YQG  120
YP_001863766   52    VF.IA.ENMLHKK.ED...F.IERIKTG.SGENL.FIN--P.KV.VRKKGDEVV...IEG  116
YP_001174646   53    W.DV.ARQ.L..P.S....IE--RI..G..------...SDVQ.TL.G..D.A.MA..HQG  116
ZP_01461267    55    V..NSAEQ.L.AP.GHFI.SVREP.E.D.RSARLKQ.NPLKVV-.RVD.FFDGIA..HQG  117
ZP_01730981    53    .F.IT.EEIIKL..DNIFDS.IEQ.KTG.ESNNL.FIKLW.RV.GDNYVIFDGVF..IEG  117
NP_354963      48    YI.VDLPIGAVA.E.N.---PFISVLS.WYS.EESNFR.A-----.-.EKK.DVSA..S.T  99
YP_608942      52    W..VPALE.P.RAFD..VS.DFDLR.TS..EDF.FHIDV.LREGA.CQAP.RVLA..HDQ  116
YP_001668195   51    W..LPAQE.I.CPF.N.VSDGFD--.H.H.ARLPE.EIDV.LRQGA.HSEP.H.LA.CHD  115
YP_001769101   53    RS.RPVAA.L..P.REAF..LRD.VASGMAEHAEEGAR.LR..TL.T.YD.A.--..SEG  116
YP_001748669   58    W..VPARE.L.C.F.DVVSDSFD-.R.H.E..-D.VFPFHIRNGA.CGDR.R.LT..HDQ  122
NP_744505      58    W..LPARE.I.CHF.D.VH.GFD-.H.H.TRLPE.EVDV.LRQGA.ISAL.HML..CHDQ  122
NP_945475      57    .I.KP.EAVI.API..V.GAG.HE.LGS.HDSG.VNIARESF.GSDQGW..F--A..C.G  118
YP_001268649   51    W..LPARE.I.CHF.D.VH.GFD-.H.H.TRLPE.EVDV.LRQGA.ISAQ.HML..CHDQ  115
NP_791725      53    V..RV.DQ.A....DCV.GAG.A--EVIRSTSAN.S.VDVPR.LMSVE.EFEALL.SQ.  111
YP_569510      57    ...KPLEAVV.S.V..V.GPA.RD.T.T..LDSGFVNIA.ESFVGTER.-FN.FA..C.G  118
YP_347894      53    L.ARPAQE.I..P.QS.IGDAHA.QVR-------E...QA.LS.A.PL-.FR.NL..HQD  111
YP_001864851   53    Y.CKA.ED.L.RP.SY...QPVEIVKQC.VKKVGS.NAFKVLINTLYGEYFDAIA..TE.  114
YP_660007      49    LMQCSLDA.L..S.DSIFDREFATKVK..DAALAQ..NSNT.IKTQSTYNAI.SL.--DD  132
YP_236574      53    V..HV.EQ.L.KG.DCV.GAG.AEVS.SAHDSFI..QRLLMSIN---GIEFEALL..HQG  111
NP_792460      58    S..L.SAE.L..P.SI..SAAHSM...YSQ.AM.NSDPI.L.V---R.VDYNASLS.A.D  116
YP_275602      53    V..HA.EHVI.KG.DHV.GAG.AEVS.SAHDSFV..QRLLM.VN---GIEFEALM..NQG  111
YP_262277      53    L...PAAQVL..P.EQ..-------------.DT.GQRI.EV.QL.RLS..AVNL..HQG  111
ZP_01050418    68    L.SRKREDIHTI..KDIFGPSA.TIASHIEG------KNTQ.IEAEVV.KRYVVI.YREN  122
ZP_01623038    54    ...V.AQS.L.KK.NDIFVD.AVSQNIDFDYFN.FEIRPKN.SCY.---QFEGVI..IDD  117
ZP_01094090    51    L..RKV.LTEAR.A..IISQES..VVVPIDG.ATIGREDE-NIRHT..A..-----.AGML  114
YP_235462      63    EF.MAADE.L.KP.SW.....SALIDH.YG.AA.HIDPIKL.I---GTA.Y.ASLQ.ADD  121
YP_780275      56    ..R.KQVL.D.DL.IRI..HLD.D.DR--.I.N.T.-EFDCL.HR.PE.G.VVEFE.A.P  125
YP_001900695   53    A..TPA.A.QAPVDHVIGTAGREV.ER..GTHSI.GHP.IG..LT.HGHA.DAV...HKG  114
YP_861991      53    LF.ISAED.L..G.ESIFSKN-------VTQRITNS.KEDGVF.IEET.KKFIVIPQIS.  109
ZP_02008304    53    A..TPAAA.QAPVDHVTGAAGREV.ER..ATQSI.GHP.IG..QT.HGHA.DAV...HKG  114
YP_001242244   55    ..NTNSV..G.DLALQI..HLNGP.HL.--------PMTL.CAVGT.PR-RVDC.I..PSN  112
YP_676783      54    .I.LSHKQ.L.KKITEIPDDIFKVI.--------.K.YAVGESK.IQGKIEEFDF.A.QNED  111
YP_570910      58    L..VSIES.A.VSAFTIFSD.IAR.R.L.G.DRRIERPLH...KAAD.TFVDVV..QASG  119
YP_001203744   55    ..NTNSV..G.DLALQI..HLNGP.HL.--------PMTL.C.VGS.PR-RVDC....PSN  112
YP_001196150   53    .IPLSH.QAL.NKF..VFGT.--.QERIFSYINS.TV.DVFP.EIELLNEFQVNI.KSDD  111
ZP_01061101    55    LFDKSAEDIL.SS.SD..S.TITQDVLKTTS.------KKSISIQLKLKDEVYVLLSHIN.  109
ZP_01884257    48    YVETSAG..LNLHVS-V.A.HV..FPSS.DGRSQ.SFD.KVLI.S.----FY.IIYTS.A  114
YP_531190      55    ..NLKQVL.D.DL.IQI..HLD.TAEGMIAVR.RP..EFDCL.HR.PE.G.IVELE.A.S  124
YP_487638      61    LP.APAGP.P.RHATEI.SD.IAR.R.L.G.DRRIERPLH.A.TA.D.TFDIVV..QSSG  122
YP_001135775   64    L..HPVESVL.RH.S..MGASQA..HRRN.VE.--V.DV.GS.EFD.IL.-----REP.G  128
YP_001361736   61    .F.RPLPEVLSSS..D..GADLTVRG.D.LDNLDEV.HA.LPGPGGS..EADVVL.VS..  126
YP_001196265   53    .VDLQH.DIL.KNFT.IFGSKQQ--KQI.DYINE.KI.NVFP.EINLL.KFQVSI.KSYD  111
YP_715500      59    T..R.AAATI.RP.RE.VGD--------.AAKAVR.VV--.TAF.LRG..PVD.V......  126
ZP_01227360    58    IE.RLAPQWL.RP..S.IGSA--.VEI.-.--.IE.--ETS.V..-.VT.S.DGVA..T..  113
ZP_01728373    51                                                    I..YDQ  56
NP_252806      48    L..FVASPGSYL.QEQVG..VLRM.EEG.TGNG.----WSNSVETRIGE..FDVI.SYK.  104
YP_789005      48    L..------FVASPGSY.T...G.EVLRM.EE.LTGNGPWSNSVETRIGE..FDVI.SYK.  104
YP_001417343   54    VE.RLAADWA.RD.G...GRDVA..LG.AAV.TVRVGRVAGRDET-----FEVQI.AS.R  108
ZP_00973293    48    L..FVASPGSYL.QEQVG..VLRM.EEG.TGNG.----WSNSVETRIGE..FDVI.SYK.  104
ZP_02055103    219   V.APDLFPPN.LN.E.V.----G.IVS.IRD.LT.GRLL.RS.TL.PR...VAHA.LGRV  283
YP_001641522   219   V.APDLFPPN.LN.E.V.----G.IVS.IRD.LT.GRLL.RS.TL.PR...VAHA.LGRV  283
ZP_00967488    48    L..FVASPGSYL.QEQVG..VLRM.EEG.TGNG.----WSNSVETRIGE..FDVI.SYK.  104
YP_570862      56    ..NL.CLL.D.DL.MRI..HLD.PSE-----.T.I.VRC.GLIHR..E.G.IVELE.A.P  125
YP_001239104   67    L.TAA.QT.L.DSASR.F.D.MRQ.RMLAGGAG.QRAVHAFSMAGHSEANADVIAF.S.A  127
ZP_01439288    61    .T.RSVDD.L.AP.NT..GDNVIH.IRSRLQSSE.GTEHVFGI.FLSN.RFDVSL.VS.S  123
YP_245299      50    L..VPMAA.L.M.QVLT...AQ.FAVDDQ.QHLMH.FPQ...PP.V..W..------YPQ  111
NP_639488      50    L..VPMAA.L.M.QVLT...AQ.FAVDDQ.QHLMH.FPQ...PP.V..W..------YPQ  111
YP_487589      58    ..NV.EVL.E.DL.IRI..HLD.TSEGTPCRI.S.G..-DFDGLIHR.LE.G.IVELE.A.P  125
YP_001770032   193   T..AA.L---.RP..G...DP---.V..IRAAAAS.WEAGRI.R..GGAPHEVLA..S.A  251
YP_001238408   46    Y..GDIGG.LQ.PI..V.S---..GV..IRSRV...VERIFGI.LLGK.R.D.AI.FS.A  108
YP_485786      52    M..ISAGAAL....RQSI--------G..AS.TI..ISRDHSALYQLS.D.H..AY...P  108
YP_001346361   48    L..APGSY.QE.QVG.---.VLRM.EDG.LG.G.----WANSVETRIGE..FDVI.SYKD  104
YP_198931      50    L..VPMDA.L.MAYTQV..DAQ.GAVDDQ.QHVLH.P.RS.PT..V..W..------YP.  111
ZP_01730981    53    L..VPMDA.L.MPYTQV..E------.PD.Q.FAVD.QP.HLLHA..V..W..------YP.  111
NP_355125      50    L..L.GD-..N.R.AEDV.GKKLV..TVTGRTTR.AM.PAME.S.GRS---FDISL..YKS  110
NP_644587      50    L..VPMDA.L.TPYTQV.E-----.PD.Q.FAVD.QP.HLLHA..V..W..------YP.  111
ZP_01302507    58    .I.LS.DDML.RPV.DIFEAD--.IH.T.LR.-..SVERLFS..G.---FDVA..FS.P  120
YP_001170431   47    I..LPAAAAL.RPICDVIGHVNEV.LREARRRGSET.ESIGS.RRADGRL.H.HAFQS.D  106
YP_001204102   46    ..DGDIGW.LHKS.G.VVC.SAE.AIR.RVDSG...VERVFGV.LQGQ.R.D.AI.FS.A  108
YP_971319      54    L..CP--LVP.SV.EG...QAPCSAV.DKVREGLM..RGE.EVPH..SRQFDVVL.ISDR  116
ZP_01017885    54    ..PLQVSD.V.DALHD.RSQ.QMSHE.SVERVFH.QFSCTDY.DVAL.MS.R  117
ZP_01157401    53    I.DLA.ER.V.APF.DFF.G.SHD.RSKMQLLAH.DQPA.VRF.LFED.R.DIAI.GS.R  115
YP_742336      53    .F.VT.EQALASDPK...GRHLRRIS.S..QAPLQPVSLV.GMRLRGRNRFRT.AY.S..  114
ZP_00998358    61    ...W.AADMP.RP.SEM..HASLSKLR.KLS.LLH.DATARLI.VDLF.DFDASI..S.R  123
NP_946341      47    .F.R.-.PRV.EL..DYFG.EAH..RN..AQSS-.PKRPALIFG.RTGRTFDISL..HDG  108
YP_611325      57    ...RPVEAIL.FS.TEIA.DI--.DEL.E.DNVHEI.ESQRNV.-DCVYDTICH....I.  120
YP_001749437   49    M...RLEAII.IEA.HTVRNSLARVKE.SR.------.SFGVP.---.S.QFDVSA.LFKG  109
YP_192038      61    IE.RLAPDWL.RP..DI.KIPESR.HDEKR.SLS.-.RVAGLK.ET----F.ILR.AQ.T  115
YP_001668821   49    V..ITGDI-N..K.Q.V.GDEVAT.RN..AEASRP..SFSVR.--.NGQAFDVAA.LFKG  109
ZP_01545930    45    YVPFS.EDML.KRALD.I..SIH.IRNR.Q.RRGVEVV.NLK.EGTDCP-FDVSI.ALES  107
YP_001523831   49    V.HLPSAGIN.LR.E.V.GGKAA..TT.TD.AR.GL.LGLNI----GERAFDVA..IYKG  109
NP_745504      49    M..VANDI-N..K.H.V.GDEVTT.RN..ADASRP..SFGV.---.NGAAVDIAA.LYKG  109
YP_345327      50    I..LPAASVL.APIGEVIGRVNEI.LREARRSGSETPETIGSFRRSDGQL.H.HAFQS.D  109
YP_001520152   48    ...VT.ADAL..S.SI....EVIHTLRNI-A.H.TIATH.ERAGY.LQSM.DISL..L.P  108
YP_001267717   49    M..VANDI-N..K.H.V.GDEVTT.RN..ADASRP..SFGV..---.NGEAVDIAA.LYKG  109
YP_345384      99    I..LPAASVL.APIGEVIGRVNEI.LREARRSGSETPETIGSFRRSDGQL.H.HAFQS.D  158
YP_001372987   49    IT.YRGDLIP.IAISLIVG.KNA.AAK.RE..LSSVV---LG.RF.GKSL.DAVI.THKG  111
ZP_01011420    56    I.DHHDGEVI..NIDEIVDASAI..RT.MTR.--.IT.TAVR.ELKNN.R.D.SL.QSDQ  118
ZP_01864718    49    I..T.REPEV.VR.SQIIAPRGS.VA.LID.DQTER.FGVDL.--DG.IFDCAI.TS.H  111
YP_769292      49    ..ET.ANAIGRPV.SLIT..ALHTIRNK.TT.SDVVERIFGIALM.DQNRFD.A..LN.G  111
ZP_00208733    51    V..IP.EA.L..IPGP..GGL-VG.DELT.L.GFPI.RTK.---FT.H.D.D.A.SPS..  107
ZP_01726549    50    L.Q.HEDI.-.KNFFE..D.D.QFI.ETYERARTRQ..VVFRNEVLI..NFYAVLYSS.S  118
NP_946838      60    L..AAAEL.P.TAAS.FSSD.IAR....TAERWIERP.HAF..NA.D.TPIDVI..HASG  121
YP_745313      60    YVPASASKVL.AS.IT....TVH..RG.VQMLGSA.MTE.LK.HHD.ESA.DFSI.IMAD  124
ZP_01041311    49    L.AIDALPEP.TN..DIIESA-.....LREAASA..VERIFGIRFTEEAE.DCAL.CSEG  111
ZP_01748188    55    I..IDHGDAI.RR.QE.IVDAFERMRKSM.D.VVRLFGVTVLN.NRS---FDVSL.GS.R  117
ZP_01109672    50    IFAEGIVI.SSD.NE.F.E.TFDRVSKSKIRLPIKLILNK.L.KEGE.KDYLAV.YDS.H  116
ZP_01884592    49    IT.KPQEIINSSFSEYIIDTDFEKIREF.KK.VTQKIPFSLSFNTE.SDQFHALM.IKAD  110
YP_677848      47    .TRISYQSFIDKN.KE..TDSFQL..EK.SSKAQK--RFTC..EFYGGVRT.FLI.VKE.  107
ZP_01110306    51    LFKV.--IVA.E..VTE.IDI-.SPD.PTFKTIHN..KV.HAYQ.KF.KNA.GVAFDSNG  120
ZP_01109728    51    .ANVTRDN.I..S.WE..DRKLV.IRG.QSQAVISKAT.LHSISI.CEDKFD.CI.QSA.  113
YP_427322      54    VA.VVAQR.I.EP.ERV.DP.RCNHRI.R..HLI.PFPV.------.GGQSF.AVA.ATDQ  114
ZP_00514108    49    ...VK.KT.L.KF.TY.MYK.IKNIKNI.ENNFV.IIKLKKKY.TQFK.----IF...QD  108
ZP_01043109    54    V..CPCDA.M.SF..ECM.SDFLTSFK.ADEKLKQGSD.EI-FA.E.GEQSFFSIYYSQA  113
ZP_01051640    58    I.KLDAKAALSKSIREVFNKD--DVHDI.NIASHNSTKF.EHIKVTSE.SIDISLF.TEN  118
ZP_01736013    47    L.QLPY.AVL.RNFD----------EF.NTADIEQI.SLKGLG..RSS.V.N.RIR.GNN  96
ZP_01446334    55    I..IPAEAAL.RP.HE.IVSDGRIR.NLRVVELQ.GVLRLFNVTMQ.S.KFDVS..GS.R  117
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Query          121   LLILEFEPTEAWDSTGPHALRNAMFALESAPNLRALAEVATQTVRELTGFDRVMLYKFAP  180
NP_285374      121   ..............................................................  180
YP_488045      129   .C...L..RDTTE.SSERSV.A.IRR.QK.TSVLMACDI.ARE..RI.....IKI.R.SA  190
YP_569534      129   .C...L..RG.TE.SSERSV.A.IRR.QK.SSVLMACDI.ARE..RI.....IKI.R..A  190
YP_533633      128   .T...L..RP.GAEPPAESV.A.IRR.QT.SD.LTVCNI.ARE..R.......KI.R.DK  190
NP_442237      117   ..VC.L..AYTS.NLPY.MANA.LNR.RQQA...DFYD.IVEE..RM.........R.DE  180
ZP_01628825    117   V....L...K.EK.NTY.LVKM..SK.Q..S..AEISQIVVKE.KKI.........R.DQ  180
NP_486939      117   .....L.ANLS-.K.HS.LVKL..LK.QGTATTTEISQILA.E..KI.......V.R.DE  180
YP_321522      117   .....L.ANLSDKNYSY.LVKL..LK.QG.ATTTEISQILA.E..KI.......V.R.DE  180
YP_488044      110   .TF..L.-VPRHEAAES..FSG.IKR.QA.QS.EGACSA.ARE...I.E....KI.R...  172
ZP_01459223    103   .TV..L..A.GMEE.ALEVV.RLVSP.AGVKGTQ..LQT.AD...A........V.R.DA  165
NP_948356      128   IV....L..RDESRY.NERSV.V.IRR.QT.AD.PTACWI.ASE..RI.....IKV.Q..A  189
YP_569533      110   .AF..L.-VPLHEAAES..FSG.IKR.QA.QT.QGACAA.ACE...I.E....KI.R..S  172
YP_779569      114   .IV..V..PQH-ETSES..FSG.IRR.QA.QT.E.ACAA.ARE...I.....KV.R.GS  176
ZP_01623500    118   F....L..ATSQENSFY.LA.MSINQ..ETAS.HEFCQIIV.E..KV.A.........DE  181
YP_324352      117   F....L..AITQENSFY.LAKASINQ.QKTA...DFCQIIV.E..KV.D.........DD  180
NP_948355      113   .VF..L..PQR-.VAE.Q.FNS.IRR.QA.ET.ESACAA.A.E...I.......I.R..S  175
NP_487197      117   F....L..AITQENSFY.LAKASINQ.QKTA...DFCQIIV.E..KV.D.........DD  180
YP_779570      128   .TF..L..RDDVH.SHERSV.A.IHR.QA.SD.A.ASDI.AREIHRI......KV.R.SA  189
ZP_01630443    117   F....L..AVSRENSFY.LAKASINQ..TTA..HDFCQIIV.E..KV.........DD  180
YP_001894923   121   VV.V.L..ADVFS.MY..LV.TFINR..DVQTVAG..QL.ADE.QRI..YG.TLV.S.DG  183
YP_001863766   117   F....L..AITQENSFY.LA.ASINQ..KTA...DFCQ.IV.E..KI.E.........DD  180
YP_001174646   117   Q......RAQ.YQALY.-LM.TFVSR.QE.RE.E..CQH.VEE.KRI...G..KA.R.DA  179
ZP_01461267    118   R....L..SSHREAVPF..V.DGLSR.RD.RD.QE.C.AVV.E..G......AII.R.DA  181
ZP_01730981    118   F....L..AISQENSFY.LAKASINQ.Q.NA..TDFCQIIVKE..KM.........DE  181
NP_354963      100   .V...V.KAGVGE.AEKGE.TSLAKY.N...S.EDALFRTA.L.SSIS.H..TLI.D.GL  161
YP_608942      117   V........CRGSAKGDYYP.VR.FVS.HQ.TSIED.LQQSVRQIKRI...G..KA.R.DT  177
YP_001668195   116   V..A....PR.GQGDYYPLV..FVGS.QL.TS.ED.LQQTVVQLKRI...G..KA.R.DA  180
YP_001769101   117   .IV..L.--.SSEAA.TD.SLD.LHG.HG.GSVPE.CALLARDI.HI.....ALV.R.DR  182
YP_001748669   123   V..A....VR--QPL..PLV.GFVSS.NN.AT.EE.LQQTVLQIKRI...G..KA.S.DT  187
NP_744505      123   V..A....PRLA.LV.QGLV.SFVAS.QV.SSIED.LQQTVLQLKRI...G..KA.R.DA  187
NP_945475      119   .I.....KA.P-EAA.TTSV.ADLA..QATEGVQ.FFDL.VERI.AF..Y....A.R..E  182
YP_001268649   116   V..A....PRLA.LV.QGLV.SFVAS.QV.SSIED.LQQTVLQFKRI...G..KA.R.DA  180
NP_791725      112   A.V...L.IQDKAAQAISYSE.TGNMG.HA.AD.QT.Y..SVREIQRM...Y...LI.R.EE  176
YP_569510      119   .I...L.KSA.-.GS.VSPV.ADLAR.QD.NS.KDFFDL.VARI.AF..Y....A.R.DV  182
YP_347894      112   V.....Q.RNV-AG.ET.-.GRMLAR.QK.QS.Q..YDISVKEIQAM..Y...LI.R.EE  176
YP_001864851   115   AV...L...DSEFEVSF.SFASEAI.MQRTS..GEFLHLVA.E.QKIIS.....V.Q.DE  178
YP_660007      133   ..AI.L..ALSAS.SSFNPVK.SLND.AQSQD.NNVFAYSVNEI.KV..........DA  196
YP_236574      112   V.V..L.IQGKDAQSVSYSE.TGNMG.HA.SD.QT.Y..SVREIQKM..Y...LI.R.EE  176
NP_792460      117   V..I.L..FVEAAHEQRIITRVLRN.QA.TT.ET.FDIGVHEIQA...Y....I.R.E.  176
YP_275602      112   V.V...LIQDKDAQAVSYTE.TGNMG.HA.SD.QT.Y..SVREIQRM..Y...LI.R.EE  176
ZP_00516991    1                                                    M..........DE  14
YP_262277      112   V.M..L..QHLKEQ.--EN.GRLLRR.QT.KT.NE.YAISVSEIQAM..Y...LI.R.EE  176
ZP_01050418    123   .IYI.L..IV.QAEAHQRQ.SDIITD.SQ.ITVSEMCDKTANLIKS...Y........DQ  184
ZP_01623038    118   I.C..L.LKSNSQISY.LSFYHLLK..K.IV.VDDFQ.STH.L...I..Y....I.Q.EE  181
ZP_01094090    115   ..EI.IA.IDKIH.RA.RL.KT.THRMQACQTMEE.YSAIATQIKS.S......I.R.LE  178
YP_235462      122   V..I.L..FVETGHGQSRIITRVLRN.QA.TT.ET.FDISVHEIQA...Y....I.R.E.  181
YP_780275      126   A.D.-----------.EQIES.LE.IRA.NT....CDETAGLF..R..Y....V.R.DE  173
YP_001900695   115   T....V..AM.FA.MY.-LV.TFVAS.QAVGTID..TDL.ARE.HH..H.G..TI.RIER  178
YP_861991      110   N...DI.KR.SY.FQ--KE.SSLLNT.TASRTAEE.CND.ARITKSIFEY....I...DE  171
ZP_02008304    115   T....L..AV.FV.MY.-LV.TFVGS.QA.GTID..TDL.ARE..R..N.G..TI.RIDS  178
YP_001242244   113   G..I.L..ATKTTNIA.-..DG.FHRIT..SS.LG.SDETATIFK.I..Y....V.R.DD  172
YP_676783      112   VI...S.IHI-.-.N.PKND.KQF.DYM.DSHT.IR.C.LVASGIKKV.DY....I.R.DK  173
YP_570910      120   ..V.....RREPAPNNSL..VQS.IRVQR.GTVQ.FCDAVVAE..AV.......I.R.M.  180
YP_001203744   113   G..V.L..ATKTTNVA.-..DG.FHRIT.SSS.IG.CDETATIF..I..Y....V.R.DE  172
YP_001196150   112   IYV..A..QFDKQILADVYTQTIQ.VMNNTKS.KD.CALVAEGT..I..Y....I.R.DE  173
ZP_01061101    111   N.V.....LQ-=..GD.YNYQ.QLSE.NA.TDEQEMCD.TATLIK.FF.Y....I.R.DE  172
ZP_01884257    115   EYVM....ITL-.FDIQNLIGRSVSRILATHS.SD.LGN.ALE.KQ.IEV....I...HD  173
YP_531190      125   S.D.LEQ-----------IAT.LE.IR.TTS.SG.CDQ.AALY.DR..Y....V.R.DD  172
YP_487638      123   ..V...D.RREPAPENSL..VQS.IRVQR.GTVQ.FC.AIVAEL.AV...E...I.R.SA  183
YP_001135775   129   V.LV.L.VAG.RPYSF.N.V.SSVE..NR.TTMAD.YDT.ARS..........V.RYDE  192
YP_001361736   127   R.VV.I..SPP--H.A.R.T.G.IAR.AGTRGIEG.C.RLVRE..V........A.R.DA  187
YP_001196265   112   IYV..A.LKF.REKLADVYTQTIQ.VMNNTTS.KD.CALVAEGT..I..Y....I...DE  174
YP_715500      123   QVVI.LQA.RPLSYS.TY.T.QSVLR.S.SSS.TE.YD.VVEE..R........V.R.DA  186
ZP_01227360    114   Y.LI.L.DA.RAGASTARIIEE.GA..ARTHD.LD.C.A.V.QF.AI..Y....I.R.HE  176
ZP_01728373    57    V.F...L..Q.EISLIDFY.SEFSISQINNNLS.QE.CQISA.EI.K.S.....I.Q.DH  120
NP_252806      105   VFY....IRT.DTLSITSFTL..QRIIAQVQDTAS.LSNV.DEL.RM..Y....A.R.RH  167
YP_789005      105   VFY....IRT.DTLSITSFTL..QRIIAQVQDTAS.LSNV.DEL.RM..Y....A.R.RH  167
YP_001417343   109   G.LV.L..AG.-----.L.AADILAG..Q..D....CAE.A.AF.RI.......I.Q.RE  170
ZP_00973293    105   VFY....IRT.DTLSITSFTL..QRIIAQVQDTAS.LSNV.DEL.RM..Y....A.R.RH  167
ZP_02055103    284   IVE..LA.ERPE.AAS.LDAEL..MR.RA.ES.TEA.QI.ALEI.AM...ES.LV.R.DT  345
YP_001641522   284   IVE..LA.ERPE.AAS.LDAEL..MR.RA.ES.TEA.QI.ALEI.AM...ES.LV.R.DT  345
ZP_00967488    105   VFY....IRT.DTLSITSFTL..QRIIAQVQDTAS.LSNV.DEL.RM..Y....A.R.RH  167
YP_570862      126   AID.A-------QMV.------.LEKIRT.NSI...C..TA.LFQDR..Y....V.R.DE  173
YP_001239104   128   V.VV.I.LRREQAPDN.L.AVKG.LRIQQTETAPSFCQAVVDE..H.I......F.R.LD  188
ZP_01439288    124   SIVI.A..SDTHQTVT.G..VRS.SG.QRT.ST.D.F.ESVRQL.SV........R.NT  184
YP_245299      112   QWLV.M..RD.L.V.-----.E..PL.R.VERDPGI..A.VRVL.S.I.....I.R.DE  172
NP_639488      112   QWLV.M..RD.L.V.-----.E..PL.R.VERDPGI...A.VRVL.S.I.....I.R.DE  172
YP_487589      126   PVD.SLMVGQ.L.K----------IRT.SSV...C.E.AVLFQNR..Y....I.R.DE  173
YP_001770032   252   RV.V.L.RVP.FAAASLAEVEE.IGH.RA.ET.AEA.R..AREA.R.....CILI.R.DA  315
YP_001238408   109   Y.VV.A..S.SGANS.-ELV.LMLGRIRKTTSMAD..QE.ARQLKL........V.R.H.  169
YP_485786      109   QVCIDV..VSP--.VA..RV.AVLD.FR..EGQ.E.CAL.VRSL..I..Y....A.R.DT  170
YP_001346361   105   VFY....T.DTLSI.SFTLNAQRII.QVQLH.DT..LSSV.EEL.RM..Y....A.R.RH  167
YP_198931      112   QWLI.I..RD.M.V.-----.E.LPL.R.IERDAGIE.A.AKGL.SMI......V.R.DE  172
YP_366123      112   QWLI.I..RD.M.V.-----.E.LPL.R.IERDAGID.A.VRAL.SMI......V.R.DE  172
NP_355125      111   TT.I....SGS-.AQPLGTA.KMVDRIRE.DSVES.ISRT.RL.KATL.Y....I.R.QE  169
NP_644587      112   QWLV.I..RD.M.V.-----.E.LPL.R.IERDAGID.A.VRAL.SMI......V.R.DE  172
ZP_01302507    121   MV.V.A..ASHDEMEASSTV.SMVSR.AQ.ESMS.FLRDGARQ..A........V.R..D  180
YP_001170431   107   YMC.DL.AVRDE.DRL.PG.TQSVIETF..AVTQV.C.L.VHGL.QV..Y....A.R.G.  167
YP_001204102   109   Y.VV.A..SLIEPGVNSGE.VRL.LGIRKTTGMID..QE.ARQLKL........V.R.H.  169
YP_971319      112   ..VA...SRRHSSAELAVFAVQ.HR.M.KLRRP...LQL..DEL.A.......A.R.R.  179
ZP_01017885    118   SI.....RS.-----.SQ.TV.SMIGRVQQSST.AD.SKM.SRH..A........V.R...  178
ZP_01157401    116   HFVF....KSSSEFRDDL..VQPLI.VRRREDIVGA.TE.ARCLKAM..L....V.R.EE  176
YP_742336      115   RVV....ALSGP.T.LFP.MGDWLSH.AG.RTAG..L.TLVAAA.D...HE.A.V.Q.D.  175
ZP_00998358    124   SI.A...TDA.P.RDDLGSVQALVHRIAAHGTFGEKLDQ.VRGLKL.S......V.R..E  185
NP_946341      109   TS.V....AA.DQADN.LR.TRQII.--RTKE.KS.E.M.ARVP.Y.Q.YH...M.R..D  169
YP_611325      121   FVLN..A.SASQARKRMRMSGP.CAQIMA..TFD.AMQI.CN...T...S..SI.R.L.  179
YP_001749437   110   TV......ASQSIAEPIELV.TVIAQ.REIDRSDR.VADTAKR..A.L.Y....I.QLGA  169
YP_192038      116   H.LI.L..V....IF.E--IDSTADRF.RC.DTTSVCRQGAAIF.R.......LV.R.ME  178
YP_001668821   110   TA......AG.SIAEPIELA.TLIAQ.REIEQTSK.FRD.ARF..AVL.Y....I.QLGT  169
ZP_01545930    108   NIVM.....LEGE.NDTANV...IDRMADL.QVE.IYSQ.VRFIKMV............T  169
YP_001523831   110   VV.I.C.AAPKGR.GT.VEFVR.LISQV.R.DV--.LRR.SHL..T.L.Y....I.R.DA  170
NP_745504      110   TA.....AG.SIAEPIELA.TLIAQ.REIDQTHK.FRD.ARF..AVL.Y....I.QLGA  169
YP_345327      110   YMC.DI..VRDE.GRL.PGA.QSVITFS..MTQVE.C.L.VHGLQLVL.Y....A.R.GA  170
YP_001520152   109   HFLI.L.SVPSAQLNSQS.IQMLLAR.QDETATS..LQL.VKDLQQV.E.....A.Q.L.  171
YP_001267717   110   TA......AG.SIAEPIELA.TLIAQ.REIDQTHK.FRD.ARF..AVL.Y....I.QLGA  169
YP_345384      159   YMC.DI..VRDE.GRL.PGA.QSVITFS..MTQVE.C.L.VHGLQLVL.Y....A.R.GA  219
YP_001372987   112   RTFV.I..CADRGQSARQ...SVIHRIGREETVDKA.ATGVRL..AML.Y....V.R.LH  174
ZP_01011420    119   Y.......KA.--ER.SDVMSEVYPLIQNIDTTKD..QL.GDAA..IA...S..V.E.Q.  179
ZP_01864718    112   YT.I.I..H.EGKVNRQIG.LRPIV...KGESD.L...A.R.-L.LSLDI....V.R.HK  172
YP_769292      112   QV.I.G.RC.DRHDAASLSM.SM.SR.DHTET.E.FFREGARQA.A........V.R.DE  172
ZP_00208733    108   G.L......G--.FS.T.S.KE.IHL.H.-.TV..SFQIL.E.IAD...YG..LI.R..D  172
ZP_01726549    119   YQV..I..ATKFRQ.YSAKHYIKLYSMNV..S.ETM.REIVE.I.YISEME..V..R.NE  184
NP_946838      122   ..VV.LD.RREPAPENSL..VQS.IRARP....QGFCDAMAAEL.SV.......V.R..R  182
YP_745313      125   TYVI.A..SVCGK.G.SDVV.MMFGR.QQSRGIAP.FQE..RQI.A...Y....I.R..E  187
ZP_01041311    112   KF.I...HD.KGYADHLM.MG.LAQ..PIRD.DT.CRK.AKL.KQML.Y....I...Y.  172
ZP_01748188    118   HM.V....SDVMSEVY..I.Q-----.RGCVD.ET..RR..VALHK.S...S....Q.QA  178
ZP_01109672    117   HYVV.L..ATEFRDAYSAEQFIKLYSMSI..RFKS.G.M.QE.I.Y..NM...V....NE  182
ZP_01884592    111   Y.L..M.KATVETNRSFQEVKQIIA.IDQ.ATVKEVC...VHEL.KIS...GILM.Q.DK  174
YP_677848      108   YILF....SDDT.IK.YQQIHE.SA.IQQSQE.GESLSI.VKELKTFS...K..I...DE  171
ZP_01110306    121   ..VI.L.....AQQWV.MDI.ALLPNVDDKESIGDV.DAIAKVFKQYI...S..V.Q.DD  187
ZP_01109728    114   H.......KL.----.A.KIVITAL.AQMSMFSE.DD.YQGLVES..TA..H......Q.LA  172
YP_427322      115   ADLV.LWSDDQ-ET.VEGVFGRLP..IGH.SRAASIEDL.AA..AD...YE...V.R..E  176
ZP_00514108    109   SI.G.L.TFKLN.NNKNKLFQD.IINTGKTND.KK.SAKI.EEI.KI.K....LI.R.EN  172
ZP_01043109    114   W.VV.T.I----.V.D.GLK.SCY...LDIS.TNSTEQTLQKLC...S.YE..LV.Q.DD  174
ZP_01051640    119   SVV..LM..-GE.FKYININN.IKW..AKTE.IEDILKN.V.SLQKI.......A...L.  180
ZP_01736013    97    W.LV.L.QA..Q.QNAFFGT.DLLWQ.NREQD.NSYTQKVAEL..QV..Y....M.Q.DH  175
ZP_00051672    1                                    MAD.RDIDS.SAIV.EAIATIS..E..LV.R.DT  34
ZP_01446334    118   H..I....KV.-~TR.RDM.AEVIS..SRNRD..S.TRA.ARGLQG.C...S..V.Q.Q.  178
YP_478662      3           ..T.-AAAARPS.D.LIQIRQSLE.DQILRATVEE..AFL.T...KV.R.D.  58
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Query          181   DATGEVIAEARREGLHAFLGHRFPASDIPAQARALYtrhllrltadtraaaVPLDPVLNP  240
NP_285374      181   ..............................................................  240
YP_488045      191   .WS.Q....D.IDSIPSL.DFH.........S.....SNTV.IIP.IGYRPS..L.DR..  250
YP_569534      191   .WS.Q....D.VDSIPSL.DFH.........S.....SNTI.IIP.VAYRPS..L.DR..  250
YP_533633      191   .WN.Q.V..D.SDSIPS..DFH.........S.....SN.I.IIP.IGYRPA..I.DF..  250
NP_442237      181   NNH.D....DK.DDMEPY..LHY.E....QP..R.FIHNPI.VIP.VYGV....T.AV..  240
ZP_01628825    181   .WN.T....EKP.Y.T.Y..LHY......T...K..SQNW...IPN.YYQPAAIV.TN..  240
NP_486939      181   QWN.K....VKP.Y.TSY..LNY......Q...K..SQNW...IP.AKYQP..IV.IN..  240
YP_321522      181   QWN.K....V.P.Y.TSY..LHY......Q...K..SQNW...IP.AKYQP..IV.TNH.  240
YP_488044      173   .FS......D.T..VES...LH..P........R..ATNPI.IP.IDYIP..IV.GHD.  232
ZP_01459223    166   .WH...L..SK.G.MDG...MH...T...V.........NP...I..A..RP...L.PVV.  225
NP_948356      190   .WS.Q....D.DS.IPSL.DFH..S......S.....INPV.IIP.IGYRPS..V.DI..  249
YP_569533      173   .YS......D.A..VES...L...P....V...R...INPI.IIP.IDYIP..IV.GTD.  232
YP_779569      177   .LS.Q....D.S..VESY..LH..P........K..AINPV.IIPNIDYRP..IA.D...  236
ZP_01623500    182   EGH.V....DKI.E.EPY..LHY.E.....KP..K.L.ENWI.IIP.AQ.Q..A.F.DK..  241
YP_324352      181   .GH.S....EKLDS.EPY..LHY.E....KP..K.FISNSI.VIPNAQ.Q.IQMI.SV...  240
NP_948355      176   .FS......D.CAEVESY..LH..........R....INPV.IIP.INYRP..VT.D...  235
NP_487197      181   .GH.S....EKLDS.EPY..LHY.E....KP..K.FISNSI.VIPNAQ.Q.IQMI.A...  240
YP_779570      190   .WS.Q....Y.VDSIPSL.DFH..S......S.....INTV.IIP.IGYSPC..V.DY..  249
ZP_01630443    181   .GH.S....EKL.SMEPY..LHY.E....KP..K.FVANSI.IIP.SH.QSIQII.AQ..  240
YP_001894923   184   TGS.H....NVEP.YASYADQH..G.........V.NRI..I..ADYRPA..V.P.H.  243
YP_001863766   181   .GH.S....EKL.S.EPY..LHY.E....KP..K.FAANSI.IIP.AYSQP.K.F..N..  240
YP_001174646   180   EDN.L.L..VADP.YPSY..LC...A...Q...R..RDN.I.VIQ.ANYKPS..V.T...  239
ZP_01461267    182   EWN.S.......DARADPY..LH.......R...E..QLNW..IIPTIDYQPARVRAL--.  239
ZP_01730981    182   .DH......DKL.E.EPY..LHY......LP..R.FSSNYI..IPNAK.EG.D.F.K.H.  241
NP_354963      162   .WS.H.V...GSGA.PSY..L....G...P...Q....INR..MIP.VDYKP..IR.EV.A  221
YP_608942      178   EGN.T.L..DADP.YPQY..LC.......R...E..RINRI.VIE.ADYQ.S..V.AA..  237
YP_001668195   181   .GN.Q.L..VADP.YPSY..LC...A...R...E..RINRI.VIE.ANYQSS..V.AA..  240
YP_001769101   183   .WN.T.V..DGNGV.PSY.DL...........E..R.NR..IIP.AAY.P..IR.T.T.  242
YP_001748669   188   EGN.Q.L..VADA.YPRY..LC.......R...E..RVNRI.VIE.ANYQ....V.AA..  247
NP_744505      188   EGN.Q.L..VVDP.YPSYA.LC...A...R...E..RVNRI.VIE.ANYQPS..L.AT..  247
NP_945475      183   .GS.Q.......DD.EPY..LHY..T....P..R.FALSWV.HLP.VGYTP...LAAKS.  242
YP_001268649   181   EGN.Q.L..VADP.YPSYA.LC...A...R...E..RVNRI.VIE.ANYQPS..L.AT..  240
NP_791725      177   EGH.Q....SAPAMEL.N.LF.......E...E..R.NW..IIP.ANYTP...V.Q.R.  236
YP_569510      183   .GS.H.....K.GD.E.Y..LHY..T....P..R.FSLSWV.HLP.VDYTP...IAAK.L  242
YP_347894      177   EGH.Q.....SDPSMEV.N.LF.......E...E..RTNW..IIPNADYQP...V.K.R.  236
YP_001864851   179   SEA.S.V..VK..D.SPY..LHY..T.......E....CF..FLP.LT.EP.K.V.TE..  238
YP_660007      197   .YN...V...KKPE.NS..KQH..E....K...E..VKNPI..L..VN.KQSM.Y.----  252
YP_236574      177   EGH.Q.....SAPSMEL.N.LF.......E...E..R.NW..IIP.ADYIP...V.Q.R.  236
NP_792460      177   EGH.K.V.Q.LTGP.PSYS.LN..G.........E...RLNWI..IP.ATYVP..A.I.T.R.  236
YP_275602      177   EGH.Q.....SAPSMEL.N.LF.......E...E..R.NW..IIP.ADYTP...V.Q.R.  236
ZP_00516991    15    .DH......DKLAE.EPY..LHY......LP..R.FSSNYI..IP.AK.TGID.FSK.H.  74
YP_262277      177   EGH.Q.....T.PTMEV.N.LF.......Q...E..RSNW..IIPNADYQP...L.A.R.  236
ZP_01050418    185   NWN.TI.S.S.E.V.ESW..MHY..T...Q...KSFLKQGV.II..VASQTSAVF.E.DE  244
ZP_01623038    182   .GS.V.....KKKE.ESY..LHY.T....L...K..CQNW...IM.INYKP.DIV.....  241
ZP_01094090    179   GGH.A.VG..AESH.ES...LHY......Q...R..ELNAV..I..IH.PP..I-AAADS  237
YP_235462      182   EGH.Q.V.Q.LTGP.PSYS.LN..G.........E...RLNWI.VIP.ATYVP...I.T.R.  241
YP_780275      174   EGH...FS.R.KPE.E.Y..N.Y.S....QM..R..E.TRV.VLV.VEYQP...Q.R.S.  233
YP_001900695   179   .GSLQAL....N.AYDTLV.THLSGAG.TPEL.N..SHNP...V..VDDTP.G.V.P.H.  238
YP_861991      172   EWN.K....EVN..MESW..LQY......K...Q.FLKNRV.AIS.VNYSP.NII.QIS.  231
ZP_02008304    179   .GSLQAL....DVAYDTLV.THWRGDGMAPEL.S..SHNP...V..VDDTP.G.V.P.H.  238
YP_001242244   173   EGH....LS.R..PE.E....N.Y......QI..R..E.NRV..LV.VNYTP...Q.RIS.  232
YP_676783      174   .YN......KQDK.ES...LHY.HT....V...E..IKN...VIG.VNYKP...I-YTIDD  232
YP_570910      181   .CS...K..S.AS.MES...L.Y.E....K......LANWI.AIP.A.Y.PARIV.MID.  240
YP_001203744   173   EGH....LS.R..PD.E....N.Y......QI..R..E.NRV..LV.VNYTP...Q.RIS.  232
YP_001196150   174   QYN...Y..SCNKD.EP...LHY.HT...V...E..IKNQ...IV.INYQP..IF-TIDD  232
ZP_01061101    173   NWD.I.VS...ASN.EEW..L.Y......Q...K.FL.QGV.II..VKSEP.AIQAFGGK  232
ZP_01884257    174   .GH...V..VKN.E.EP.F.LHY......Q...N..KAN.T.II..VHSED---SRI.TY  230
YP_531190      173   EGH....FS.RC.SD.E.Y..N.Y......QM..R..EQTRV.VLV.VNYQP...Q.R.S.  232
YP_487638      184   .DS.......SCAA.IES...L.Y.E....K......LTNWI.AIP.A.Y.PA.IT.AV..  243
YP_001135775   193   EYN...V...K.DD.NS...LHY.ST.........EKNW...IS.VDY.P...V.AVD.  252
YP_001361736   188   QWN......D...D.DT...LHY.........R....LNWM..I..VDYVPS..H.L.D.  247
YP_001196265   175   LYN...F..SC..D.EP...LHY.HT...V...E..IKNQ...IV.INYKP..IFTIDDN  234
YP_715500      187   AWN...V...KLDR.NS.H.LHY..T.........E.SW...IP.VDYRP...V.AV.I  246
ZP_01227360    177   .GA.S.V..D.APH.VS..N.Q...T...K......V.NRI.VIP.VCYEPA.IRAA--E  234
ZP_01728373    121   .WH.K.V..SKITDIESY...LH...E...PLS.H.FSLQP..PIPNVNYKS.KFL.NN..  180
NP_252806      168   .DS...V..S...D.ESY..Q.Y.........R..IQNPI..I..VAYTPMRVF.A...  227
YP_789005      168   .DS...V..S...D.ESY..Q.Y.........R..IQNPI..I..VAYTPMRVF.A...  227
YP_001417343   171   .EA.V.L...KAPEMGS..N.H..GG.V.R......V.NRV.VIP.VAYVPA..R.AATD  230
ZP_00973293    168   .DS...V..S...D.ESY..Q.Y.........R..IQNPI..I..VAYTPMRVF.A...  227
ZP_02055103    346   .WN..A...DMPDWQRPLI.L.............KAKS.FVI.RDCVP....VADRA  405
YP_001641522   346   .WN..A...DMPDWQRPLI.L.............KAKS.FVI.RDCVP....VADRA  405
ZP_00967488    168   .DS...V..S...D.ESY..Q.Y.........R..IQNPI..I..VAYTPMRVF.A...  227
YP_570862      174   EGH....FC.RHVP..ESYF.N.Y.S....QM..R..E.IRV.VLV.VNYQP...Q.R.S.  233
YP_001239104   189   .GS.A.....AAPDVES...LHY......K...E..RTNWI.AIP.A.Y.PA.ILSLGDA  248
ZP_01439288    185   .GA.T.V...L.T..ES.R.LNY..A...T......V.NRV.TI..V..EP..VE.A.D.  244
YP_245299      173   EWN.DI.....KPE.E.Y..LHY.............L.NRV.QI..VGYQPS.IQ.TVH.  232
NP_639488      173   EWN.DI.....KPE.E.Y..LHY.............L.NRV.QI..VGYQPS.IQ.TVH.  232
YP_487589      174   EGH....FS.RHVP..ESY.SN.Y.S....QM..R..E.IRV.VLV.VGYEP...Q.R.S.  233
YP_001770032   316   .WN..A.....DPAWRSL..LH..............A.AKS.FVI.RDYVP....--LAG.  374
YP_001238408   170   .GS......VAGP..EP...LHY......R...Q..Q.NW..II..IN..PA.--LST.  227
YP_485786      171   .GH........GCEMDPY..LHY......P...Q..L.QRVGAIV.S.YRP...LTDRTL  230
YP_001346361   168   .DS...V..S..DD.ESY..Q.Y.........R..IQNPI..I..VAYIPMRVL.T...  227
YP_198931      173   EWN.D.....QPE.E.Y..LHY.............L.NRV.QI...V.YQPS.IQ.T.H.  232
YP_366123      173   EWN.D.....QPE.E.Y..LHY.............L.NRV.QI...V.YQPS.IQ.T.H.  232
NP_355125      170   .GA.K.VS..KQPE.ES...QY.......Q......LKNT..IIS.ASGTRI.VL.AVD-  228
NP_644587      173   EWN.D.....QPE.E.Y..LHY.............L.NRV.QI..V.YQPS.IQ.T.H.  232
ZP_01302507    181   GGD...V...L.P.IES.F.LHY......S......L.NIF.II..VQ.QP..VV.A.D.  240
YP_001170431   168   .GH......DL.PD.EPY..L.Y......QI.....L.QRVGSI..SHYEP....--LGH.  225
YP_001204102   170   .GS......TAGS..EP...LHY......R...Q..Q.NW..II..ID..PA.--LST.  227
YP_971319      180   .DS...V..SCIPT.DPYR.R.Y.........R..VVNT...I..VG.PV..-----.LQ  235
ZP_01017885    179   .GS...V..SKNAD.DPY.NL.Y......Q......V.NPV.IIS.VHSVP.KIV.ATD-  237
ZP_01157401    177   .DS.T......EPK.EP..HL.Y..........E..R.NTF.II..VDGEVH.IV.E.G.  236
YP_742336      176   .WH.C.V..S.C.HMDSY.S.H.......P.V.Q..DVNPV.SIP.AP..P...V.TED.  235
ZP_00998358    186   .GA...V....ERSMEP...L.Y......Q...Q....N....I..VD.VPS..L.ETD.  245
NP_946341      170   .GS.K..G..K.SD.ES...QH.......Q...L..LKNAI.VIS.S.GISSRIV.E-RD  228
YP_611325      180   .WS..T...SNDGS.PSY..MH..SG...K.V...MEIVPF.FVGRVDDDNIAIRALTSG  239
YP_001749437   170   .GA.K.V.....S..ES...QY.......Q......V.NPV.VI..ANFKT...E...D-  228
YP_192038      179   .G..R.VG.S.NDAFPSLMN.H.......T......L.NRI.VIP.ITYE.A.IR.---.  235
YP_001668821   170   .GA.K.V.....SD.ES.M.QY.......Q......L.NPI.VIS.AQFKT.AIE...D.  229
ZP_01545930    170   .GS...V...KKY.MAP..NL.Y..T...R......LENPI..I..VADDG.VVVEHRRS  229
YP_001523831   171   .GS.K.VS...MPS.ES...QH...G...R...E..LKNII.IVS.SSG.RI.ME.EF.-  229
NP_745504      170   .GA.K.V..SK.SD.ES.M.QY.......Q......L.NPI.VIS.AQFNT.AIN...D.  229
YP_345327      171   .GH......R...QD.EPY..LHY.....QI.....L.QRVGAI..ACYRP...LGHPEL  230
YP_001520152   172   .GA...V...MVDE.EPN..L.Y......Q.V.GIALKMPI.AIS.ID.PTA--.LIAAD  229
YP_001267717   170   .GA.K.V..SK.SD.ES.M.QY.......Q......L.NPI.VIS.AQFNT.AIN...D.  229
YP_345384      220   .GH......R..QD.EPY..LHY.....QI.....L.QRVGAI..ACYRP...LGHPEL  279
YP_001372987   175   NGA.R.....KSPM.CS.M.QH.......V...R..LINTI.MIS..SYQPIA.C.S.AA  234
ZP_01011420    180   .HS.R..G.C.SD.ETRY..LN.......V......K.A....I..VEDPGSVIR.GVDA  239
ZP_01864718    173   .LS...V..SK.DD.ES.H.L.Y.KT.......E..K.NRF.IIS.VEE.PI.IE.GV.A  232
YP_769292      173   SGS...V...A.A.IGS...LHY......V......L.N.F.II..VD.VP..IL.Q.D-  231
ZP_00208733    173   .WS...V..TL.RPMQSYQ.LH...A...VI..D...LNRQ.YIR.AL.GS..I-LGCD.  231
ZP_01726549    185   .G..K....TKHDD.DSY.DLYY......Q...E..KINWV..VP.VDLPSAR.I.TVED  244
NP_946838      183   .GSAD......GPETSP...L.D.QP..SN.PGSI---SRI.VQP.VH.P.A..W.AHS.  239
YP_745313      188   .GS...V..SL.S.TESC..LHY..T...H...T..E.SW...IG..EDQTC---LSL.  245
ZP_01041311    173   .ES.....EK..D.QSYE.L.Y.RA.....Q...E.FR.NRF.II..MEIP.LIE.T.SI  232
ZP_01748188    179   .KS.K.L..T.SD.GQKY..LM.............K.S....IS.VDD---.GSAICP.  235
ZP_01109672    183   .YS.K.....KA.DMESYKDLY.......K...E..KTNWV...P..ELPPAR.V.SVEE  242
ZP_01884592    175   .WN.S....EKDDR.EKYI.QT.....V.R....Q..LKNPY..IPSRDYQPIR.Y....S  234
YP_677848      172   .WN.H.L...MEP.MESY..IT.......K...E..LKNPY..IP.REYKPSK.Y..I..  231
ZP_01110306    188   AYC....G..CESISRS.K.LK.......K...E..LKNRV.CVF.VEEQPT..Q.SILE  247
ZP_01109728    173   .GS......STSSDMTP..L.Y......R...Q..KKN.I.TIS.VNGETYSIIGKGKE  232
YP_427322      177   NWE.....TLNGPVESYK.Q.........S.N...SIP.VNYRPL.---.GRS  234
ZP_00514108    173   .DS.V....NK..DIESY..LHY.YY...NP..QFFSKK...MIPNIHDEPI.IL.RKH.  232
ZP_01043109    175   SWN.R..S.TT..DIEQYI.LS.......S.V....HVNPI.YI..VDTEDAVI-VYAEE  234
ZP_01051640    181   .NS.......VSTSMNS...L....F...PK..E.FLKNPI.YIKN.SDEGSKI--LI.K  238
ZP_01736013    176   NRD......S.SAQMNSY..N....P.....T...NSQN.TWV..NRKC....VHGAPDI  235
ZP_00051672    35    .GC.D.VG.SLADWPQS...L...DT.........RQTAD.WIPTRDYVP...V.AA.D  95
ZP_01446334    179   .QS.K.V..V.KD.QSKYD.LM.......V......K.A....IS.VND---.GS.I.PG  235
YP_561241      4                                                    .TSSLVFV  11
YP_478662      59    EGH.T.V....G.R.PSL..LT...G...EE..R.FRLAQV.VIV.VE.QSRSISQPESW  119
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Query          241   QTNAPTPLGGAVLRATSPMHMQYLRNMgvgsslsvsvvvggQLWGLIACHHQTPYVLPPD  300
NP_285374      241   ..............................................................  300
YP_488045      251   V.GG.ID.SYS...SV..I.VE.MV..A.YGAM...I.RE.R...M.S..NTS.RFVAYE  310
YP_569534      251   V.GG.ID.SY....SV..V.VE.MV..A.YGAM...I.RE.R...M.S..NTL.RFV.FE  310
YP_533633      251   V.GG.ID.SF....SV..I.VE.MV..A.YGAM...I.RD.R...M.S..NTL.RFVSYE  310
NP_442237      241   S..RAVD.TESI..SAYHC.LT..K.....A..TI.LIKD.H...........K.I.FE  300
ZP_01628825    241   L.DE.LD.SRS...SV..L.VE.MH....TA.M.I.IMKN.N.........S.KYI.YE  300
NP_486939      241   LNDQ.LD.SRS...SV..L.IE.MQ....TA.M.I.IMKNQK.........S.KYI.YE  300
YP_321522      241   LN.Q.LD.SRS...SV..L.IE.MQ....TA.M.I.IMKNQK.........S.KYI.YE  300
YP_488044      233   S.GQAID.SF....SV..I.LE.M..I.MRGTM...ILR.DK........NRQ.RYVGH.  292
ZP_01459223    226   ALGR.LD.SNSA..SV..V.LE........A.F.L.LLKE.V.........LE.LHISHE  285
NP_948356      250   RLGG.ID.SFS...SV..T.LE.MV...MHAAM.I.I.RDNR...M.S..NL..RFVSYE  309
YP_569533      233   S.GQAID.TFS...SV..V.LE.M..I.MRGTM...ILR.DR........NRQ.RYVGH.  292
YP_779569      237   L.GQ.ID.SF.T..SV..I.LE.M..I.MRGTM...ILR.ER....V...NRE.RYVGH.  296
ZP_01623500    242   LIEK.LD.THST..SA.SC.L....K.....A..TI.LIQD.........R..KYVSYE  301
YP_324352      241   VSDR.VD.TNSI..SAANC.LE..H.....A..TI.LIKDNK........LSAKYVSYE  300
NP_948355      236   V.GR.ID.SF.I..SV..V.LE.M..I.MHGTM.I.ILR.ER.........RK.NYVDL.  295
NP_487197      241   VSDR.VD.TNSI..SAANC.LE..H.....A..TI.LIKDNK........LSAKYVSYE  300
YP_779570      250   V.GG.ID.SFST..SV..T.IE.MV..A.YGAM.I.I.RD.....M.S..NTA.RFV.FE  309
ZP_01630443    241   LSDR.VD.TDSI..SAATC.TE..H.....A..TI.LIKDQK.........V.KYVSYE  300
YP_001894923   244   S.GR..D.TY..S...SV..V.V..MK....TL...M.M.I..R.K....S...D.AR.P.FE  303
YP_001863766   241   ISDR.IN.TNSI..SAASC.TE..H.....A..TI.LIKDQK.........S.KYVSYE  300
YP_001174646   240   ISGT.LD.SFSA..SV..V.L..M....TLA.M.I.I.IRDR.....S..DAQ.RQVSYQ  299
ZP_01461267    240   GHGE.LD.SFS...SV..I.LE..H....QA.M.I.LMKD.K.....S.TQG.R..-.YE  300
ZP_01730981    242   VNDTALD.THSI..SA..C.LE..H.....A..TI.LIDE.K.........L..KYV.YE  301
NP_354963      222   E.G.VLDMSFSQ..SV..V.LE.M....TAA.M...I..N.A.........A..HSVSLA  281
YP_608942      238   R.GKALDMSF.S..SV..V.L..M....TLA.M.L.I..D.K....LS...DQ.RAVDFQ  297
YP_001668195   241   R.GKALDMSF.A..SV..I.L..M....TLA.M.L.I..D.E....VS...HQ.RPVDLV  300
YP_001769101   243   SSGR.LD.SQSI..SV..V.VE.M....TMA.M...IL.D.A.....S...NKI.RRV.LQ  302
YP_001748669   248   R.GK.LDMSF.A..SV..V.L..M....TMA.M.L.I.........VS...EQ.RPVDLR  307
NP_744505      248   R.GK.LDMSF.A..SV..V.L..M....TLA.M.L.I..D.......S....Q.RPVDLR  307
NP_945475      243   LVTG.VDMSF.S..SV.V.YTG..K....Q.T.VMPL.KE.R......M..AA.RHISHQ  303
YP_001268649   241   R.GKALDMSF....SV..V.L..M....TLA.M.L.I..D.E.....S....Q.RPVDLR  300
NP_791725      237   D.QQQLD.SFST..SV..I.C..MK....L..M...LIQ..K.....S.G.R..LYVSHE  296
YP_569510      243   LVPG.VDMSV.S..SV.V.YTG..K..D.R.T.VMPL.KE.K......M..AA.RHITHE  303
YP_347894      237   D.QT.LD.SF.T..SV..I.C..MK....L..M.I.LLK.DK.....S.GNRQ.LHV.HE  296
YP_001864851   239   T.HQHLD.SYCL..SFDWCCAE.HQ....KAL.VI.LIQEQK.....S......KYISYE  298
YP_660007      253   -NDR.VD.SKVT..SV..I.C........NA.M.I.I..S.K.........YRSH.V.FE  311
YP_236574      237   D.QQQLD.SFST..SV..I.C..MK....L..M...LIQS.K.....S.GNR..LYVSHE  296
NP_792460      237   A.GQ.LD.SLST..SV..V.CE..K....R..M.I.LLD..E.....T.S.PE.LLVSRE  296
YP_275602      237   D.QQQLD.SFST..SV..I.C..MK....L..M...LIQ..K.....S.G.R..LYVSHE  296
ZP_00516991    75    LNDTALD.THSI..SA..C.LE..H.....A..TI.LIDDRK.........L..KYV.YE  134
YP_262277      237   D.QQALD.SF.T..SV..I.C..MK....L..M.I.LLK.D......S.GNRQ.LLV.HE  296
ZP_01050418    245   .-GQ.LD.THCES..S..I.IE..E..K..AT.TAAI.SN.T.........YSSKFTNYY  303
ZP_01623038    242   LN.Q.LD.SNS...SV..I.VE..Q....AA..CI.LIKDD...M.V...YEAKYVNYE  301
ZP_01094090    238   DAQQ.LD.TFSYF.SV..I.IE..Q....AA.M.I.ILQ..D...M.....YE.RN.TLE  297
YP_235462      242   A.GQ.LD..FST..SV..V.CE..K....R..M.I.LLD..E.....V...G.PE.LRVSRE  301
YP_780275      234   L.GRELDMSLCF..SM..I.L...Q....RAT.V..LM.D.K....V....YE.RFVHFE  293
YP_001900695   239   S.GRT.D.TY.A...A.DAQRETM.R..AKA..TLALT.R.N......R..A..CS.SFE  298
YP_861991      232   VN.K.LD.TNSK..GV..I.IE..Q.....A...TAALISN.K....L....N.SKFINYY  291
ZP_02008304    239   S.GRA.D.TY.A...A.EAQRGTM.G..ARA..TLALT.R.S.........A..CS.SFE  298
YP_001242244   233   LNGRDLDMSLSC..SM..I.QK..Q.....AT.VC.LI.S.R....V....YE.RFV.F.  292
YP_676783      233   SE.QNLD.SCS...SV..I.V...H.I...AT.TI.LIHKKK....V....YS.KY.HYE  292
YP_570910      241   R.GL.LD.SQS.I.SV..A.RL..AH...VA.M.L.IIQH.R.........SS.RY..YR  300
YP_001203744   233   LNGRDLDMSLSC..SM..I.QK..Q.....AT.VC.LM.S.R.........YE.RFV.F.  292
YP_001196150   233   SKDKNLD.SL.I..S...I.VE..K.....AT.TI.LIHHDR.........YSKKNIS.A  292
ZP_01061101    233   EQDN.ID.SISET..S..I.IE..E..K..A.TAAIISK.T.........YS.KFVNYY  292
ZP_01884257    231   EGKENLD.THSG...V..I.I........D..F.I.LLSK.E.....YN..RFIDYK  290
YP_531190      233   L.GRELDMSRCF...SM..I.L...K....RAT.V..LM...K.....YE.RFIHFE  292
YP_487638      244   R.GLRLD.SQS.I.SV..A.RV..AH...VA.M.L.MIQH.R.....SA.RY..YR  303
YP_001135775   253   AVGK.LD.TH.T..SV..I.IE..Q....HA.M.I.LLRH.R.........YA.HLP.FG  313
YP_001361736   248   G.G..LD.SHS...SV..I.VE..K.....A.M.I.LI.E.R....V....YSGAHR.G.  308
YP_001196265   235   KE.KNLD.SLSI..S...I.VE..K.....AT.TI.LIHHDR.........YSKKNIS.E  294
YP_715500      247   V.GG.LD.SD.W..SV..I.IE..Q....TA.M.I.LLRD.R.........YSGRHE.GE  307
ZP_01227360    235   AGLSEVD.SDVG..SV..I.IR..Q..A...A.A.I.I.MD.H.....V....DEAKAISLS  294
ZP_01728373    181   I.EEALD.SYCI..GVA.V.LE..Q....IAA.MTI.L.KNN.....V....NK..KLVSIG  240
NP_252806      228   E..ESFD.SYS...SV..I.CE..T....RA.M.I.I....K....FS...MS.KLI.YP  287
YP_789005      228   E..ESFD.SYS...SV..I.CE..T....RA.M.I.I....K....FS...MS.KLI.YP  287
YP_001417343   231   GAGSDLDMSDLG..SV..I.V...K.....A.A...I.KD......V....R.ARL..YE  293
ZP_00973293    228   E..ESFD.SYS...SV..I.CE..T....RA.M.I.I....K....FS...MS.KLI.YP  287
ZP_02055103    406   AG...ID.TF.QN.TL..I.LE.Q..L..DG.M.I.IM.ENR....MIG..RR.HYVA.E  465
YP_001641522   406   AG...VD.TF.QN.TL..I.LE.Q..L..DG.M.I.IM.ENR....MIG..RR.HYVA.E  465
ZP_00967488    228   E..ESFD.SYS...SV..I.CE..T....RA.M.I.I....K....FS...MS.KLI.YP  287
YP_570862      234   F.GQDLDMSSCF..SM..I.L...K....RAT.V..L....K.........YQ.RFIHFE  293
YP_001239104   249   PPA.ALD.SQST..SV..I.R...A....VA.M.M.IIMR.R.........RE.RY..YG  308
ZP_01439288    245   -SGE.LD.SMST..SV..I.IE..Q....DA.Y.I.I.ID.K....F.L..YK.RR.SME  303
YP_245299      233   .LGT.VD.SDVS..SV..V.LE..A....TAT.VA.I..NDA.....S...YS.HFTNHA  292
NP_639488      233   .LGT.VD.SDVS..SV..V.LE..A....TAT.VA.I..NDA.....S...YS.HFTNHA  292
YP_487589      234   L.GRDLDMSSCF..SM..I.L...K....RAT.V..L....K.....V....YQ.RFIHFE  293
YP_001770032   375   DAPG.ID.TF.QS.SL..I.LE.Q..L..NG.M...ILLE.R....MIG..RK.HYVA.E  434
YP_001238408   228   VH..GLD.SMS....V..I.IE.......AA.M...ILRD.K....F....YA.HH.SFE  288
YP_485786      231   DHGT.LD.TCST..SV..Y.LA.MQ..QTAA..TIGLAE.PE...MLV...R..RNPG.E  290
YP_001346361   228   ESGGSFD.SYS...SV..I.CE..T....RA.M.I.I....K....FS...MS.KLI.YP  287
YP_198931      233   RLGT.VD.SDVS..SV..V.LE..A....SAT.VS.I..NDA.....S...YS.HFTSHA  292
YP_366123      233   RLGT.VD.SDVS..SV..V.LE..A....SAT.VS.I..NDA.....S...YS.HFTSHA  292
NP_355125      229   VSGE.LD.SY.H..SV..I.CE.......AA.M.I..I.D.A.........YS.R..SMP  288
NP_644587      233   RLGT.VD.SDVS..SV..V.LE..A....SAT.VS.I..NDA.....S...YS.HFTSHA  292
ZP_01302507    241   H-G.ALDMSLCLT..V..I.IE..H.....A...I.II...K....F....YE.RLPTFA  299
YP_001170431   226   GID.-LD.THSA..SV..I.LE.M...HTAA..TIGLAD.DR...MLV..NM..RTAG.E  284
YP_001204102   228   AH...LD.SMS....V..V.IE.......A.M...ILRD.K....F....YS.RH.SFE  288
YP_971319      236   REAG.LD.SASI..SV..I.IE..S....AA.M...I.IN.....I....MQ.RQV.YS  295
ZP_01017885    238   ENE..LD.SLST..SV..I.IE.......AA.M.L.ITYQ.K.........YR.M..SFE  297
ZP_01157401    237   D-GR.LD.SF..T..V..I.LE.......RA.....ILRR.K....F....GE.FYVDYE  295
YP_742336      236   LDQH.LD.SAG....V..I.QA..H....K.A...AIRDDAE....L...G.EARS...T  296
ZP_00998358    246   TGEK.-D.SL..T..V..I.LE.......A.M...LLRR.K....M....MS.HYIDFE  304
NP_946341      229   ASG.ALD.SF.H..SV..I.LE.......SA.M.L.IIID.T.........YE.RAV.MA  288
YP_611325      240   A--GDID.TW.MN.SV..A.TA.....I.A...F.C.LMDK.K.........SGGSM.V.A  297
YP_001749437   229   LSGE.LD.SY.H..SV..I.CE..N.....A.M.I..I.D.A.........YA.RT.SMG  288
YP_192038      236   EAG.GLD.SDVQ..SV..I.L..MA...TRA.A...L..D.V.........NA..RC.SE.  296
YP_001668821   230   -SGE.LD.SY.H..SV..I.CE..C.....A.M.I..I.N.E...M.....YA.RT.AMG  288
ZP_01545930    230   E.GV.ID.S.SR..SV..I.LE........A.M.I..I.N.E.........N.AL.PSMR  289
YP_001523831   230   ASGE.LD.SF.H..SV..I.CE.......SA.M.L.I.I...........YS.R..SMA  289
NP_745504      230   -SGE.LD.SY.H..SV..I.CE..C.....A.M.I..I.N.E...M.....YA.RT.AMG  288
YP_345327      231   DDGK.LD.THSS..SV..I.LD.MQ..HTAA..TIGLAD.DR...MLV..NT..RIAG.E  290
YP_001520152   230   P.AD.LD.TLTHV..V..I.LE..A....Q..MN.AII.HRE....F.F..NSVKL....  289
YP_001267717   230   -SGE.LD.SY.H..SV..I.CE..C.....A.M.I..I.N.E...M.....YA.RT.AMG  288
YP_345384      280   DDGK.LD.THSS..SV..V.LD.MQ..NTAA..TIGLAD.DR...MLV..NT..RIAG.E  339
YP_001372987   235   DEP.-VDMSF.Q..SV..I.C...Q....SA...I.I..D.A.....S...DS.K.T.LP  293
ZP_01011420    240   E-GK.ID.SL..T..V..I.IE..H....IEA.M...IMKD.E....F....NS.RYIDYE  298
ZP_01864718    233   E-GE.ID.SMST...V..I.IE..H....A...I.III..E....F....YG.K...YS  291
YP_769292      232   EHGR.LD.SMSI..SV..I.IE..K.....A...I.I..D.R....F....YG.RLPSAQ  291
ZP_00208733    232   ADG..DQTF.D-..SV....LT..G....RA.F.A.ILMR.K.........PE.KP.SL.  290
ZP_01726549    245   SDRE.LD.THSI..SL..I.Q..V..Q.LKA.M.F.L.THN....M.S..SRE.RYIEQN  304
NP_946838      240   RNGLALD.SFSAT.SA..E.RL..AQL..AA...L.L..E.E.....V...A..RF..YR  299
YP_745313      246   EQTE.LDMSLST...V..V.V.........VA.A.I.ILRS.........AMR.LW.AA.  305
ZP_01041311    233   K-..E.LD.SMST...H.Q..V..MK....KA..AIAI.RH.E....M.S...YE.RLPAYS  291
ZP_01748188    236   ..GT.VD.SLS.T..V..I.IE..K....SA.M...IMKD.E....F....HS.CYIDYE  297
ZP_01109672    243   SGRKRLD.TRSL..TF..I.L..I..Q.LRA.F.I.L.TD.K.Y...S...REACYI.Q.  302
ZP_01884592    235   I..SFID.SDCN..GVVAV.LE.MK..NIKA.M.FR.IRN.......S...IEEKY.DYE  294
YP_677848      232   ASSGFVD..VCN..GVIKV.LE..T..N.K..M.TRILKDNT.........REKKF.NF.  291
ZP_01110306    248   AERP.LD.SMSMV.SV..V.IE..K....IR..F...L.FE.K....L...NSE.KYIDQK  307
ZP_01109728    233   D.DT-.ID.SLSR...V.EV..I....K..R..A.M.I.LI.E.E.........NCKK.I.GR  291
YP_427322      235   PDGRELDMTFCN..SV..V.LE.....AA.F...L..D.R....V...DRV.RR.SLA  294
ZP_00514108    233   LKKKKLD.QN.F..SIA.C.IE..K....TA.FNI.LLKENK.........YS.KYVIYE  292
ZP_01043109    235   LGSMALD.SLGTI.GK..I.TE.MK...LQR.M..AIFDQN.....VS..GVSAQP.SYS  294
ZP_01051640    239   KNEDKLN.TYSF...AA.V.N........Q..MTIPIIINNK....F.H..N.IKE.S.Q  298
ZP_01736013    236   G.DQ.LDMTYSAY.SLPLV.LE..G....AAA.TI.LTQN.R...MLT...N..KNVTLR  295
ZP_00051672    96    R-DR.IS.ALSRY.SV..I.RM.QG.I..DG.M.I..MRD.E.....IG..RK.HRV.VA  154
ZP_01446334    236   T.GQ.LD.SL..T.SV..I..........................................  256
YP_561241      12    NN.IELD.TWSQ...VH.V.I...K.LA.EA.F...L.CN......L...NM.AKY.SFE  71
YP_478662      120   GLS.RV...EPLQ.PVD.C.VH..KS...A...V.PLMHHQE....LVS..AE.RPYSQE  179
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Query          301   LRTTLEYLGRLLSLQVQVKEAADVAAFRQSLREHHARVALAAAHSLSPHDTLSDPALDLL  360
NP_285374      301   ..............................................................  360
YP_488045      311   I.QAC.LIAQV.TW.IS.L.E.EIVHHSVQV.ATQNKLLHQFGDEQ.L.GG..RIGDE..  370
YP_569534      311   I.QAC.LIAQV.TW.IS.L.E.EIVQHSVQV.AIQNKLLHQFGDEQNL.EG.TRIGDEM.  370
YP_533633      311   V.QAC.LIAQV.TW.IS.S.E.E.VGHSVRV.AMQN.MLHELGDEQDLKKW.IRSGQ.M.  370
NP_442237      301   ..KAC.FF..VVFSNISAQ.DTETFDY.VQ.A..E.VLLDKMTTAADFVEG.TNHPDR..  360
ZP_01628825    301   I.NAC.F..QMT..EMAA..DSEDVEYKMQVKSYNSKLVEYMSSESNFI.G.INKQPN..  360
NP_486939      301   I.SAC.F..QMT.VEMSA..DSEDTEDKIQVKSV.SKLVQYMSAENDFINA.I.HQPNI.  360
YP_321522      301   I.SAC.F..QMT.VEMSA..DSEDTEDKIRVKSV.SKLVQYMSAENDFINA.I.HQPNI.  360
YP_488044      293   A.QACDMVAQV.AW..G.M.--EQ..T..T.KKAIQ.SLISDIEQ.HD.RA.VRNSEA..  352
ZP_01459223    286   R.RAC.V.TQ..A..LSAE.R.AE.SEDAHRAALLGQL.T.MGEGGTLEEV.EKESERV.  345
NP_948356      310   V.QAC.LIAQV.TW.IG.L.E.EIVRHSVRM.AIQN.LLHELGDEQGLTAG..RVSEEM.  369
YP_569533      293   A.QAC.MVAQV.AW..G.M.--EQ..T..T.KKAIQ.SLISDIEQ.HD.RA.IRNSEA..  352
YP_779569      297   S.QAC.MVA.V.AW.IG.M.--EQ.IT..T.KKAIQ.SLISDIEQ.HD.RA.ARNSEA..  356
ZP_01623500    302   ..KAC.F...VIFSELSSR.ETEDNDYQIK.TYIRSALINFMSRDKNFIES.IRYQPN..  361
YP_324352      301   ..KAC.F...VIFAEISAR.ETEDYDY.MN.THIQSLLVEYMSQEDNFV.G.VKHQPN..  360
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YP_779570      310   T.QAC.LIAQV.TW.IS.L.E.E.IRHSVRV.ALQNKLLHEL.DEQGLQAG..RVGEE..  369
ZP_01630443    301   ..KAC.F...VIFSEISAR.ETEDYDY.MN.TYIQTKLVEYMSQEENFI.G.QKNQPN..  360
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YP_001863766   301   ..KAC.F...VIFAEISAR.ETEDYTH.IN.THLQSLIEYMSQEENFI.G.VKNPQH...  360
YP_001174646   300   T..AC.L...I.A..IEAR.TETL.QRKLQ..QQIVHLLS.M.DRD.VVEGFRQAPEVV.  359
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YP_608942      298   T..AC.L.ANV....IEAH.SHNSTRLLLD..QRIVHMLASM.DQD.VG.G.LALPEVM.  357
YP_001668195   301   T..AC.L.ASV....IESR..HASTRKLLA..Q.IV.M----IS.MAD..SV..GLRE..  360
YP_001769101   303   A.NACDF.T.IFA..LAS..RGAL.EQ.LR.GGIA..LLGHM.EEE.FL.G.LRHPE.V.  362
YP_001748669   308   T..AC.L.ASV....IESR.SHANTRKLLD..Q.IV.M----IS.MAD..SV.E.EV-..  367
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NP_945475      304   M.MAA.F.AHT...LMSA..--.AEQ.ER.SARKA.AE....L.AAGAL.L.-------  363
YP_001268649   301   T..AC.L.ASV....IESR.SHASTRKLLA..Q.IV.M----IS.MAD..SV..GLR...  360
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YP_569510      304   T.MAA.F.AHT...LMSA..D.ELFGLITAMKATSD.LIR.L.VDANVARA.RA...Q..  364
YP_347894      297   ...ACQTI.QV....ISAM..LE.SRQ.EEKL.AL.LLNQ.MID.QNVF.G.ANQPQV.M  357
YP_001864851   299   V.KMC.F..QIV.SELAH.ISSSEWDYKVK.KSLQSEFLESISQADNFI.A.IK.EIR..  358
YP_660007      312   T.EVAL.M.LM..YLISL.VQ..AEHRDSAVLSLN.SITAKM.ERIFFT.G.REETDN.M  371
YP_236574      297   ..SACQAI.QV....ISAM..LEISRQ.EAKVRALEQLN..M.G.ENVF.G.AQQPQL.M  357
NP_792460      297   ..DACAMI.Q.....------.IS.I..THI.RE..EKVVLQ..D.MNRAD.EI..R.Q.--.Q  357
YP_275602      297   ..SACQAI.QV....ISAM..LEISRQ.EAKVRALEQLHQ.M.E.ENVF.G.AQQPQL.M  357
ZP_00516991    135   ..KAC.F..QVVFSEISA..ETKDYDY.MK.----T.IQG.LIE.M.QA.NFIEGLIN..  194
YP_262277      297   ..IACQTI.QV....ISAM..L.IS--..REEKVT.LAS.DQ.MRDT.F.G.AQVPQL..  357
ZP_01050418    304   Q.Q.IKF.TQVF.T.LTLRSSNE.L.RINTTTASR.KLVEQMSNEWDVQGG.TKKPTSM.  363
ZP_01623038    302   T.KAC.F..QFM.IELFK.HYKELEKYQHKVS.LQKEFKILSIQPANINNF.QNNGDR..  362
ZP_01094090    298   V.DAC.LI..Q.A.EN.IYRVRR-D.LH.T..TAA..AGIE..LPIM.QIVDAEE..VC.  369
YP_235462      302   ..DACAMI.Q...VKISAIV.TNIQ-------.REEK.V..D.M.RAN.EV..R.E.--.M  362
YP_780275      294   M.AVC.L.AEAVATRIVAL.SFAQSQSEIVVQRLEQ.MIE.ISRDGDWRAG.F.G.QTI.  353
YP_001900695   299   V..AC.H.AQI....IEA..DRAEI.H.LE..RILV.LLA.M.DRDHF.EG.LEHPA...  358
YP_861991      292   Q.Q.C.F.IQVF.NELS...SGSFLSNIEK.DDLRVKLINQIQKKN.IKKG..SARTK.T  351
ZP_02008304    299   V..AC.H.AQI....IEA..DRAEI.H.LE..RILV.LLA.MSDRDHFE.G.IEHPA...  358
YP_001242244   293   I.AAC.A.AETCAIRIAAL.SFAQSQSELVV.RLEQ.LVE.VSRDGEWQAA.F.GSQS..  352
YP_676783      293   TKLAAKLQ.HFITS.IEIR.QNEQV.TS.K.--.Q.VDD.ISRKFSADRNS.K.IVI.V.  352
YP_570910      301   M.EAC.LFAEMA.S.LEA.V..EQLEA.LRSTRI.EELVTRMSQESDLAEG.IRFHPN..  360
YP_001203744   293   I.AAG.A.AETCAIRIAAL.SFAQSQSELVV.RLEQ.LVE.VSRDGEWQAA.F.GSQS..  352
YP_001196150   293   V.LAAKLQ.QFITS.IDIR.SN.--------ENINSKKSIE.LER.TAL.P..EDS.E..  352
ZP_01061101    293   Q.QSCKFITQVF.S.LVLM.SNTWLKKINKAANLRSKLIEKITKDWDI.KG.TQGEATM.  352
ZP_01884257    291   A.EGAKMI.NI..SALEYRQTEEDGEKDEVIKDAVQSLSTYLEKDVDLIAA.TKQEVT..  350
YP_531190      293   M.AVC.L.AEAIATRIAL.SFAQSQSEIFVQRLEQ.MIE.ISREGDWRAGVF.TSQSI.  352
YP_487638      304   M.EAC.LFAEMA.S.LEA.V..EQLEA.LRSTRI.EELVTRMSQESDLAEG.IRFHPN..  363
YP_001135775   314   N.AAA.F..ST...RLVDQYED.QLHR.LDAQAVLVKLTA.TMNDGK.LVSALLG.P...  373
YP_001361736   309   AQSAA.F.SQ.IGERARSQ.RDGAL.AQEL.SDIT.A.SASGREP.T--TLIEE.R--..  368
YP_001196265   295   I.LAAKLQ.QFITS.IDIRQSN.ENVSA.--------.AS..LEELT.LELP...DS.EI.  354
YP_715500      308   ICAAA.F..H.F..RLVSR.NEQTLESTLAT..ALDQILV.QSGGALLV.V.TSGGPN.A  368
ZP_01227360    295   D..ACRI.AHT..Q.IAA.DE.ELTRE.VRI.ASE-DT...LYDPE.SFESFMEG.PE.C  354
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NP_252806      288   V.MSFQIFSQVC.AI.ERL.QGRI.ELLRVST.RRLAL.RR.RDADDLFGA.AH.DDGIA  347
YP_789005      288   V.MSFQIFSQVC.AI.ERL.QGRI.ELLRVST.RRLAL.RR.RDADDLFGA.AH.DDGIA  347
YP_001417343   294   ..LACQS.AGN.AR.IRA.--V.AVLY.ERI.LRA.ED...L.GDFAVE.V.DRHGD..C  353
ZP_00973293    288   V.MSFQIFSQVC.AI.ERL.QGRI.ELLRVST.RRLAL.RR.RDADDLFGA.AH.DDGIA  347
ZP_02055103    466   T.AAATV.TDAFAMR..EI.GKALWGE..RHLDVQG.LVRGLTR.DDFVTS.TQGDPT..  525
YP_001641522   466   T.AAATV.TDAFAMR..EI.GKALWGE..RHLDVQG.LVRGLTR.DDFVTS.TQGDPT..  525
ZP_00967488    288   V.MSFQIFSQVC.AI.ERL.QGRI.ELLRVST.RRLAL.RR.RDADDLFGA.AH.DDGIA  347
YP_570862      294   ..AVC.L.AEAIATRITAL.SFAQSQSELFVQRLEQ.MIE.ISREGDWRAAIF.A.QSI.  353
YP_001239104   309   ..EAC.LFAEMV.SHLEARL..E----SFE.QKRS.KIHEELLNR..RESE.AAGLVN..  368
ZP_01439288    304   M.NAT.LF.LMI..MIEG.L.REQR.AEEKA..L.D.F-VGKLM..T.SSD..NF.G..R  363
YP_245299      293   M.DVTDAVA.T.AGRIGALQ.VAR.RLESV.LT--V.EK.ITDFNDAE.M..D.M.P..M  353
NP_639488      293   M.DVTDAVA.T.AGRIGALQ.VAR.RLESV.LT--V.EK.ITDFNDAE.M..D.M.P..M  353
YP_487589      294   ...AVC.L.AEAIATRITAL.SFAQSQSELFVQRLEQ.MIE.ISREGDWRAAIF.TTQSI.  353
YP_001770032   435   T.AAAGL.TDA.A.RLHEL.SRRLRREQ.AHLAAES.LVR.L.R.DDVLTA.TSGETT..  494
YP_001238408   289   K..AA.LF.QMY.WLLEAR.RETDI.Y--ET.A..IQER.IERAAAQA.SAIL.FVA.YR  348
YP_485786      291   ..AAADI..QFV.TLLGPLGE.EA.RK.VERNATMM.L.EQF.SAPTMLEAFAATESE..  350
YP_001346361   288   V.MSFQIFSQVC.AI.DRL.QGRI.ELLRVST.RRLALVRR.RDADDLFGA.AH.DDGIA  347
YP_198931      293   M.DATDAVT.A.AGRIGALQ.VGR.RLESV.LT--I.EK.ITDFNDAE..M.A.M.P..M  353
YP_366123      293   M.DATDAVT.A.AGRIGALQ.VGR.RLESV.LT--I.EK.ITDFNDAE..M.A.M.P..M  353
NP_355125      289   V.IAA.MF.EFF.MHL..LKQK-----.RLDTIN..HA..L...HANIEEL.V.SFQ.FA  348
NP_644587      293   M.DATDAVT.A.AGRIGALQ.VGR.RLESV.LT--I.EK.ITDFNDAE..M.A.M.P..M  353
ZP_01302507    300   Q.SAA.LF.QIF.MMLESR.R.ET.HYEGMA.QVAD.LLS.V.QD---..L..NARWIMF  359
YP_001170431   285   R.AAAGMI.QVV..LLE.EN..EKL.RQAT.STLVD.--.SIGDT.AAAI.AA..L--..  344
YP_001204102   289   K..AA.LF.QMY.WLLEAR.RETDV.YESRAHQIQE.LIER..TQAHSKRAILEFVGEYR  348
YP_971319      294   V.MACDVIAQV..SNI.SSLLRAQTERTEAAATVRS.LIADIL..DDEYAA.ARH.AE.C  355
ZP_01017885    298   K..AC.LFAQM..FL.SDF.SRAALDATTRS.TV.D.IMAMI.EGEGLA.NFDILIDQMA  357
ZP_01157401    296   ...AV.LF.Q.F.YELARL.TDAEL.DVEKA.RL.DNLMSQVSGGMDLLQSFDRV.DEID  355
YP_742336      297   ..DAVLA.VQVAQSRLMLLN.QRN.RYQRRV.ACR..LV.RRPRATRLSELVA.HGA.W.  357
ZP_00998358    305   K..AI.LFAQ.F.YELAQH..EVER.DMLRAQAL.DK.IGRVSDGEALL.VFPEF.EEVE  364
NP_946341      289   Q.VAA.MFADFF..HFTA--.HHQRR.QS...TRRTLDS.TSEM.F.VD.F.RGNLKRIA  348
YP_611325      298   SWSLVQEI.TA.M.KFDQT.RMAT.DMISR..RIENEF.AEMRRTGDVE.VIKTLVPI.Q  357
YP_001749437   289   Q.VAA.MF.EFF..HI.TLQ.------..T.EAA...QV.HD..RTTDI.E.LRAR..FQ  348
YP_192038      297   I.AACRT.AGVM.R.LRN.-.--ELVTYQER..LRN.-MEFVTS.FEVR.SN.RSFMGE.Q  356
YP_001668821   289   Q.VAA.MF.EFF..HIETLRSRQ--KLEAAVQV.K.LDS.RD.NQTADI.SFFHAR.P.M  348
ZP_01545930    290   Y.NCALLF.QM...VL.SRF..EEKSKDARVA.LTTE.SR.LSTEV.SPEL.RSS.EAFG  349
YP_001523831   290   E.IGA.MFAEFF..HLEAVNHREKLEVATRA.RTLD.ILGH..RYAGLPEL.RGSLA.FM  349
ZP_00998358    305   Q.VAA.MF.EFF..HIETLRSRQ--KLEAAV.I.K.LDS.LR.NQAADI.GFFHAR.P.M  348
YP_345327      291   W.A.AGMI.QVV..LLE.EN..ETL.RQST.STLVE.--.S.GDT.AAAFVAA.QL--I.  350
YP_001520152   290   Y.SICDLF.Q.F..KF.LVLEEERFNN.KHIISAISQITQKLTS.G.FTL.IQTLGPQ.C  349
YP_001267717   289   Q.VAA.MF.EFF..HIETLRSRQ--KLEAAV.I.K.LDS.LR.NQAADI.GFFHAR.P.M  348
YP_345384      340   W.AAAGMI.QVV..LLE.EN..ETL.RQST.S--------TLVER..TG...AAA.A.I.  399
YP_001372987   294   ..IGA.LF.QYF..HIADC.RRKTLQLTADA..KLDAIVSQLSI.DEIRES.GAQLSRFS  353
ZP_01011420    299   R..AV.LFAH.F.FELGQYQ.RIRSRAQDDTARLQT.IMAHM.DG.ALDES.FSLSP.IQ  358
ZP_01864718    292   Q..SA.LFSE.F..ILRHSLFREREEL.E.G.KV.D.LMI..GTP..RSLP.LT.VIQ--  351
YP_769292      292   S.S.A.LF.QMFASRLESR.RRLALDYETKA.RIAD.LLTSV.DNA.---L.D...WA.A  351
ZP_00208733    291   V.QQ.VKIA.DF.VGLL.YI.SIHLK.IDGI-QREV.TM.DS.GH.DLTQG.VRCQDRF.  349
ZP_01726549    305   V.LEC.S.CQ.F.WHLYA..EEIYFEKQ.N.ERAINQMLEKTSLDN.AVKVFQENEAEV.  364
NP_946838      300   M.EACALFAEMA...LETRL...QL.A.LRSTRI.EELVTRMSQESDLAEG.IRFYPN..  359
YP_745313      306   R.AVM.MF.QMF..LLDSR.GEIQQERDER..DR.HLA.I.DMV.CDGVAVVLSG.VSAY  382
ZP_01041311    292   ...VADMFSQMF..MIDIRSEELRSSGRA.HD-QLM.R..GGAK..R.LPMLEEL.N--.  351
ZP_01748188    298   R..AF.MFAHMF.YELTRF.DGQRKIAEVNTNRLQS.LMTHMVDGQELAES.LAVSD.IQ  357
ZP_01109672    303   V.LQC.N.SQ.F.WHLLA..-EEI.KQKKFVTDEAVDAM.DKIGPAN.SRVVKSGERAF.  362
ZP_01884592    295   VCSVF.W.STVI.AKISS...Y.F.TEL.-----.K.A...DRIYE.DDGIITEDGP.I.  355
YP_677848      292   QCSVF.MFSNVV.TRLST.TTENQ.LMNSIIE.LYSQTM.IN.--------IDNC.ALIM  351
ZP_01110306    308   K.LVC.S..H.YAW.MHT.ALTRKEQ.QMRQ.KLNNI.HQLTSY.-N.LEAI.QKETA..  367
ZP_00052871    12          ..........................EA.V..SS.H...G.DDFV--.AM.E.P..MF  49
ZP_01109728    292   .VAQ..LF.EMF..ELSRRLVNEHIRVSEKANATFT..LSNLSLGR.LNNAIVEQLSL.K  351
YP_427322      295   TMGACQVYAETIAQ..LRLDNTRRSRH.SRTGDLIDDISVLLGSGR.LAEA.DYTLD.T.  354
ZP_00514108    293   I.KIC.L..EIF..KLMYE.EKSFRQY..TIK.IKK.IKEELSKNKNK..FIDN        346
ZP_01043109    295   T.LNIHS.VK.AEQRLMLQKQFEADR.FDRVE.SRKALLDRKREIK..QQL.E.QGHFW.  354
ZP_01051640    299   ETYSADI..QTINMVLEHQTRSKAQKTIKDIL.NGNELVAINSN.FKLDKFWEAQ.EN.F  358
ZP_01736013    296   E.ELY.FI..TI.IKL                                              311
ZP_00051672    155   IQHLIVA...AF..RL                                              170
YP_561241      72    T.QLC.E.SQIT..HMSGLLR.EIDFQ.YHYKVEF.EIRG.MQS.IDAFKAIKSQISEIK  131
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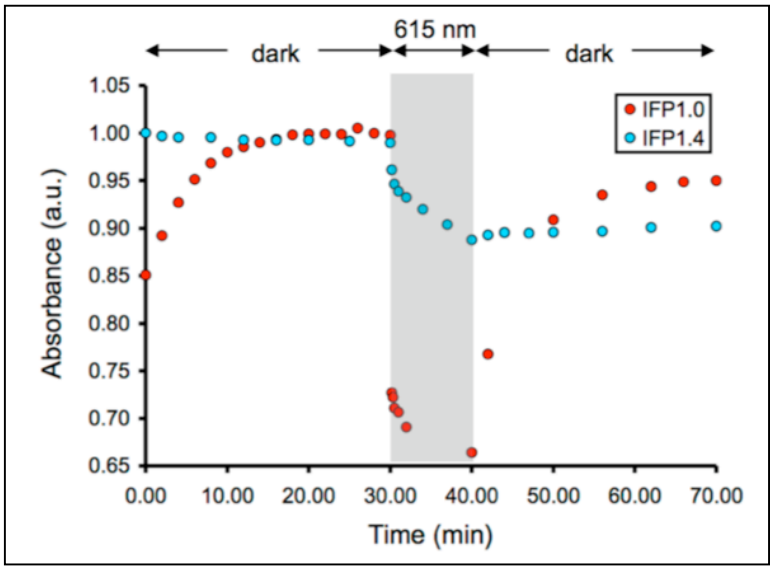

Fig. S1 Dark and light adapted behavior of IFP1.0 and IFP1.4. Absorbance spectra at different time points were taken in the dark (0 – 30 min.), upon 615 nm light illumination by solar simulator (30 – 40 min.), and then in the dark again (40 – 70 min.).

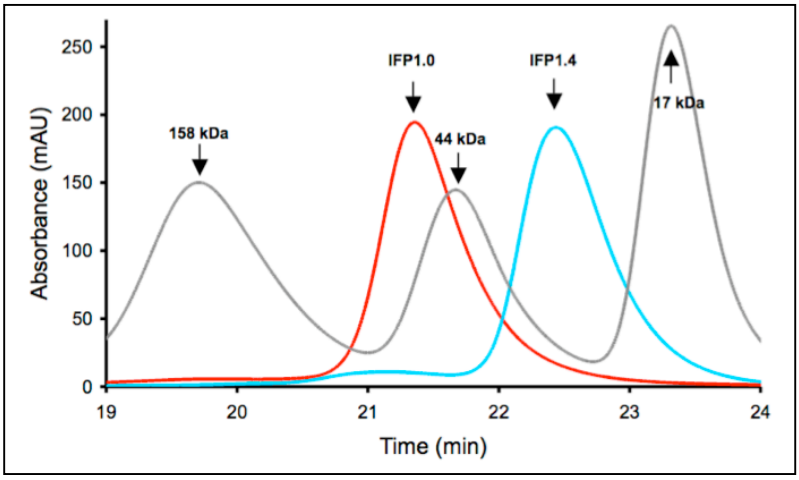

Fig. S2 Size exclusion chromatography of IFP1.0 and1.4. Three standards are also shown: γ-globulin (158 kDa), ovalbumin (44 kDa) and myoglobin (17 kDa). Absorbance was measured at 280 nm.

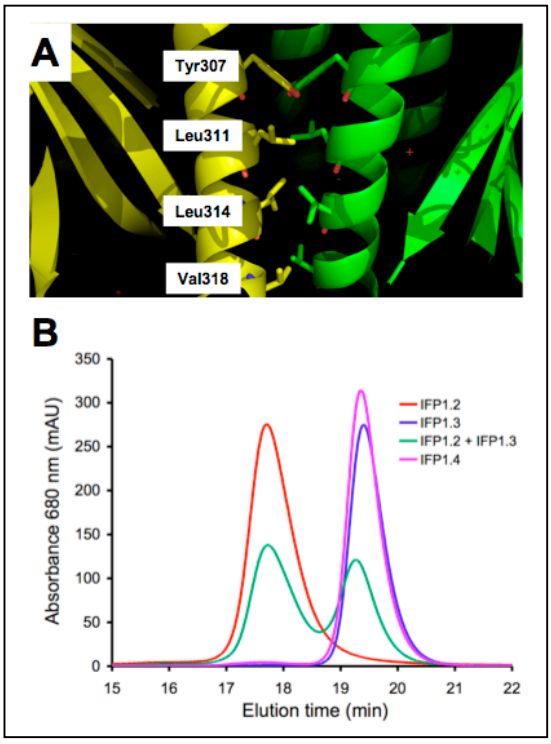

Fig. S3 IFP monomerization by L311K mutation. (**A**) The dimer interface in DrCBD is formed from 4 residues (Y307/L311/L314/V318). (**B**) Size exclusion chromatography of IFP1.2, 1.3, 1.4 and a mixture of IFP1.2 and 1.3.

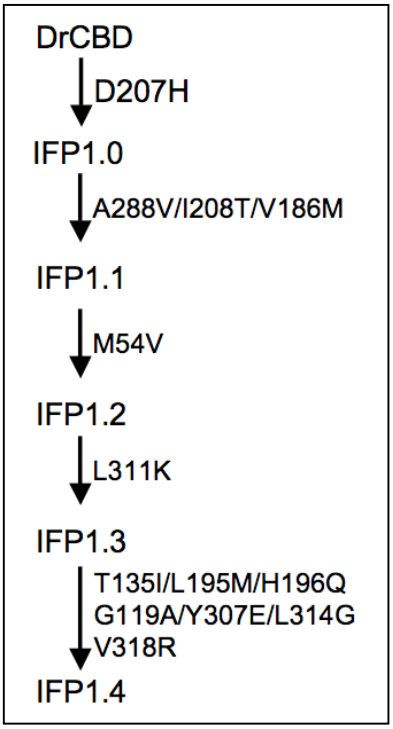

Fig. S4 Evolution of IFPs showing the mutations introduced at each stage. .

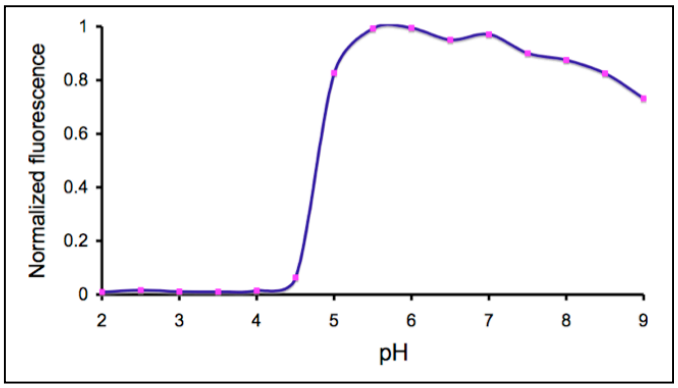

Fig. S5 pH dependence of IFP1.4 fluorescence. IFP1.4 was excited at 640 nm and its emission at 700 - 800 nm was integrated, normalized and plotted against pH.

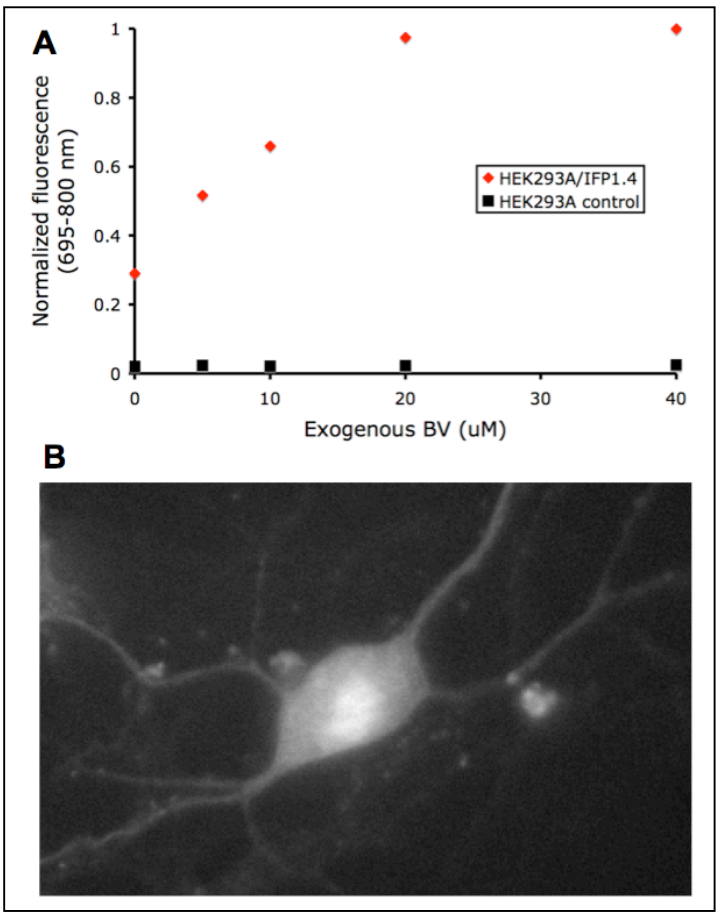

Fig. S6 Increase of IFP fluorescence by addition of exogenous BV. (**A**) IFP1.4-transfected HEK293A cells indicated increase of fluorescence upon addtion of exogenous BV, with untransfected cells as the control. IFP fluorescence was integrated from 695 to 800 nm upon excitation at 660 nm. (**B**) Fluorescence image of a P2 cultured cortical neuron 2 weeks after transfection of IFP1.1, 10 minutes after addition of 25 uM BV.

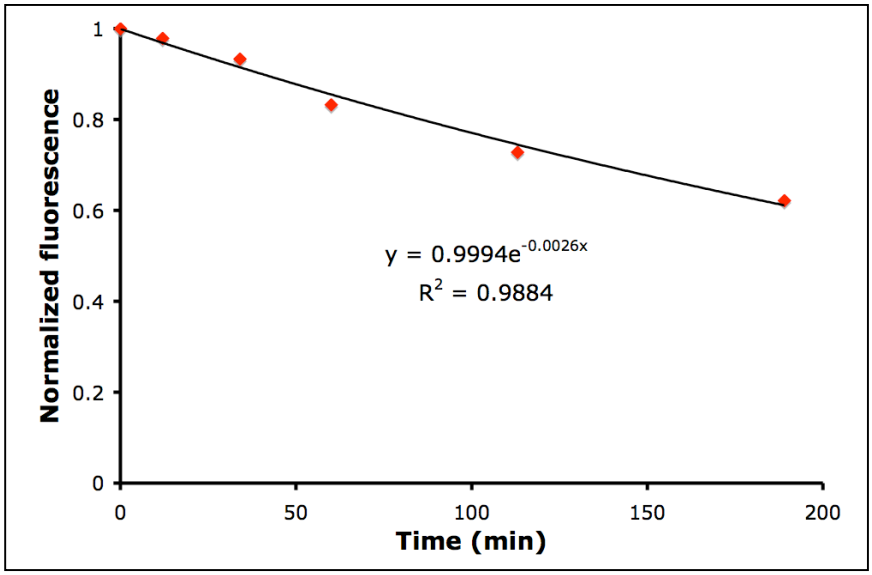

Fig. S7 IFP1.4 degradation in HEK293A cells with 20uM BV added.

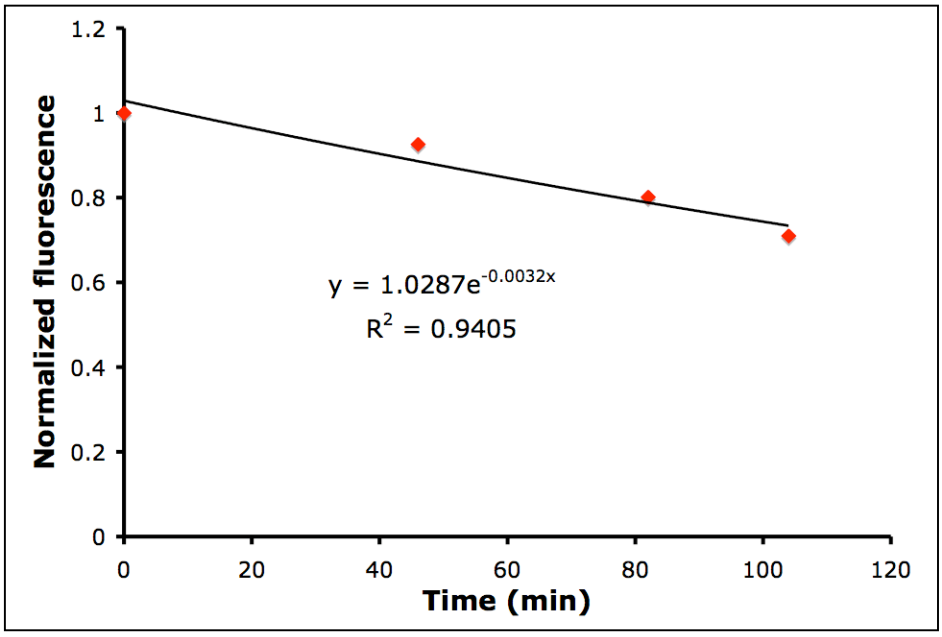

Fig. S8 IFP1.4 degradation in HEK293A cells without exogenous BV.

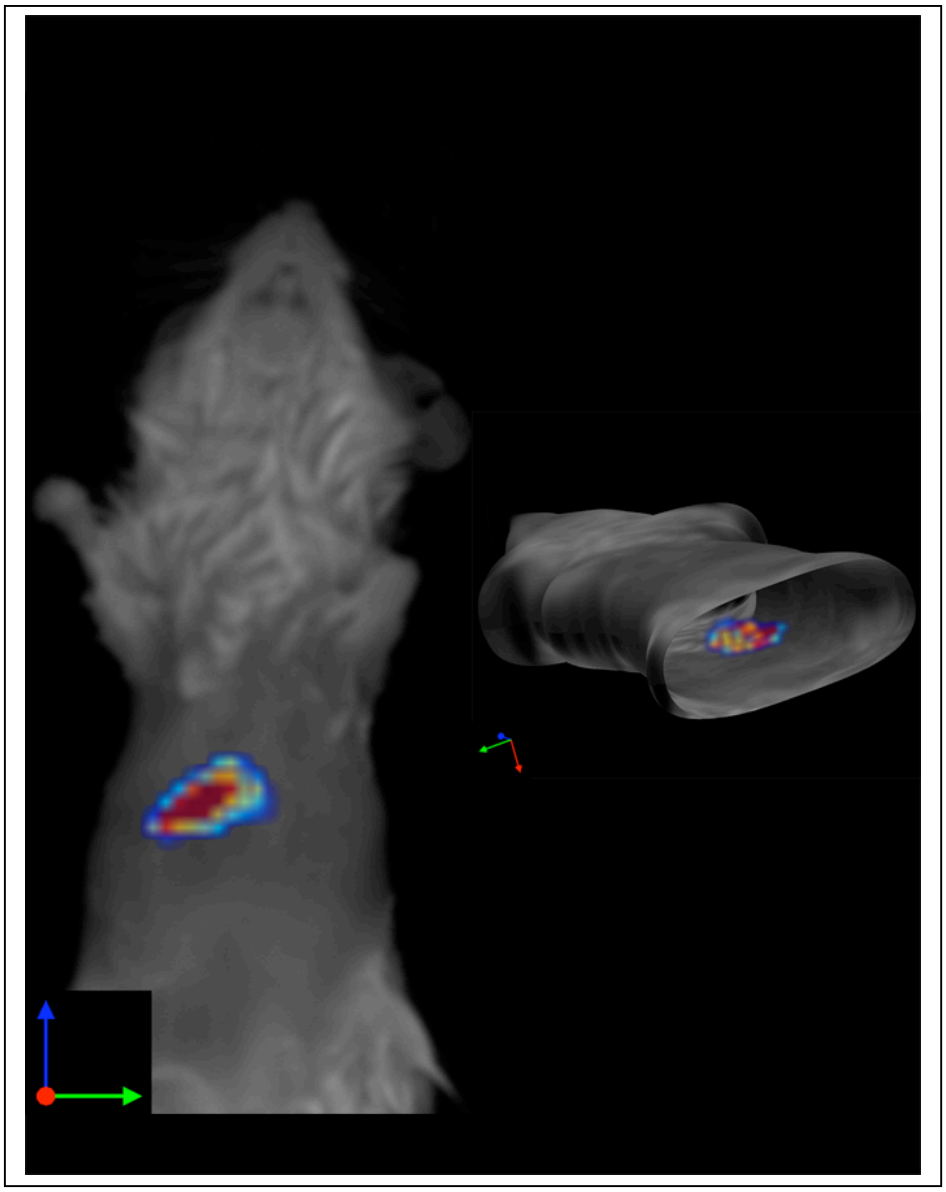

Fig. S9 Noninvasive fluorescence molecular tomographic (FMT) imaging of IFP-expressing mouse liver. Blue, green, and red arrows indicate rostral-caudal, left-right, and dorsoventral axes respectively. Left: top view. Right: tilted view to show the 3D localization of fluorescence within the mouse.

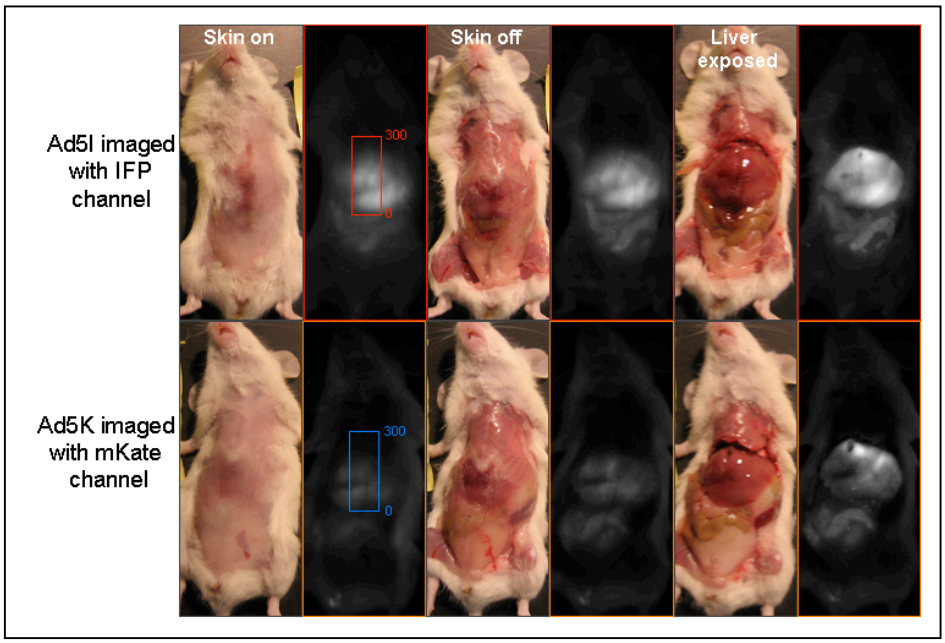

Fig. S10 IFP/mKate fluorescence images before dissection (skin on), after removal of skin (skin off), and after removal of overlying peritoneum and ribcage (liver exposed). mKate images were 2.5X brightened relative to IFP images. Note that Ad5I infected mouse was imaged after 250 nmole IV injection of BV.

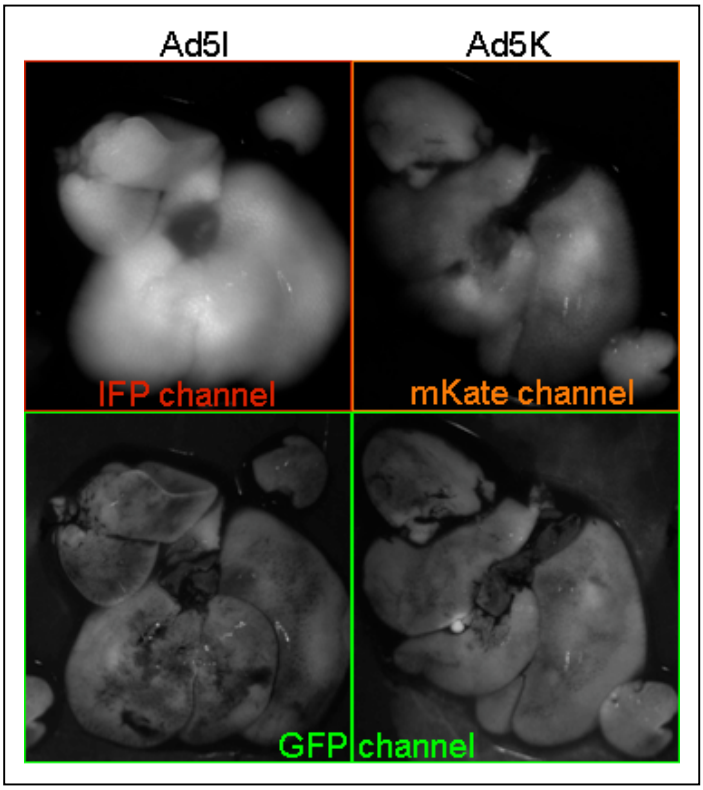

Fig. S11 Imaging of extracted livers infected with Ad5I and Ad5K.

Table S1 Properties of infrared fluorescent protein variants.

Fluorescent protein	Absorption max. (nm)	Extinct. coeff. (M^{-1} cm^{-1})	Emission max. (nm)	Quantum yield	Relative brightness (%)	Stoichiometry
IFP1.0	699	60,000	722	0.028	100	Dimer
IFP1.1	686	86,000	713	0.050	256	Dimer
IFP1.2	684	86,000	707	0.066	338	Dimer
IFP1.3	684	84,000	707	0.061	305	Monomer
IFP1.4	684	92,000	708	0.070	383	Monomer

Supporting References

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