

XX

signal sequence

↓

↓

active Ser residue

●

conserved residue

↴

↴

active Lys residue

*

substrate binding residue

-----MASVL

MLALLGLTTR

AVAVVPEVSS

RPAPSSAYQP

AERPTLTARA

SFAVDITAGV

ELWAQEADRP

LPPASTTKLM

TALVVRWR--

---LRPDES

MSGRIVRCVL

-GLLIV---

ALAI-----

---IPVRA

DSLPEVVAQH

WIIMDAETGQ

IVAERAARQP

VAIASLTKVM

TAVVALER--

---GALDQPV

MSKKIKFSVL

-LVIVS---

LRLL-----

---YSNECYAGL

KCDIQVTAKS

AIAIEWITGK

ILFEKNKDLK

LMMASTTKIM

TAILAIEN--

---CDLNKEI

MNKQKRLIAL

-ILALA---

AGIM-----

---FVP---

ERM

RAMDGVSAKS

AILIEQHSGR

VLFPAKDAYTK

RRIASITKIM

TAILAIES--

---GKMDDTV

MRIFPKAVF-

-VIMIS---

FLIA-----

---T---

VNV---NTA

HAAIDVSAKS

ATIIDGASGR

VLYAKDEHQK

RRIASITKIM

TAVLAIES--

---GKMDQTV

MNIKKCKQLL

MSLVVL---

TLAV-----

---TC

LAPMSKAKAA

SDPIDINASA

AIMIEASSGK

ILYSKNADKR

LPIASMTKMM

TEYLLLEAID

QKVKWDDQTY

MRRRK-QNWL

FWLLSI---

GLCL-----

---TFF

GPFQQTQKAE

SAPLDIRADA

AILVDAQTGR

ILYEKNIDTV

LPIASMTKMM

TEYLLLEDAIK

AKRVKWDQMY

MKRIL-TLLI

LSFFLS---

SLNF-----

---IR

AFCCQTONNEL

TNSPELSAMS

AILVDFDTGR

VLFPEKNSHEK

LPPASITKIM

TMILLICEAIE

KGKLLKLSDKV

MKTKV-TRLL

LLPFLI---

FLPL-----

---SA

HAEAKEMKEA

KVKLADEAKS

AILIERDTGK

VLYEKNAHEP

LPPASMTKIM

TMLLVMEAID

EGKLSYDEKV

MKTKI-STLL

IGI-M----

LTTF-----

---AP

SAPAKQDGKR

TSLEAHEAKS

AVLIERDTGK

VLYNKNNSNER

LAPASMTKIM

TMLLVMEALD

KGKIKMSDKV

TIRSDDL--V

DPAVYANAGF

QPGDRVTVTD

LLAAMLIASA

GDAALALARV

AGERIDPEHD

VPRTAFIDAM

NQEAARLGLR

HSWFATPDGR

DVP-----

TIVPEDL-IG

---ESSAGL

RAGQVVTLRT

LLYGLLLRS

NDAAAMAIARA

VGGSPDAEDP

AAQRQFVTWM

NAKAVELGLQ

ATSFRRNPHGL

DEP-----

EIPAQAIGVP

---GSSIYL

EKGERIKIIE

LLYGMLIASG

NDAAAALATS

VCGDV-----

---KKFVNLM

NKKAKELGLE

NFMFSSPHGL

EEG-----

TVSARAVRTE

---GSSIYL

RQGEKIKLRD

LVYGLMLRS

NDAAVAIAEH

VGGSV-----

---EGFVFLM

NQKAAEIGMR

DTEFANPHGL

DDA-----

TVSANAVRTE

---GSAIYL

TEGQVKVLLD

LVYGLMLRS

NDAAVAIAEH

VGGSV-----

---DGFVYMM

NQKAEQLGMK

NTRFRGNPHGL

DDH-----

TPDDYVYEIS

QDNLSNVPL

RKDGKITYKE

LYQATAIYSA

NAAAIAIAEI

VAGSE-----

---TKFVEKM

NAKAKELGLT

DYKFVNATGL

ENKDLHGHQP

TPSDYVYRLS

QDRALLNVPL

RKDGKITYKE

LYEAMAIYSA

NGATVAIAEI

IAGSE-----

---KNFVKMM

NDKAKELGLK

DYKFVNATGL

SNKDLKGPHF

IASQNAASLG

---GSQVYL

KENEEMTVEE

LLKSIAIASA

NDACVALAEH

LAGSV-----

---QGQFVMM

NQKAKELGML

DTNFVNPHGL

DAE-----

RASEYAAAMG

---GSQIFL

EPGEEMTVDE

LLRGIAIGSA

NDASVAMAEQ

IAGSE-----

---EAFVEMM

NEKAKQLGLK

NTHFANATGL

PAE-----

RTSEHAAMG

---GSQIFL

EPGEEMTVKE

MLKGIAIASG

NDASVAMAEF

ISGSE-----

---EEFVKKM

NKKAKELGLK

NTSFKNPTGL

TEE-----

-----GQT

VSARDLAIIA

AAVLSD-PLL

AELVATRTRE

IEIAGPQSRR

ITVVNTNQF-

-----LTEP

DALGVKTTGTS

VAAQGCLVAA

VRRGNDIVVL

-----GHV

SSAYDLARLT

RVALAD-PVF

VEIFGAASYH

G-----EG

FSWRHTN--

-RLPERYP-

GIIGKTTGWT

DEAGLCLIEV

AERAGKTAIV

-----EHY

TTAHDLARLT

YVAMKN-QYF

REIVSTQKRE

IRW-TRTPYS

RVLKNNKMM-

-LKS-YQP-

GABGVKTGFT

GABGRCLEV

ACRDDFRVIC

-----ENHY

STAYDMAILM

QYAMKN-KEF

RRISGTVKYR

APAPPEGDA

RVWRNKNKL-

-LTSLYE-

YCTGGKTYGT

KRAHRTLVT

ASKGGIDLIA

-----ENHY

STAYDMAILT

KYAMKL-KDY

QKISGTVKIYK

AET-----ME

SVWKNKNKL-

-LTMLYP-

YSTGGKTYGT

KLAKRTLVT

ASKDGLDLIA

EGTSVNEESE

VSAKDMAVLA

DHLITDYPEI

LETSSIAKTK

FR--EGTDDE

MDMPNNWFM

KGLVSEYKKA

TVDDLKTGST

DSAGSCFTGT

AERNMGMRVIT

EGTSVNEENV

MSARAMAMLA

YRLKDHPEV

LKTASIPHKV

FR--EGTKDE

IKMDNNWMM

PGLVVGYYE-

GVDGLKTGYT

EFAGNCFTGT

AKRNGVRLIS

-----GHY

TSAYDVAVMS

RELLKH-KLV

RNYLTMTWDT

VR-----DGK

FGLTNTN--

-KLVRFYR-

GCTGVKTGST

DKAKFCISAS

AQRNALHLIA

-----HHY

SSAYDMAMMA

RELLKY-EDI

TKYTSKYEDY

LR--ENTDKK

FWLVNTN--

-RLVKFYF-

GVDGLKTGYT

AEAKYCLTAT

AKKNGMRVIA

-----GHY

SSAYDMAIMA

KELLYK-ESI

TKFTGYEDY

LR--ENTDKK

FWLVNTN--

-RLIKFYF-

GVDGVKTGYT

GEAKYCLTAS

AKKNGMRAIA

●VLLSSRD--

-----RYAD

ARALLTYLDR

QYRWFTLDGR

SFAELARLAR

EGIVP-----

-----A

LVPTV-VVAN

ETADQVRV--

IIDRQ-----

VLTGSTL--

-----AAWYDD

AAKLLDYGWT

KLDRLTGSAD

AERLFDDWNR

RTEDPVARGL

VVRTWLWPGA

LGPVVEEAYA

DAPDGKRLVR

VVLNAPD--

-----MWND

TKKILDFAYQ

NYKILKIARG

EIGYL-----

-RVKDSKEN

WI--KLG--I

TEQNIFVLTK

DQYPGLNVVI

S-----

VTLDPAD--

-----DWND

HTAMYEYGSF

HYHIAKVSSE

RVVD-----

-KIS-----

-DP

FYRGRLQ--A

VRDLRYPVTD

KEESGLRVKV

VTINDPN--

-----DWND

HKMFPNYVEF

HYQPYLIAKK

GDIP-----

-KLK-----

-GT

FYESKAF--I

KRDITYLLTE

EKENVKINT

VVLNAKGN--

--LHTGRFDE

TKKMFDYAFD

NFSMKEIYAE

GDQVKGH--

-KTISVDKKG

EKEVGIV--T

NKAFSLPVKN

GEEKNYKAKV

TLNK-----

VVMNAKDASG

KTTKEARFKE

TKFLPNYGFN

QYSLETLYPK

GYQLKGK--

-ETLPVVGK

EKEVVRVA--T

GKNLDDLKVN

GEEKQYKPVY

VLDKKKMTKE

VVMAAPD--

---SKTRFNE

AEVRLDWGFA

NFAMYAPYAK

DFSFG-----

-KVRVRNGL

KKEVSAV--L

ERDVKLLVKK

GDEN-SIETK

T-----ILP

VVFGAPT--

---PKSRNAQ

ITKMLDYAFS

QYRTHPVYKR

NETVA-----

-RVNISKKG

RSSVEAV--T

SEPVSVLTKK

GQSVQIEKV

I-----KVK

VVFGAST--

---PKERNAQ

VTKMLDFAFS

QYETHPLYKR

NQTVA-----

-KVKVKKGK

QKFIELT--T

SEPI SILTKK

GEDMNDVKKE

I-----KMK

-----HSSA

DVVGTVRLRI

GT-----

-----SDL

-----FIVPL

L-----R

-----Y

YEKGRMELTH

PDRAVDARWR

VTGGR LAWEL

LTGWQQIGDE

TYVQRKPAAI

AVAGDPGNPV

TYALLGTMLA

APSGPADEPV

TARLFPGDTV

KKVSA PVKKY

TEVGKLEIKY

DH-----

-----QT-

-----YSVPI

A-----T

EWEKYPERAP

TEVGKAVLYL

HQ-----

-----KAV

-----DSVPL

L-----YE--PG

AWEKDASKIP

DIVGHMEIMF

ND-----

-----ATI

-----AKVPI

Y-----YE--NE

DNLTA PVKKG

TKVGKLTAEY

KG-----

-----DEK

-----DYGFLNSDL

GKLVAPLKKG

ETVGYMTLEY

TC-----

-----DDS

-----LAFLSPDMQ

KN-----

-----IRVPL

V-----T

KEIPAPVKLG

QVVGRIELIK

DG-----

-----KTL

-----AIYNL

V-----A

DNVKAPVRKG

DELGVLILKQ

DG-----

-----KEI

-----LHSPV

V-----A

DNISAPIQKG

QELGTVLVKK

DG-----

-----EVL

-----AESPV

A-----A

-----VER-

VHDVLEARYG

-----VRYGA

VFRETNHSVA

SIFANWLEQR

GSVWAGYRLR

EEPLFSPWIA

VVGYPITEPY

WVRVVRVGRVE

QDVLVQCFER

ROLTFTPANP

LQGCQRKTFW

DKLKERFFGQ

KASQK-----

KEGSGRGFLW

QVFRFLGVRS

DG-----

RHQKPKQKFF

ETFKSIFPLA

AGGAKWSI--

KENVEKANWF

VLTMR-SIGG

FFAGIWGSIV

DTVTWGFW--

TAEVEKANWF

VLSMR-AVGG

LPVLDLWTSVA

KTVKGWL---

SEBVEKRNIF

DIFKM-LLRL

EM-----

KQTVBEASFV

DLFKR-VFGR

FVQAG-----

KEDMKKAGFI

TFLKR-TMGD

WTKFK-----

PGWQVEMGNI

GVHYRQNVQR

DRGVLLQNLS

RSS-----
