Electronic Supplementary Material to

LOCALIZATION AND FUNCTION OF THE MEMBRANE-BOUND RIBOFLAVIN IN THE Na^+ TRANSLOCATING NADH:QUINONE OXIDOREDUCTASE (Na^+-NQR) FROM *VIBRIO CHOLERAE* *

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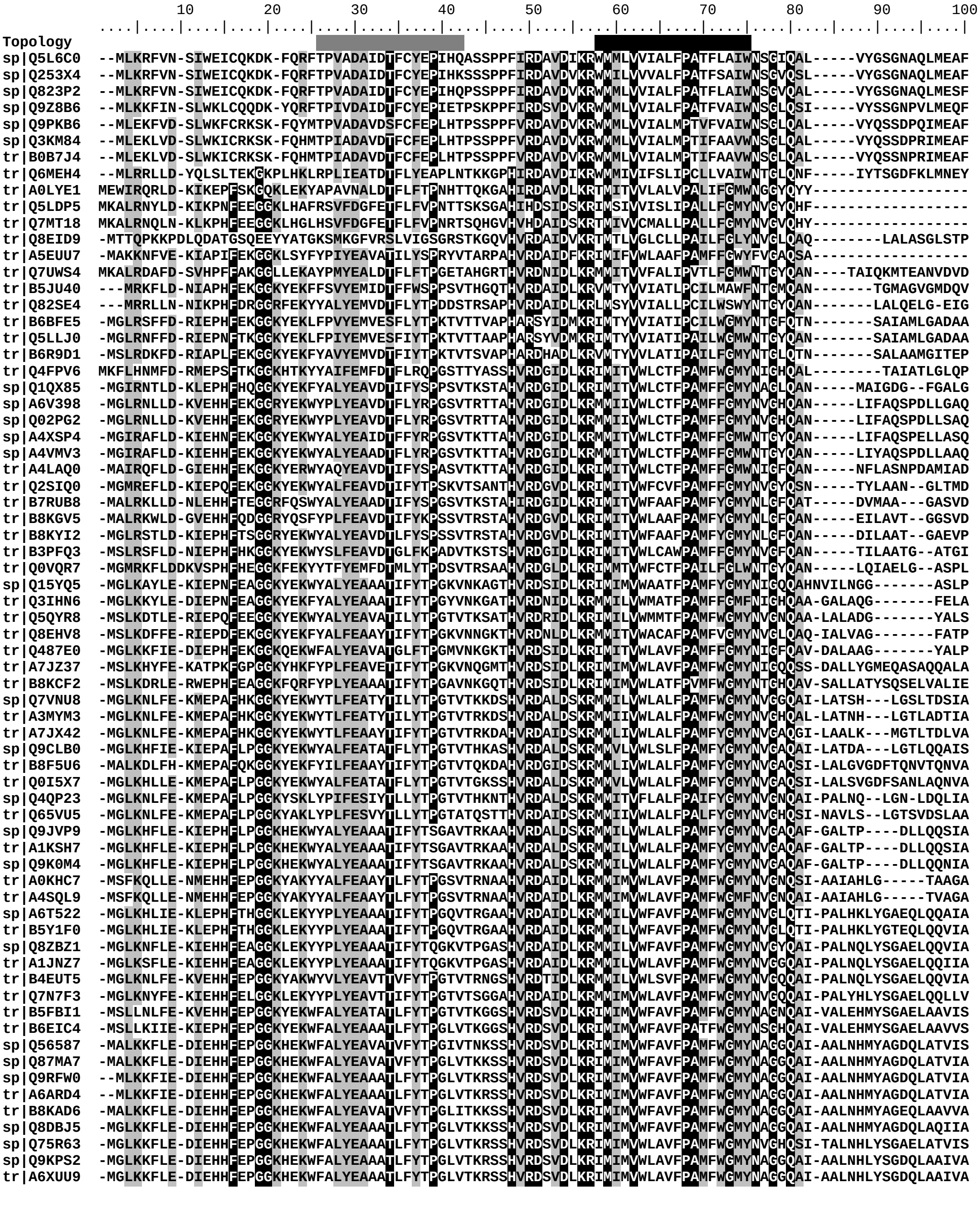
Fig. S1. Sequence alignment of non-redundant NqrB homologues. NqrB-related proteins from 69 organisms were retrieved from the UniProt knowledge base. Multiple sequence alignment was performed using the ClustalW algorithm (1) implemented in the BioEdit Sequence Alignment Editor (Version 7.0.9.0, (2)) with default settings. Identical residues and similar residues (BLOSUM62 scoring matrix) are underlaid with black and grey bars, respectively, and were identified with the BioEdit program using an identity and similarity threshold of 85% and the BLOSUM62 scoring matrix (3). Black bars indicate transmembrane helices, grey bars indicate hydrophobic stretches, as predicted from a consensus model based on 11 different topology prediction algorithms (see Materials and Methods and supplementary Fig. S2).



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Topology
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tr|Q7UWS4  MKALRDAFD-SVHPFFAKGGLLEKAYPMYEALDTFLFTPGETAHGRTHVRDNIDLKRMMITVVFALIPVTLFGMWNTGYQAN----TAIQKMTEANVDVD
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sp|A6V398  -MGLRNLLD-KVEHHFEKGGRYEKWYPLYEAVDTFLYRPGSVTRTTAHVRDGIDLKRMMIIVWLCTFPAMFFGMYNVGHQAN-----LIFAQSPDLLGAQ
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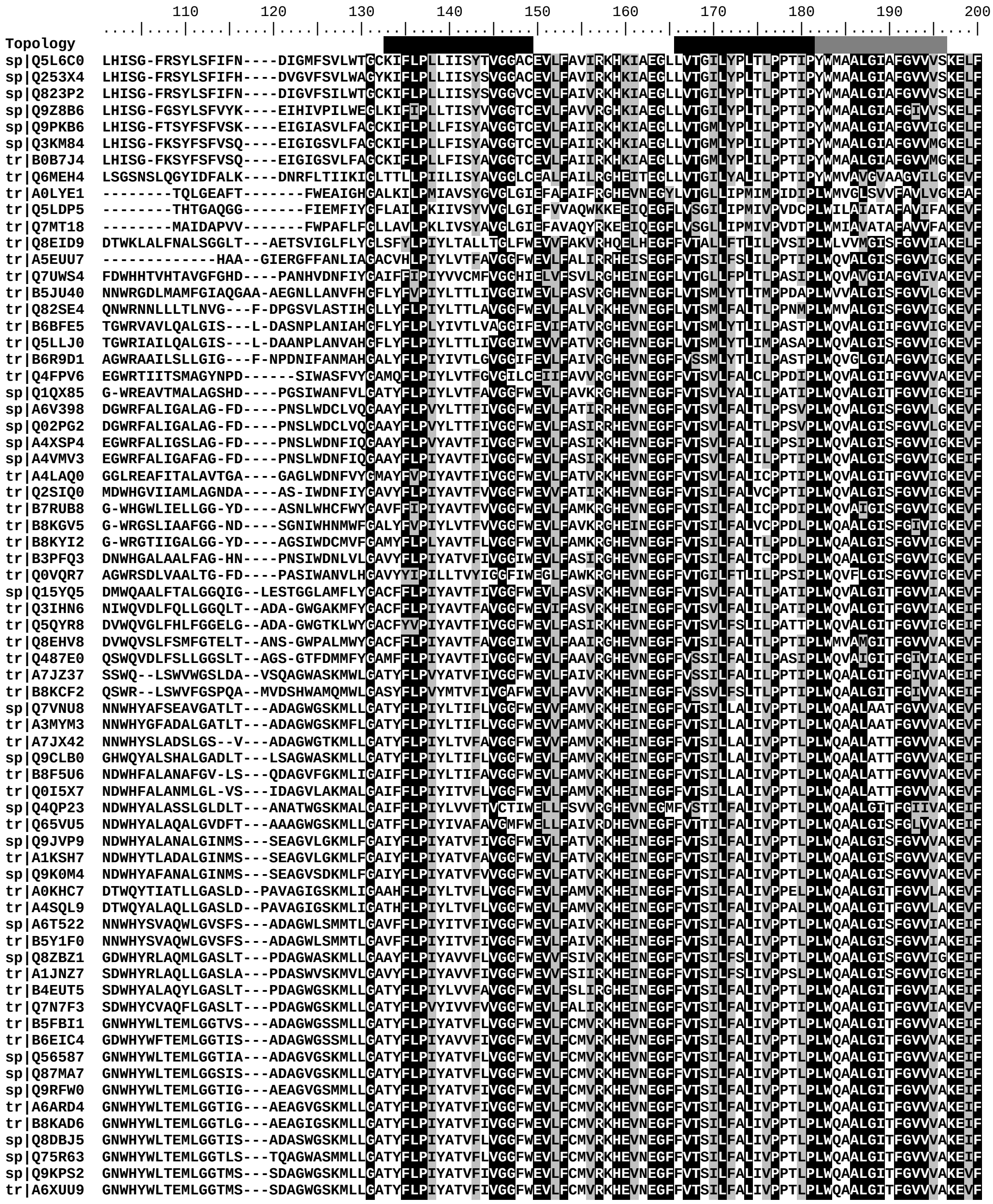

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Topology
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tr|A7JX42  NNWHYSLADSLGS--V---ADAGWGTKMLLGATYFLPIYLTVFAVGGFWEVVFAMVRKHEINEGFFVTSILLALIVPPTLPLWQAALATTFGVVVAKEVF
sp|Q9CLB0  GHWQYALSHALGADLT---LSAGWASKMLLGATYFLPIYLTIFLVGGFWEVLFAMVRKHEINEGFFVTSILLALIVPPTLPLWQAALATTFGVVVAKEIF
tr|B8F5U6  NDWHFALANAFGV-LS---QDAGVFGKMLIGAIFFLPIYLTIFAVGGFWEVLFAMVRKHEINEGFFVTSILLALIVPPTLPLWQAALATTFGVVVAKEVF
tr|Q0I5X7  NDWHFALANMLGL-VS---IDAGVLAKMALGAIFFLPIYITVFLVGGFWEVLFAMVRKHEINEGFFVTSILLALIVPPTLPLWQAALATTFGVVVAKEVF
sp|Q4QP23  NDWHYALASSLGLDLT---ANATWGSKMALGAIFFLPIYLVVFTVCTIWELLFSVVRGHEVNEGMFVSTILFALIVPPTLPLWQAALGITFGIIVAKEIF
tr|Q65VU5  NDWHYALAQALGVDFT---AAAGWGSKMLLGATFFLPIYIVAFAVGMFWELLFAIVRDHEVNEGFFVTTILFALIVPPTLPLWQAALGISFGLVVAKEIF
sp|Q9JVP9  NDWHYALANALGINMS---SEAGVLGKMLFGAIYFLPIYATVFIVGGFWEVLFATVRKHEINEGFFVTSILFALIVPPTLPLWQAALGISFGVVVAKEVF
tr|A1KSH7  NDWHYTLADALGINMS---SEAGVLGKMLFGAIYFLPIYATVFAVGGFWEVLFATVRKHEINEGFFVTSILFALIVPPTLPLWQAALGISFGVVVAKEVF
sp|Q9K0M4  NDWHYAFANALGINMS---SEAGVSDKMLFGAIYFLPIYATVFVVGGFWEVLFATVRKHEINEGFFVTSILFALIVPPTLPLWQAALGISFGVVVAKEVF
tr|A0KHC7  DTWQYTIATLLGASLD--PAVAGIGSKMLIGAAHFLPIYLTVFLVGGFWEVLFAMVRKHEINEGFFVTSILFALIVPPELPLWQAALGITFGVVLAKEVF
tr|A4SQL9  DTWQYALAQLLGASLD--PAVAGIGSKMLIGATHFLPIYLTVFLVGGFWEVLFAMVRKHEINEGFFVTSILFALIVPPALPLWQAALGITFGVVLAKEVF
sp|A6T522  NNWHYSVAQWLGVSFS---ADAGWLSMMTLGAVFFLPIYITVFIVGGFWEVLFAIVRKHEINEGFFVTSILFALIVPPTLPLWQAALGISFGVVIAKEIF
tr|B5Y1F0  NNWHYSVAQWLGVSFS---ADAGWLSMMTLGAVFFLPIYITVFIVGGFWEVLFAIVRKHEINEGFFVTSILFALIVPPTLPLWQAALGISFGVVIAKEIF
sp|Q8ZBZ1  GDWHYRLAQMLGASLT---PDAGWASKMLLGAAYFLPIYAVVFLVGGFWEVVFSIVRKHEINEGFFVTSILFSLIVPPTLPLWQAALGISFGVVIGKEIF
tr|A1JNZ7  SDWHYRLAQLLGASLA---PDASWVSKMVLGAVYFLPIYAVVFIVGGFWEVVFSIIRKHEINEGFFVTSILFSLIVPPSLPLWQAALGISFGVVIGKEIF
tr|B4EUT5  SDWHYALAQYLGASLT---PDAGWGSKMLLGATYFLPIYLVVFAVGGFWEVLFSLIRGHEINEGFFVTSILFALIVPPTLPLWQAALGITFGVVIAKEIF
tr|Q7N7F3  SDWHYCVAQFLGASLT---PDAGWGSKMLLGATYFLPVYIVVFVVGGFWEVLFALIRKHEINEGFFVTSILFALIVPPTIPLWQAALGITFGVVIAKEVF
tr|B5FBI1  GNWHYWLTEMLGGTVS---ADAGWGSSMLLGATYFLPIYATVFLVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEIF
tr|B6EIC4  GDWHYWFTEMLGGTIS---ADAGWGSSMLLGATYFLPIYAVVFIVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEIF
sp|Q56587  GNWHYWLTEMLGGTIA---ADAGVGSKMLLGATYFLPIYATVFLVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEIF
sp|Q87MA7  GNWHYWLTEMLGGSIS---ADAGVGSKMLLGATYFLPIYATVFLVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEIF
sp|Q9RFW0  GNWHYWLTEMLGGTIG---AEAGVGSMMLLGATYFLPIYATVFIVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEIF
tr|A6ARD4  GNWHYWLTEMLGGTIG---AEAGVGSKMLLGATYFLPIYATVFIVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEIF
tr|B8KAD6  GNWHYWLTEMLGGTLG---AEAGIGSKMLLGATYFLPIYATVFIVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEIF
sp|Q8DBJ5  GNWHYWLTEMLGGTIS---ADASWGSKMLLGATYFLPIYATVFLVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEIF
sp|Q75R63  GNWHYWLTEMLGGTLS---TQAGWASMMLLGATYFLPIYATVFLVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEIF
sp|Q9KPS2  GNWHYWLTEMLGGTMS---SDAGWGSKMLLGATYFLPIYATVFIVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEVF
tr|A6XUU9  GNWHYWLTEMLGGTMS---SDAGWGSKMLLGATYFLPIYATVFIVGGFWEVLFCMVRKHEVNEGFFVTSILFALIVPPTLPLWQAALGITFGVVVAKEVF
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                   210       220       230       240       250       260       270       280       290       300
           ....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|
Topology              ███████████████
sp|Q5L6C0  GGTGMNILNPALSGRAFLFFTFPAKMSGD-VWVGSNPTHIKDSLLTMNATAGKSIIDGFSQSTCLQTLNSTPPSVKRIHVDAIASNILHMTHVPTQNVIE
sp|Q253X4  GGTGMNILNPALSGRAFLFFSFPAKMSGD-VWVGSNPMKIKESLLAMNSTAGKSIIDGFSQSTCLHTLNSTPPSVKRVHVDAIASNILHMTHVPTQNVIQ
sp|Q823P2  GGTGMNILNPALSGRAFLFFTFPAKMSGD-VWVGSNPTKIKESLLAMNSTAGKSIIDGFSQSTCLQTLNSTAPAVKRVHVDAIASNILQMPHVPTESVIH
sp|Q9Z8B6  GGTGMNILNPALSGRAFLFFTFPAKMSGD-VWVGSNPGVIKDSLMKMNSSTGKVLIDGFSQSTCLQTLNSTPPSVKRLHVDAIAANMLHIPHVPTQDVIH
sp|Q9PKB6  GGTGMNILNPALTGRAFLFFTFPAKMSGD-VWVGSNPSKIKESLAMMNSLAERSNFDGFSQSTCLQILNSTPPSVKRVHIDAIASNILKLEHVPSQEVLQ
sp|Q3KM84  GGTGMNILNPALTGRAFLFFTFPAKMSGD-VWVGSNPSRIKESLATMSSLAEKSHFDGFSQSTCLQVLNSTPPSVKRVHIDAIASNILNLEHVPTQDVLQ
tr|B0B7J4  GGTGMNILNPALTGRAFLFFTFPAKMSGD-VWVGSNPSRIKESLATMSSLAEKSHFDGFSQSTCLQILNSTPPSVKRVHIDAIASNILNLEHVPTQDVLQ
tr|Q6MEH4  GGSGMNIVNPALACRAFLFFTFPGKMSGD-VWVGTNPTLVRESLLKMNHDAHTGSLDGYSQATHLARFNVTP-EIKRIHVDAIASNDLG-NQVHSFPIIE
tr|A0LYE1  GGTGMNILNPALTARAFAFFAYPTYMSGNSVWVSNAS-----------------EVDAVSGETILGSL--------------------------------
tr|Q5LDP5  GGTGMNVFNVALVTRAFLFFAYPTKMSGDAVWVAQDSI---------FGLGN--TVDGLTAATSLGVA--------------------------------
tr|Q7MT18  GGTGRNIFNVALVTRAFLFFAYPAAMSGDQVFVRTADT---------FGLGAGTVADGFSGATPLGQI--------------------------------
tr|Q8EID9  GGMGYNFLNPALAGLAFIYFAYPSEVTTVKQLVA---------------------VDGFSGATALAQA--------------------------------
tr|A5EUU7  GGTGRNFVNPALAGRAFLYFAYPIQMSGD-VWIASVKG---------HA-----WIDGFSGATPLATI--------------------------------
tr|Q7UWS4  GGTGRNFLNVALTSRAFLYFAYAGQISGDKVWTA---------------------VDGFSGATALGQM--------------------------------
tr|B5JU40  GGTGKNFLNPALTGRAFLYFAYPAHLSGNSVWTA---------------------VDGVTGATPLGLA--------------------------------
tr|Q82SE4  GGTGKNFLNPALVGRAFLYFAYPADISGDLVWVA---------------------VDGYTSATPLGLG--------------------------------
tr|B6BFE5  GGTGKNFLNPALTGRAFLYFAYPANMSGDSVWTP---------------------VDGFSGATALGVT--------------------------------
tr|Q5LLJ0  GGTGKNFLNPALVGRAFLYFAYPANMSGDSVWTP---------------------VDGFSGATALAVS--------------------------------
tr|B6R9D1  GGTGKNFLNPALVGRAFLYFAYPAAMSGDAVWTP---------------------VDGFSGATALGVA--------------------------------
tr|Q4FPV6  GGTGKNFLNPALSGRAFLYFAYPAYMSGDSVWTA---------------------VDGFSGATPLGLA--------------------------------
sp|Q1QX85  GGTGKNFLNPALTGRAFLYFAYPAQISGDSVWVA---------------------ADGYTGATALSTA--------------------------------
sp|A6V398  GGTGKNFLNPALVGRAFLFFAYPAQMSGDAVWTS---------------------VDGFAGATSLSLA--------------------------------
sp|Q02PG2  GGTGKNFLNPALVGRAFLFFAYPAQMSGDAVWTS---------------------VDGFAGATSLSLA--------------------------------
sp|A4XSP4  GGTGKNFLNPALTGRAFLFFAYPAQMSGDAVWTA---------------------VDGFAGATSLSLA--------------------------------
sp|A4VMV3  GGTGKNFLNPALTARAFLFFAYPAQMSGDAVWTA---------------------VDGYAGATALSLG--------------------------------
tr|A4LAQ0  GGTGKNFLNPALTGRAFLYFAYPAQISGDTVWTA---------------------VDGFSGATALSWA--------------------------------
tr|Q2SIQ0  GGTGKNFLNPALTGRAFLYFAYPAQISGDAVWTA---------------------VDGFSGATPLSVA--------------------------------
tr|B7RUB8  GGTGKNFLNPALTGRAFLYFAYPAQLSGDTVWVA---------------------VDGYTAATPLSLV--------------------------------
tr|B8KGV5  GGTGKNFLNPALTGRAFLYFAYPAQLSGDAVWTA---------------------VDGYSGATPLGLV--------------------------------
tr|B8KYI2  GGTGKNFLNPALTGRAFLYFAYPADLSGDAVWTA---------------------VDGYSGATPLGIV--------------------------------
tr|B3PFQ3  GGTGKNFLNPALTGRAFLFFAYPAEISGDAVWTA---------------------VDGYTGATTLSVA--------------------------------
tr|Q0VQR7  GGTGKNFLNPALVGRAFLYFAYPAQMSGDAVWTA---------------------VDNFSGATSLSLA--------------------------------
sp|Q15YQ5  GGTGRNFLNPALSGRAFLYFAYPAQISGDAIWTA---------------------ADGFSGATWLSQA--------------------------------
tr|Q3IHN6  GGTGRNFLNPALAGRAFLFFAYPAQISGDTVWTA---------------------VDSFSGATMLGQA--------------------------------
tr|Q5QYR8  GGTGRNFLNPALTGRAFLYFAYPASMSGDSIWTA---------------------VDGFSGATNLGKA--------------------------------
tr|Q8EHV8  GGTGRNFLNPALAGRAFLFFAYPLNMSGDTSWVV---------------------ADGYSGATALSQA--------------------------------
tr|Q487E0  GGTGKNFLNPALAGRAFLFFAYPSQISGDAVWVA---------------------ADGFSGATMLSSA--------------------------------
tr|A7JZ37  GGTGRNFLNPALAGRAFLYFAYPANMSGGAVWVA---------------------ADGYSGATPLSQW--------------------------------
tr|B8KCF2  GGTGRNFLNPALAGRAFLYFAYPANMSGGAVWVA---------------------ADGYTGATPLSQW--------------------------------
sp|Q7VNU8  GGVGKNFMNPALAGRAFLFFAYPAQISGDLVWTA---------------------ADGFSGATALSQW--------------------------------
tr|A3MYM3  GGVGKNFMNPALAGRAFLFFAYPAQISGDLVWTA---------------------ADGFSGATALSQW--------------------------------
tr|A7JX42  GGVGKNFMNPALAGRAFLFFAYPGQISGDAVWVA---------------------ADGFSGATALSQW--------------------------------
sp|Q9CLB0  GGVGKNFMNPALAARAFLFFAYPAQISGDTVWVA---------------------ADGFSGATALSQW--------------------------------
tr|B8F5U6  GGVGKNFMNPALAGRAFLFFAYPAQISGDLVWTA---------------------ADGFSGATALSQW--------------------------------
tr|Q0I5X7  GGVGKNFMNPALAGRAFLFFAYPAQISGDLVWTA---------------------ADSFSGATALSQW--------------------------------
sp|Q4QP23  GGVGRNFMNPALAGRAFLFFAYPAQISGDTVWTA---------------------ADGFSGATALSQW--------------------------------
tr|Q65VU5  GGVGKNFMNPALAGRAFLFFAYPGQISGDLVWTA---------------------TDGFSGATALSQW--------------------------------
sp|Q9JVP9  GGTGKNFMNPALAGRAFLFFAYPANLSGDAVWTA---------------------VDGYSGATALAQW--------------------------------
tr|A1KSH7  GGTGKNFMNPALAGRAFLFFAYPANLSGDAVWTA---------------------VDGYSGATALAQW--------------------------------
sp|Q9K0M4  GGTGKNFMNPALAGRAFLFFAYPANLSGDAVWTA---------------------VDGYSGATALAQW--------------------------------
tr|A0KHC7  GGTGKNFLNPALAGRAFLFFAYPGQISGDAVWVA---------------------VDGYSGATALSQW--------------------------------
tr|A4SQL9  GGTGKNFLNPALAGRAFLFFAYPGQISGDAVWVA---------------------VDGYSGATALSQW--------------------------------
sp|A6T522  GGTGRNFLNPALAGRAFLFFAYPAQISGDLVWTA---------------------ADGFSGATPLSQW--------------------------------
tr|B5Y1F0  GGTGRNFLNPALAGRAFLFFAYPAQISGDLVWTA---------------------ADGFSGATPLSQW--------------------------------
sp|Q8ZBZ1  GGTGRNFLNPALAGRAFLFFAYPAQISGDLVWTS---------------------ADGFSGATPLSQW--------------------------------
tr|A1JNZ7  GGTGRNFLNPALAGRAFLFFAYPAQISGDLVWTA---------------------ADGFSGATPLSQW--------------------------------
tr|B4EUT5  GGTGRNFLNPALAGRAFLFFAYPAQISGDLVWTA---------------------ADGFSGATPLSQW--------------------------------
tr|Q7N7F3  GGTGRNFLNPALAGRAFLFFAYPAQISGDLVWTA---------------------ADGFSGATPLSQW--------------------------------
tr|B5FBI1  GGTGRNFLNPALAGRAFLFFAYPAQISGDTVWTA---------------------ADGFSGATALSQW--------------------------------
tr|B6EIC4  GGTGRNFLNPALAGRAFLFFAYPAQISGDTVWTA---------------------ADGFSGATALSQW--------------------------------
sp|Q56587  GGTGRNFLNPALAGRAFLFFAYPAQISGDVVWTA---------------------ADGFSGATALSQW--------------------------------
sp|Q87MA7  GGTGRNFLNPALAGRAFLFFAYPAQISGDVVWTA---------------------ADGFSGATALSQW--------------------------------
sp|Q9RFW0  GGTGRNFLNPALAGRAFLFFAYPAQISGDVVWTA---------------------ADGFSGATALSQW--------------------------------
tr|A6ARD4  GGTGRNFLNPALAGRAFLFFAYPAQISGDVVWTA---------------------ADGFSGATALSQW--------------------------------
tr|B8KAD6  GGTGRNFLNPALAGRAFLFFAYPAQISGDVVWTA---------------------ADGFSGATALSQW--------------------------------
sp|Q8DBJ5  GGTGRNFLNPALAGRAFLFFAYPAQISGDVVWTA---------------------ADGFSGATALSQW--------------------------------
sp|Q75R63  GGTGRNFLNPALAGRAFLFFAYPAQISGDVVWTA---------------------ADGFSGATALSQW--------------------------------
sp|Q9KPS2  GGTGRNFLNPALAGRAFLFFAYPAQISGDLVWTA---------------------ADGYSGATALSQW--------------------------------
tr|A6XUU9  GGTGRNFLNPALAGRAFLFFAYPAQISGDLVWIA---------------------ADGYSGATALSQW--------------------------------
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                       310       320       330       340       350       360       370       380       390       400
           ....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|
Topology                                                                                 ██████████████      ██
sp|Q5L6C0  SQFSIWTES-HPGLLLDKLTLEQLQSFVTSPLSEGGLGLLPTQFDSAYAITDVIYGIGKFSSGNLFWGNILGSLGETSTFACLLGAVFLVITGIASWRTM
sp|Q253X4  SQFSIWTES-HPGLMLDKLTLEQLQSFVTSPLSEGGLGLLPTQFDSAYAITDVIYGIGKFSSGNLFWGNIVGSLGETSTFACLLGAIFLIVTGIASWRTM
sp|Q823P2  SQFSIWAES-HPGLMLDKLTLEQLQNFVTSPLSEGGLGLLPTQFDSAYSITDVIYGIGKFSSGNLFWGNIIGSLGETSTFACLLGAIFLVVTGIASWRTM
sp|Q9Z8B6  SQFSLWTET-HPGWVLDNLTLTQLQTFVTAPVAEGGLGLLPTQFDSAYAITDVIYGIGKFSAGNLFWGNIIGSLGETSTFACLLGAIFLIVTGIASWRTM
sp|Q9PKB6  SQFSTWAES-FPGLTVDQLSLDQLQNFVTSPTAEGGLGLLPAHFDAAYSLTDAIYGIGKFSTGNLFFGNIVGSLGETSTVACLLGAGLLLLTGIASWRTM
sp|Q3KM84  TQFATWAES-YPGLTVDQLSLEQLQNFVTTPITEGGLGLLPAHFDSACSLTEAVYGIGKFSTGNLFFGNILGSLGETSTVACLLGAGLLLLTGIASWRTM
tr|B0B7J4  TQFATWAES-YPGLTVDQLSLEQLQNFVTTPITEGGLGLLPAHFDSACSLTEAVYGIGKFSTGNLFFGNILGSLGETSTVACLLGAGLLLLTGIASWRTM
tr|Q6MEH4  KQFNQWKEVGQHQATLTQLESDQLRQFVTSPLQDGGLGLASGNYEDAYHFASLNYGLGHNSDWHCFLGDKLGCMGETSVFACILGAILLIWTGVGSWRTM
tr|A0LYE1  --------------------------------ASG----------SEVSY----------SAMNMFSGVIPGSIAETSVICILAGALILVLTKVGSWRII
tr|Q5LDP5  --------------------------------STA-------TDPNGFPA----------FSWDMVTGLIPGSIGETSVIAILIGAVILLWTGIASWRTM
tr|Q7MT18  --------------------------------ATAGAKMPEIHNVAGDPS----------SLMDAFLGFIPGSIGETSTLAILIGAVLLIWTGIASWKIM
tr|Q8EID9  --------------------------------AAGQLQFADYAWYSAFS---------DPNWWNNFFGFTVGAIGETSTLAVLLGGLLLLITRLADWRIV
tr|A5EUU7  --------------------------------TADG-----FDVMRE-----------NISWWAAFWGNMGGAIGEVSTFAIVLGGIFLLVTGIASWRIV
tr|Q7UWS4  --------------------------------ANASEDAVGSLSAVQYVWG---AEE-PITWMSAFIGTIQGCVGETSALLCLVGALILIATGIGSWKIM
tr|B5JU40  --------------------------------ATGGIQAVEEAG---------------FTLQQSFLGMIPGSLGETSTLACLIGAAFLIFTKIASHRVI
tr|Q82SE4  --------------------------------AIGGMEAVTAGG---------------YTWWNAFIGLMPGSLGETSTLACLLGAIFLIYTKVASWRII
tr|B6BFE5  --------------------------------AADGVQALAAKG---------------IEWSDAFIGTIQGSFGETSTLACAIGLAFLLATKIANWRLI
tr|Q5LLJ0  --------------------------------AADGYQQLATNG---------------ITWMDAFYGTIQGSFGETSTLACLIGLAFLLMTKIANWRLI
tr|B6R9D1  --------------------------------AADGMQGLAANG---------------ITWTSSFIGTIQGSFGETSTIAIALGGVFLVTTGIANYRLI
tr|Q4FPV6  --------------------------------ALGVVPQDFVDVYGN-----------AITWSDAFLGNMQGSIGEVSTLAILMGAAVLLWTRIASWRIM
sp|Q1QX85  --------------------------------AQNGMSAVQQAY----------------SWWDAFLGFIPGSVGETSTLAILIGAAVLLITRIASWRIM
sp|A6V398  --------------------------------AAGGVDNILGHG---------------LTWMDAFLGHMQGSMGETSTLAIFIGGAVLLLTRIASWRIV
sp|Q02PG2  --------------------------------AAGGVDNILGHG---------------LTWMDAFLGHMQGSMGETSTLAIFIGGAVLLLTRIASWRIV
sp|A4XSP4  --------------------------------ASGGIENVINNG---------------ITWMDAFIGTIHGSLGETSTLAIAIGGLVLLITKIASWRIV
sp|A4VMV3  --------------------------------FAGGIENVISSG---------------ITWMDAFVGTIHGSIGETSTLAIFIGGAVLIGSKIASWRIV
tr|A4LAQ0  --------------------------------ASGGLEALEAQI----------------GWMNAFVGTIQGSMGETSTIAILIGGLILLAMKIASYRIV
tr|Q2SIQ0  --------------------------------ASGGMDALNTSI----------------TWMDAFLGFQQGSVGETSTLAILIGGAVLLVMGIASWRIV
tr|B7RUB8  --------------------------------ASDGMAALQAQI----------------PWMDAFTGAIPGSVGETSTLAILIGGVILLASRIASWRII
tr|B8KGV5  --------------------------------ASEGMTALQAQY----------------TWMDSFIGAIPGSIGETSTLMVMIGGAILLLTKVASWRVV
tr|B8KYI2  --------------------------------AADGMGGLTEAY----------------SWTQAFMGSIPGSIGETSTLAVMIGGAVLLLTRIASWRVV
tr|B3PFQ3  --------------------------------AQQGMDAVMNQV----------------SWLDAFIGFEQGSIGETSALALMLGGIVLLVMGIASTRIV
tr|Q0VQR7  --------------------------------ASGSLNYAVGLTGNALTEGAAAATA-SLSWMNTFLGNIQGSIGETSTLAILIGGAALLMTKIASWRIV
sp|Q15YQ5  --------------------------------AAGN-----VTDWSL-----------NADWWDAFFGNIQGSVGEVSSLAILLGGLFIIYMRIASWRIV
tr|Q3IHN6  --------------------------------FVG------TLDFSN-----------MELWWNAFYGFIQGSVGETSTLALLVGGLFLIYVRIASWRIV
tr|Q5QYR8  --------------------------------ALG------EMDYGN-----------TQLWWDAFLGNIQGSVGEVSTLLILIGGLALIYFRIASWRIV
tr|Q8EHV8  --------------------------------AAG------SLDYAF-----------NQNWWDAFFGFIPGSVGEVSTLAILLGGLVIIYTRIASWRIV
tr|Q487E0  --------------------------------SQG------LVDYSV-----------NADWWNAFWGFIPGSVGEVSTFAILLGGAYILYKGIASWRIV
tr|A7JZ37  --------------------------------YEGGQSALINNMTGQ-----------PISWGDAFVGNLPGSMGEVSTLLIALTGLVLIFMKIASWRIV
tr|B8KCF2  --------------------------------YEAGGDGLINNISGD-----------AISWTDAFIGSMPGSMGEVSTLLIALSGLALIAMRIASWRIV
sp|Q7VNU8  --------------------------------AQGGQIALKHAVTGQ-----------EITWMDAFLGNIPGSIGEVSTLMLMIGAAIIVFARIASWRII
tr|A3MYM3  --------------------------------AQGGQGALKHVVTGQ-----------EITWMDAFLGNIPGSIGEVSTLMLIIGAAIIVFTRIASWRII
tr|A7JX42  --------------------------------AVGGQGALQHVATGE-----------TITWMDAFLGNIPGSIGETSTLMLIIGAAIIVFARIASWRII
sp|Q9CLB0  --------------------------------AVGGEAGLKHVVTGQ-----------PITWMDAFIGNIPGSIGEVSTLALIIGAAIIVFARIASWRII
tr|B8F5U6  --------------------------------AVGGQAALKHVATGE-----------TITWMDAFLGNIPGSIGEVSTVALMIGAAIIVFARIASWRII
tr|Q0I5X7  --------------------------------AAGGQVALKHVATGE-----------PITWMDAFLGNIPGSIGEVSTFALLIGAAIIVFARIASWRII
sp|Q4QP23  --------------------------------SQGGQGALQHTVTGA-----------PITWMDAFVGNLPGSMGEVSTLAILIGGAVIVFTRIAAWRII
tr|Q65VU5  --------------------------------AQGGEAALQHVASGQ-----------PITWMDAFLGNIPGSMGEVSTLALIIGAAIIVFARIASWRII
sp|Q9JVP9  --------------------------------AAHGADGLKNAITGQ-----------TITWMDAFIGKLPGSIGEVSTLALLIGGAFIVFARIASWRII
tr|A1KSH7  --------------------------------AAHGADGLKNAVTGQ-----------TITWMDAFIGKLPGSIGEVSTLALLIGGAFIVFARIASWRII
sp|Q9K0M4  --------------------------------AAHGADGLKNAVTGQ-----------TITWMDAFIGKLPGSIGEVSTLALLIGGAFIVFARIASWRII
tr|A0KHC7  --------------------------------AQGGQMALINGATGQ-----------TISWMDAFLGNLPGSIGEVSTLMILIGAAMIVYMRIASWRII
tr|A4SQL9  --------------------------------AQGGQMALINGATGQ-----------TISWMDAFLGNLPGSIGEVSTLMILIGAAMIVYMRIASWRII
sp|A6T522  --------------------------------ASGGGEALVNVATGV-----------PVSWMDAFLGNIPGSIGEVSTLMIFIGGAIILFGRVASWRIV
tr|B5Y1F0  --------------------------------ASGGGEALVNVATGI-----------PVSWMDAFLGNIPGSIGEVSTLMILIGGAIILFGRVASWRIV
sp|Q8ZBZ1  --------------------------------SVNGSHSLVNTVSGQ-----------PITWMDAFLGYIPGSIGEVSTLMILIGGAIIIFGRVASWRIV
tr|A1JNZ7  --------------------------------SVNGSHSLVNTVSGQ-----------PITWMDAFLGNIPGSIGEVSTLMILIGGAIILFGRVASWRIV
tr|B4EUT5  --------------------------------SVSGQSALLNNVTQQ-----------PISWMDAFLGNIPGSIGEVSTLMILIGGAIILFARIASWRIV
tr|Q7N7F3  --------------------------------AAGGSQGLVNTVTGQ-----------PVTWMDAFIGNIPGSIGEVSTLMIFIGGAIILFTRIASWRIV
tr|B5FBI1  --------------------------------AQGGQGGLVNTITGD-----------TITWMDAFIGNIPGSIGEVSTLALILGGLMIVYMRIASWRII
tr|B6EIC4  --------------------------------AQGGQGGLVNTVTGN-----------TISWMDAFIGNIPGSIGEVSTLALILGGLMIVYMRIASWRII
sp|Q56587  --------------------------------AQGGNGALVNTVTGS-----------PITWMDAFIGNIPGSIGEVSTLALMIGAAMIVYMRIASWRII
sp|Q87MA7  --------------------------------AHGGSGALINNITGA-----------PITWMDAFIGNIPGSIGEVSTLALMIGAAMIVYMRIASWRII
sp|Q9RFW0  --------------------------------AHGGSGALINNITGA-----------PITWMDAFIGNIPGSIGEVSTLALMIGAAMIVYMRIASWRII
tr|A6ARD4  --------------------------------AHGGSGALINNITGA-----------PITWMDAFIGNIPGSIGEVSTLALMIGAAMIVYMRIASWRII
tr|B8KAD6  --------------------------------AQGGNGALVNTVTGA-----------PITWMDAFIGNIPGSIGEVSTLALMIGAAMIVYMRIASWRII
sp|Q8DBJ5  --------------------------------AQGGNSALVNTVTGA-----------PITWLDAFIGNIPGSIGEVSTLALLIGAAMIVYMRIASWRII
sp|Q75R63  --------------------------------AQGGNGALINKVTGE-----------AITWMDAFVGNIPGSIGEVSTLALAIGAAFIVYMGIASWRII
sp|Q9KPS2  --------------------------------AQGGAGALINNATGQ-----------TITWMDAFIGNIPGSIGEVSTLALMIGAAFIVYMGIASWRII
tr|A6XUU9  --------------------------------AQGGAGALINNATGQ-----------TITWMDAFIGNIPGSIGEVSTLALMIGAAFIVYMGIASWRII
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                   410       420       430       440       450       460       470       480       490       500
           ....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|....|
Topology
sp|Q5L6C0  VSFGIGAFVTAWLFKICSILIAGKHGAWAPAKFFIPAYRQLFLGGLAFGLVFMATDPVSSPTMKLAKWIYGLFIGFMTIIIRLINPAYPEGVMLAILLGN
sp|Q253X4  VSFGIGAFVTAWLFKIVSILIVGKHGAWAPARFFIPAYRQLFLGGLAFGLVFMATDPVSSPTMKLAKWIYGLFIGFMTILIRLINPAYPEGVMLAILLGN
sp|Q823P2  VSFGIGAFITAWLFKIFSILIVGKHGAWAPARFFIPAYRQLFLGGLGFGLVFMATDPVSSPTMKLAKWIYGLFIGFMTIVIRLINPAYPEGVMLAILLGN
sp|Q9Z8B6  AAFGIGAFLTGWLFKFISVLIVGQNGAWAPARFFIPAYRQLFLGGLAFGLVFMATDPVSSPTMKLGKWIYGFFIGFMTIVIRLINPAYPEGVMLAILLGN
sp|Q9PKB6  LSFGLSSLFFAWLFKIISILAAGQSGAWAPAKFFIPVYRHLFIGGLAFGLVFMATDPVTSPATKLAKWFYGAFIGFLTILIRLINPAYPEGVMLAILLGN
sp|Q3KM84  LSFGLSAFFFAWFFKIMSILTTGNAGAWAPAKFFIPAYRHLCIGGLAFGLVFMATDPVSSPAMKLAKWLYGAFIGFLTILIRLINPAYPEGVMLAILLGN
tr|B0B7J4  LSFGLSAFFFAWFFKIMSILTTGNAGAWAPAKFFIPAYRHLCIGGLAFGLVFMATDPVSSPAMKLAKWLYGAFIGFLTILIRLINPAYPEGVMLAILLGN
tr|Q6MEH4  VGMTLGAFMTALLFEFGTRLLGAEGGAWNPAAFTFPAYKHLLLGGLAFGIVFMATDPVSSPSRKLAKWIYGAFAGMIAIVIRTINPAYPEGVMLAILMAN
tr|A0LYE1  LSAFIGAALMGLIFNALPSMGLEG-----NALTNFPWYLHLIVGGLAFGIVFMATDPVSAAQTMKGKWIYGFLIGFLSVMIRVFNPAYPEGVMLGILLMN
tr|Q5LDP5  LSVFVGGAFMGWIFNTVG----PD-----TAMAHMPWYEHLVLGGFCFGAVFMATDPVTSARTETGKYIFGFLIGAMAIIIRVLNPGYPEGMMLAILLMN
tr|Q7MT18  LSGLVGASAMALVFNAIG----TT-----AAMQITP-LMHIVYGGFAFGLVFMATDPVTSARTEKGKWIFGFFVGLMAVFIRVLNPGYPEGMMLAILLMN
tr|Q8EID9  VGVMLGMIATATLFNLIGSST--------NQMMSMPWTWHLVTGGFAIAMMFMATDPVTTSYTRPGKFVYGALIGFMTVLIRVANPKMPEGVMLAILFAN
tr|A5EUU7  VGVLAGAAATSLLLNWVGSDT--------NPMFAVPFWWHFVLGGFAFGTVFMATDPVSASVTNVGRYIFGALIGVMTILIRVVNPAFPEGIMLAILFAN
tr|Q7UWS4  AGVIAGVTGTALLLNVAGSET--------NAMFAVPFYWHLVIGGVAFGLVFMATDPVSASMTEMGKWIYGILIGFMTVLIRVINPAFPEGIMLAILFGN
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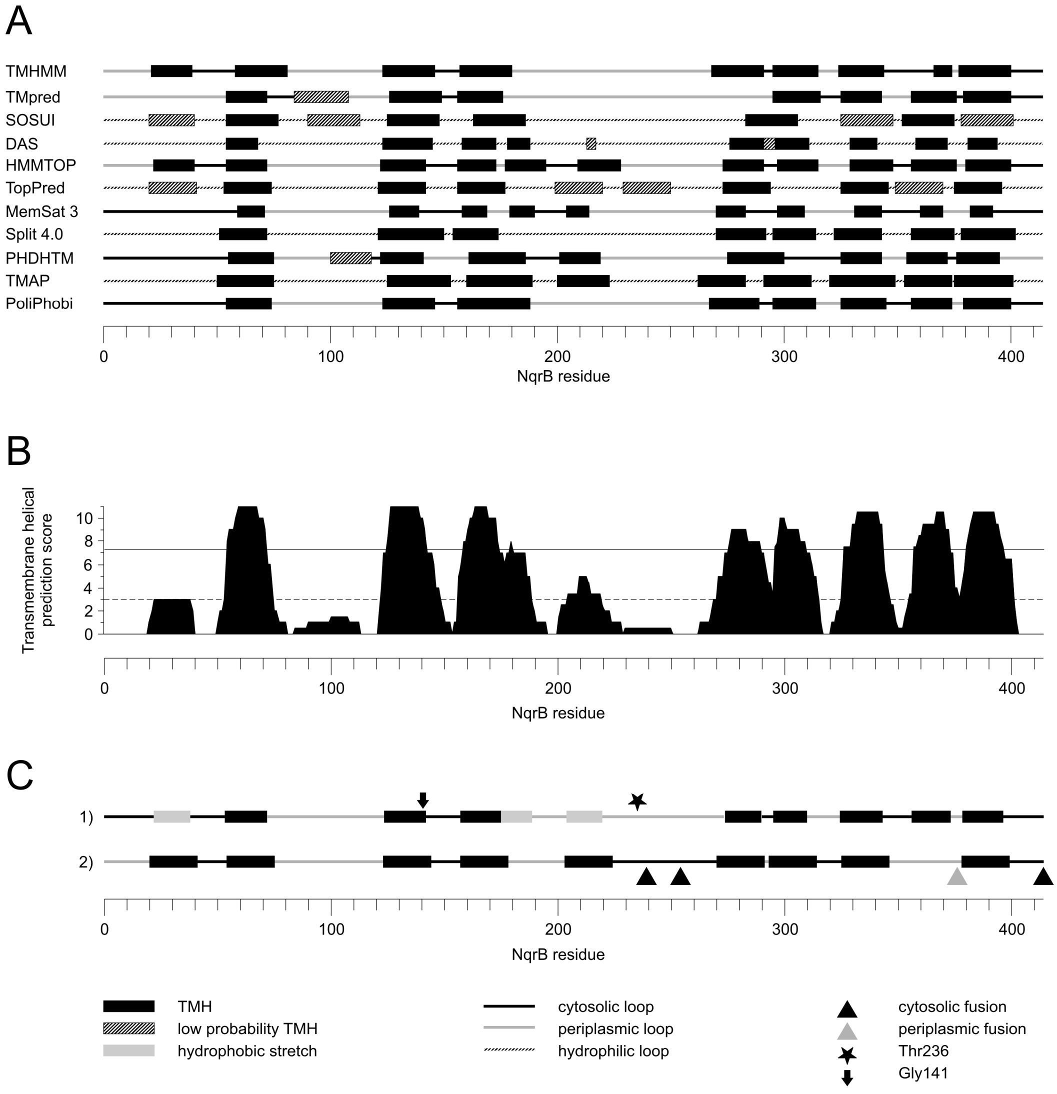
tr|Q82SE4  FGVFFGMVATSFLFNILESD---------NPMMAMPWHWHLVLGGFAFGMVFMATDPVSAAMTNAGRWVFGLLIGFMTVLIRVVNPAFPEGIMLAILFAN
tr|B6BFE5  AGCLGGMIGFSALLNLIGSDT--------NPMFAMPWYWHLVLGGYAFGLVFMVTEPVSASHTNAGRYIYGALIGVMVVLIRVLNPAFPEGMMLAILFGN
tr|Q5LLJ0  VGSMAGMIGFSLLLNVIGSDS--------NPMFAMPWYWHLVLGGYAFGLAFMVTEPVSASHTNTGRYIYGALIGVMVVLIRVINPAFPEGMMLAILFGN
tr|B6R9D1  LGCLGGMIGFSLLLNLIGSES--------NPMFAMPWYWHLVTGGFMFGLVFMVTEPVTAAMTNPGRYIYAALIGVMCILIRVINPAFPEGMMLAILFGN
tr|Q4FPV6  AGCVVGLIATSLVFNMIGSED--------NMMMSLPFYWHLVIGGFAFGAVFMATDPVSAAHTNKGRWAYGILIGFMTVLIRVINPAFPEGIMLAILFAN
sp|Q1QX85  LGVFVGMALTAMLFTAIGSES--------NPMFGMPWYWHLVLGGFAFGMVFMATDPVSASMTDPGKLLFGFLIGVMTVLIRVVNPAFPEGIMLAILFAN
sp|A6V398  AGVMLGMIAMSYLFNAIGSTS--------NPMFAMPWYWHLVTGGFAFGMIFMATDPVSASMTDTGKWLFGALIGVMVMLIRVVNPAFPEGMMLAILFAN
sp|Q02PG2  AGVMLGMVAMSYLFNAIGSAS--------NPMFAMPWYWHLVTGGFAFGMIFMATDPVSASMTDTGKWLFGALIGVMVMLIRVVNPAFPEGMMLAILFAN
sp|A4XSP4  SGVMLGMIGLSLLLNLIGSNT--------NPMFAMPWYWHLVVGGFAFGMFFMATDPVSASMTNTGKWIFGALIGVMVVLIRVVNPAFPEGMMLAILFAN
sp|A4VMV3  TGVMLGMIALSTLFNLIGSET--------NPLFGMPWYWHMVVGGFAFGMIFMATDPVSASMTNTGKWVFGILIGVMVVLIRVVNPAFPEGMMLAILFAN
tr|A4LAQ0  GGVLIGMIGMSLLLNLIGSET--------NPMFGVPAHWHLVMGGFAFGMMFMATDPVSAAMTNTGRWCFGILVGVMTVLIRVINPAFPEGIMLAILFAN
tr|Q2SIQ0  AGVFLGMAATATLLNMIGSDT--------NPMFQVPAHWHFVLGGFAFGMMFMATDPVSASMTNTGKWAFGILVGLMTVLIRVINPAFPEGIMLAILFAN
tr|B7RUB8  TGVFLGMVVLSTFLNMVGSDS--------NLAFAMPWYWHLVTGGFAFGMIFMATDPVSGAMTNGGKWMFGILVGLMTVLIRVINPAFPEGIMLAILFAN
tr|B8KGV5  AGVFLGMFVFSSFLNLVGSDS--------NPAFSMPWYWHMVVGGFAFGMFFMATDPVSAAMTNRGRWAYGFLIGLMTVLIRVINPAFPEGIMLAILFAN
tr|B8KYI2  AGCFIGMIAFSTLLNAVGSDA--------NPAFAMPWYWHMVVGSFAFGAFFMATDPVSAAMTDRGRWAYGILIGVMCVLIRVVNPAFPEGMMLAILFAN
tr|B3PFQ3  LGVLIGSLLTTLLYNWAGAES---S----NPMFQMPFWWHWVVGGFAFGLFFMATDPVSASMTNTGKWIFGALIGFMVITIRVVNPAYPEGMMLAILFAN
tr|Q0VQR7  LGVFLGMLGMSSLFNVIGSET--------NAMFGMPWYWHLSVGGFAFGMIFMATDPVSASMTNTGKYIFGALIGVMTVLIRVINPAFPEGIMLAILFGN
sp|Q15YQ5  LGVLLGGAVFSTLLNVIGSDT--------NAMFAMPWYWHVVTGGFAFGMFFMATDPVSASFTNSAKWAYGFLIGLMCVLIRVLNPAFPEGMMLAILFAN
tr|Q3IHN6  LGVFFGMVITALLLNTVGSET--------NPVFAMPWHWHFVLGGFAFGMFFMATDPVSAAFTDKGKLAYGALIGFMVVMIRVVNPAFPEGMMLAILFAN
tr|Q5QYR8  LGVFAGMVLFSGLLNLVGSET--------NPMFAMPWYWHLVLGGFAFAMMFMATDPVSASFTNKGKFAYGLLIGFMTVMIRVINPAFPEGIMLAILFAN
tr|Q8EHV8  GGVMVGMIAISTLLNVVGSDT--------NPMFAMPWYWHLVLGGFAFGMMFMATDPVSASFTNQAKWAYGFLIGAMAVFIRVINPAFPEGMMLAILFAN
tr|Q487E0  LGVFGGMVITSLLFNAIGSDT--------NAMFAMPWHWHLVIGGFAFGMMFMATDPVSASFTNTGKYWFGALVGVMVVLVRVVNPAFPEGMMLAILFAN
tr|A7JZ37  AGVLVGLIGASLLLNAIGSDS--------NPMFSMPFYWHFVIGGVAFGTFFMATDPVSAAFTNNGKWAYGLLIGVMTIFIRVLNPAYPEGIMLAILFAN
tr|B8KCF2  AGVFLGALLTSTLLNLIGSDT--------NPMFSMPFYWHLVLGGLAFGAFFMATDPVSAAFTNKGKWAYGLLIGVMTIGIRVLNPAYPEGIMLAILFAN
sp|Q7VNU8  AGVLVGMAATATLFNLIGSET--------NLLFAMPWYWHLVLGGFALGMFFMATDPVSASFTNKGKWWYGALIGVMCVVIRVANPAYPEGMMLAILFAN
tr|A3MYM3  AGVMVGMAATATVFNLIGSDT--------NPLFSMPWHWHLVLGGFALGMFFMATDPVSAAFTNKGKWWYGALIGVMCVVIRVANPAYPEGMMLAILFAN
tr|A7JX42  AGVMIGMAATATLFNVIGSDT--------NPLFSMPWHWHLVLGGFAIGMFFMATDPVSAAFTNKGKWAYGILIGFMCVLIRVVNPAYPEGMMLAILFAN
sp|Q9CLB0  AGVMIGMIATSALFNLIGSST--------NPLFAMPWYWHFVLGGFALGMFFMATDPVSAAFTNKGKWWYGILIGAMAVLIRVVNPAYPEGMMLAILFAN
tr|B8F5U6  AGVMIGMASMATVFNLIGSDT--------NPLFSMPWHWHLVLGGFAIGMFFMATDPVSAAFTNKGKWWYGILIGVMCVLIRVANPAYPEGMMLAILFAN
tr|Q0I5X7  AGVMIGMIATSTLFNIIGSET--------NPLFAMQWYWHFVLGGFALGMFFMATDPVSAAFTNKGKWLYGALIGVMAVIIRVANPAYPEGMMLAILFAN
sp|Q4QP23  AGVMIGMIATSTLFNLIGSET--------NPMFSMPWHWHFVLGGFALGMVFMATDPVSASFTNTGKWWYGALIGVMAVLIRTVNPAYPEGMMLAILFAN
tr|Q65VU5  AGVMVGMIITSSLFNLIGSES--------NPLFAMPWYWHLVLGGFAIGMFFMATDPVSASFTNKGKWWYGALIGVMAVLIRVVNPAYPEGMMLAILFAN
sp|Q9JVP9  AGVMIGMIAMSSLFNFIGSDT--------NAMFAMPWYWHLVVGGFAIGMLFMATDPVSASFTNVGKWWYGALIGVMCVLIRVVNPAYPEGMMLAILFAN
tr|A1KSH7  AGVMIGMIAMSSLFNFIGSDT--------NAMFAMPWYWHLVVGGFAIGMLFMATDPVSASFTNVGKWWYGALIGVMCVLIRVVNPAYPEGMMLAILFAN
sp|Q9K0M4  AGVMIGMIAMSSLFNFIGSDT--------NAMFAMPWYWHLVVGGFAIGMLFMATDPVSASFTNVGKWWYGALIGVMCVLIRVVNPAYPEGMMLAILFAN
tr|A0KHC7  AGVMIGMVATSLLFNVIGSDT--------NPMFNMPWHWHLVLGGFAFGMAFMATDPVSAAFTNKGKWWYGALIGVMVVLIRVVNPAFPEGMMLAILFAN
tr|A4SQL9  AGVMIGMVATSLLFNVIGSDT--------NPMFNMPWHWHLVLGGFAFGMAFMATDPVSAAFTNKGKWWYGALIGVMVVLIRVVNPAFPEGMMLAILFAN
sp|A6T522  AGVMIGMIATATLFNVIGSDT--------NPMFAMPWYWHLVLGGFAFGMMFMATDPVSASFTDKGKWSYGVLIGVMCVLIRVVNPAYPEGMMLAILFAN
tr|B5Y1F0  AGVMIGMIATATLFNVIGSDT--------NPMFSMPWYWHLVLGGFAFGMMFMATDPVSASFTDKGKWSYGVLIGVMCVLIRVVNPAYPEGMMLAILFAN
sp|Q8ZBZ1  AGVMIGMIATAYLFNWIGSTT--------NPLFAMPWYWHLVLGGFAFGMIFMATDPVSASFTNKGKWWYGGLIGVMCILIRVANPAYPEGMMLAILFAN
tr|A1JNZ7  AGVMIGMIATAYLFNWVGSTT--------NPLFAMPWYWHLVLGGFAFGMIFMATDPVSASFTNKGKWWYGGLIGAMCVLIRVANPAYPEGMMLAILFAN
tr|B4EUT5  AGVMVGMIAMSYLFNLIGSDS--------NPLFSMPWHWHLVLGGFAFGMMFMATDPVSASFTDKGKWAYGILIGVMAVLIRVVNPAYPEGMMLAILFAN
tr|Q7N7F3  AGVMLGMVATSYLFNAIGSET--------NPLFAMPWYWHMVLGGFAFGMIFMATDPVSASFTDKGKWWYGVLIGVMCVLIRVVNPAYPEGMMLAILFAN
tr|B5FBI1  AGVMIGMVAVSTLFNLIGSDT--------NAMFSMPWHWHLVLGGFAFGMIFMATDPVSASFTNKGKWWYGILIGGMAVMIRVVNPAYPEGMMLAILFAN
tr|B6EIC4  AGVMIGMVAVSTLFNLIGSDT--------NAMFSMPWHWHLVLGGFAFGMIFMATDPVSASFTSKGKWWYGILIGGMAVMIRVVNPAYPEGMMLAILFAN
sp|Q56587  AGVMIGMIAVSTLFNVIGSDT--------NPMFNMPWHWHLVLGGFAFGMFFMATDPVSASFTNKGKWWYGILIGAMCVMIRVVNPAYPEGMMLAILFAN
sp|Q87MA7  AGVMIGMIAVSTLFNVVGSDT--------NPMFNMPWHWHLVLGGFAFGMFFMATDPVSASFTNKGKWWYGILIGAMCVMIRVVNPAYPEGMMLAILFAN
sp|Q9RFW0  AGVMIGMIAVSTLFNVIGSDT--------NPMFNMPWHWHLVLGGFAFGMFFMATDPVSASFTNSGKWWYGILIGAMCVMIRVVNPAYPEGMMLAILFAN
tr|A6ARD4  AGVMIGMIAVSTLFNVIGSDT--------NPMFNMPWHWHLVLGGFAFGMFFMATDPVSASFTNGGKWWYGILIGAMCVMIRVVNPAYPEGMMLAILFAN
tr|B8KAD6  AGVMIGMIATATLFNVIGSDT--------NPMFNMPWHWHLVLGGFAFGMFFMATDPVSASFTNKGKWWYGALIGVMCVLIRVVNPAYPEGMMLAILFAN
sp|Q8DBJ5  AGVMIGMIVVSTLFNVIGSDT--------NAMFSMPWHWHLVLGGFAFGMFFMATDPVSASFTNKGKWWYGILIGAMCVMIRVVNPAYPEGMMLAILFAN
sp|Q75R63  AGVMVGMIAISTLFNVIGSDT--------NAMFNMPWHWHLVLGGFAFGMFFMATDPVSASFTNKGKWAYGILIGAMCVMIRVVNPAYPEGMMLAILFAN
sp|Q9KPS2  GGVMIGMILLSTLFNVIGSDT--------NAMFNMPWHWHLVLGGFAFGMFFMATDPVSASFTNSGKWAYGILIGVMCVLIRVVNPAYPEGMMLAILFAN
tr|A6XUU9  GGVMIGMILLSTLFNVIGSDT--------NAMFNMPWHWHLVLGGFAFGMFFMATDPVSASFTNSGKWAYGILIGVMCVLIRVVNPAYPEGMMLAILFAN
```

```
                   510       520       530
           ....|....|....|....|....|....|....
Topology   ███████
sp|Q5L6C0  VFAPLLDYFAVRKYRRRRI---------------
sp|Q253X4  VFAPLLDYFAVRKYRRRRI---------------
sp|Q823P2  VFAPLLDYFAVRKYRRRRI---------------
sp|Q9Z8B6  VFAPLIDYFAVRKYRKRGV---------------
sp|Q9PKB6  VFAPSFDRIALKQYRQRRV---------------
sp|Q3KM84  VFAPLFDNIALKQYRQRRI---------------
tr|B0B7J4  VFAPLFDNIALKQYRQRRI---------------
tr|Q6MEH4  VFAPLIDYYVVQYERNRSLRRVRA----------
tr|A0LYE1  VFAPTIDHYVVQANVNRRKKRLKNANPQVETA--
tr|Q5LDP5  IFAPLIDYCVVQSNIKLREKRAIKSNN-------
tr|Q7MT18  VFAPLIDYFVVDSNIKARKARMLKKS--------
tr|Q8EID9  LWAPLFDYLVARANIKRRLKRHGI----------
tr|A5EUU7  MFAPLIDYFVMNANIKRRKVRTHV----------
tr|Q7UWS4  VFAPLIDWGVVQLNIRRRAARYVTA---------
tr|B5JU40  LWAPIFDNFVVQANIKRRMQRNG-----------
tr|Q82SE4  VFAPLIDYVVIQLNIRRRLRRHG-----------
tr|B6BFE5  VFAPLIDYFVVQANIKRRARRHG-----------
tr|Q5LLJ0  VFAPLIDYFVVQANIKRRARRHV-----------
tr|B6R9D1  IFSPLIDYFVVKANITRRMKRHA-----------
tr|Q4FPV6  LFAPLFDYFVTQANIKRQTARRVRYVQAQK----
sp|Q1QX85  LFAPMIDHFFVQANIKRRMKRDAAYSPATNEETA
sp|A6V398  LFAPLIDHFVVQANIKRRLARNG-----------
sp|Q02PG2  LFAPLIDHFVVQANIKRRLARNG-----------
sp|A4XSP4  LFAPLIDHFVVQANIKRRLARNV-----------
sp|A4VMV3  LCAPLIDHFVIQANIKRRLARNV-----------
tr|A4LAQ0  LFAPLMDHYVVQANIKRRLARG------------
tr|Q2SIQ0  LFAPFIDHLVVQANIKRRLARV------------
tr|B7RUB8  LFAPLMDNFVVQANIKRRLARVQ-----------
tr|B8KGV5  LFAPLFDHFAVQANIKRRLARVQ-----------
tr|B8KYI2  LFAPLFDHFAVQSNVKRRLARVQP----------
tr|B3PFQ3  MFAPTIDYFVVQSNIKRRLARG------------
tr|Q0VQR7  LCAPLIDYFVTQANIRRRLRRTGGEV--------
sp|Q15YQ5  LWAPLFDYFVAQSNIKRRMARVG-----------
tr|Q3IHN6  LFAPLFDHFVVQANIKRRLARNV-----------
tr|Q5QYR8  VFAPLFDHFVAQANIKRRLARNG-----------
tr|Q8EHV8  LFAPLFDHFVVQANIKRRIARG------------
tr|Q487E0  LFAPLFDYFVVQGNIKRRLARNV-----------
tr|A7JZ37  LFAPLFDYLVKESNIKRRMKRARPS---------
tr|B8KCF2  LFAPLFDHLVKEGNIKRRRNRAIKRQA-------
sp|Q7VNU8  LFAPIFDYLVVQSNIKRRKAKAA-----------
tr|A3MYM3  LFAPIFDYLVVQGNIKRRKAKAA-----------
tr|A7JX42  LFAPIFDYLVVQGNIKRRLARVANNG--------
sp|Q9CLB0  LFAPVFDYLVVQANIKRRRARNV-----------
tr|B8F5U6  LFAPIFDYFVVQANIKRRKARNG-----------
tr|Q0I5X7  LFAPLFDYLVVQANIKRRRSRNG-----------
sp|Q4QP23  LFAPIFDYIVVQANIKRRRARTNG----------
tr|Q65VU5  LFAPIFDYLVVQGNIKRRKARTA-----------
sp|Q9JVP9  LFAPIFDYFVAQANIKRRKARSNG----------
tr|A1KSH7  LFAPIFDYFVAQANIKRRKARSNG----------
sp|Q9K0M4  LFAPIFDYFVAQANIKRRKARSNG----------
tr|A0KHC7  LFAPLFDHFVAQANIKRRIARGV-----------
tr|A4SQL9  LFAPLFDHFVAQANIKRRIARGV-----------
sp|A6T522  LFAPLFDYLVVQANIKRRKSRG------------
tr|B5Y1F0  LFAPLFDYLVVQANIKRRKSRG------------
sp|Q8ZBZ1  LFAPLFDYVVVQANIKRRKARGE-----------
tr|A1JNZ7  LFAPLFDYVVVQANIKRRKARGE-----------
tr|B4EUT5  LFAPLFDYVVVQANIKRRKARG------------
tr|Q7N7F3  LFAPLFDYLVVQANIKRRKARG------------
tr|B5FBI1  LFAPLFDNLVVEGNVKRRLKRYGK----------
tr|B6EIC4  LFAPLFDNLVVEGNVKRRLKRYGK----------
sp|Q56587  LFAPLFDHVVIEKNIKRRLARYGK----------
sp|Q87MA7  LFAPLFDHVVIEKNIKRRLARYGK----------
sp|Q9RFW0  LFAPLFDHVVIEKNIKRRLARYGK----------
tr|A6ARD4  LFAPLFDHVVIEKNIKRRLARYGK----------
tr|B8KAD6  LFAPLFDHVVIEKNIKRRQARYGK----------
sp|Q8DBJ5  LFAPLFDHLVVEKNIKRRQARYGK----------
sp|Q75R63  LFAPLFDHIVIEKNIKRRLARYGK----------
sp|Q9KPS2  LFAPLFDHVVVERNIKRRLARYGKQ---------
tr|A6XUU9  LFAPLFDHVVVERNIKRRLARYGKQ---------
```

Fig. S2. Consensus membrane topology prediction of NqrB. **(A)** Graphical representation of results from individual topology prediction algorithms (see Material and Methods). Regions classified as transmembrane helices (TMH) are indicated as black bars, regions classified as low probability TMHs or aliphatic helices are indicated as striped bars. Hydrophilic loops are represented by dashed lines or, if the prediction algorithm distinguishes between cytosolic and periplasmic loops with solid black and grey lines, respectively. **(B)** A histogram from the individual prediction results from (A) was constructed by scoring an NqrB residue from a predicted TMH region by a value of 1 and a residue from a low probability TMH or an aliphatic helix by a value of 0.5. The solid line at a score of 7.33, which is 2/3 of the maximal score, represents the cut-off for defining a TMH in the consensus topology prediction. Three larger regions of the histogram show intermediate scores (between 3 and 7) and were considered as hydrophobic stretches. **(C)** Comparison of 1) the consensus topology prediction derived from (B) with 2) the topology model proposed by Duffy *et al.* (4). TMHs and hydrophobic stretches are indicated by black and grey bars, respectively. Results from PhoA fusion analyses reported in (4) are indicated by black and grey triangles for cytosolic and periplasmic PhoA localization, respectively. The asterisk indicates Thr236 with its covalently attached FMN. The arrow indicates Gly141, which was proposed to interact with the inhibitor korormicin (5).



Tab. S1. π-stacking interaction of aromatic amino acid residues in riboflavin-containing proteins to riboflavin

Protein	Source	π-stacking interaction	PDB code	REF
redox enzyme:				
flavodoxin	*Desulfovibrio vulgaris*	Y97	1BU5	(6)
riboflavin pathway:				
6,7-Dimethyl-8-ribityllumazine synthase	*Schizosaccharomyces pombe*	H94	2A58	(7)
FAD synthetase	*Thermotoga maritima*	no stacking	1T6Z	(8)
riboflavin kinase	*Homo sapiens*	no stacking	1NB9	(9)
riboflavin synthase	*Escherichia coli*	no stacking	1HZE	(10)
riboflavin storage/homeostasis:				
riboflavin binding protein	chicken	Y57, W156	---	(11)
dodecin	*Halobacterium salinarum*	W35, riboflavin[b]	1MOG	(12)
original yellow antibody	*H. sapiens*	Y33, F59, Y105	2FL5	(13)
other function:				
liver glycogen phosphorylase a[c]	*H. sapiens*	Y614, F286	1L5R	(14)
lumazine protein	*Photobacterium leiognathi*	no stacking	3DDY	(15)

[a] Native cofactor for flavodoxin is FMN (16).

[b] Dodecin is a small dodecameric flavoprotein that contains two flavins stacked between two tryptophan residues to form an aromatic tetrad.

[c] Riboflavin is an inhibitor of the liver glycogen phosphorylase a.

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