

Mammalian Protamine P2 sequences

Primates

Human (*Homo sapien*) VRYRVRSLSEESH - - - - - EVYRQQLHGQEQGHGGQEEQGLSPHEHVEVYERTH - GQ - SHYRRRHCSRRLRHR IHRQQHRS^{CRRRKR} - - - - - SCRHRRRHR - - - - - RGCR - TRKRT - - - - - CRRH - - - -
Chimpanzee (*Pan troglodytes*) VRYRVRSPSEESH - - - - - EVYRQQLHGQEQGHGGQEEQGLSPHEHVEVYERTH - GH - SHYRRRHCSRRLRHR IHRQQHRS^{CRRRKR} - - - - - SCRHRRRHR - - - - - RGCR - TRRT - - - - - CRRH - - - -
Bonobo (*Pan paniscus*) VRYRVRSPSEESH - - - - - EVYRQQLHGQEQGHGGQEEQGLSPHEHVEVYERTH - GH - SHYRRRHCSRRLRHR IHRQQHRS^{CRRRKR} - - - - - SCRHRRRHR - - - - - RGCR - TRRT - - - - - CRKH - - - -
Gorilla (*Gorilla gorilla*) VRCRVRSPSEESH - - - - - EVYRQQLHGQEQGHGGQEEQGLSPHEHVEVYERTH - GH - SHYRRRHCSRRLRHR IHRQQHRS^{CRRRKR} - - - - - SCRHRRRHR - - - - - KGCR - TRRT - - - - - CRRH - - - -
Bornean orangutan (*Pongo pygmaeus*) VRYCVRSLSEESH - - - - - EVYGGQLHGQEQGHGGQEEQGLSPQEVVEYERTQ - GH - SHYRRRHCSRRLRHR IHRQQHRS^{CKRRRH} - - - - - SCRHRRKHR - - - - - RGCR - TRRT - - - - - CRRH - - - -
Lar gibbon (*Hylobates lar*) VRYCVRSLSEESH - - - - - EVYGGQLHGQEQGHGGQEEQGLSPEDVEVYERTH - GH - SHYRRRHCSRRLRHR IHRQQHRS^{CGRRRH} - - - - - SCRHRRRHR - - - - - RGCR - RRR - - - - - RCRRH - - - -
Southern pig-tailed macaque (*Macaca nemestrina*) VRYRMRSLSERPH - - - - - EVHGQQVHGQDQGHNGQEEQGLNPEHVEVYERTHRGH - SHHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRHRRRHR - - - - - RGCR - TRRR - - - - - RCRRH - - - -
Japanese macaque (*Macaca fuscata*) VRYRMRSLSERPH - - - - - EVHGQQVHGQDQGHNGQEEQGLNPEHVEVYERTHRGH - SHHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRHRRRHR - - - - - RGCR - TRRR - - - - - RCRRH - - - -
Crab eating macaque (*Macaca fascicularis*) VRYRMRSLSERPH - - - - - EVHGQQVHGQDQGHNGQEEQGLNPEHVEVYERTHRGH - SHHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRHRRRHR - - - - - RGCR - TRRR - - - - - RCRRH - - - -
Rhesus macaque (*Macaca mulatta*) VRYRMRSLSERPH - - - - - EVHGQQVHGQDQGHNGQEEQGLNPEHVEVYERTHRGH - SHHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRHRRRHR - - - - - RGCR - TRRR - - - - - RCRRH - - - -
Drill (*Mandrillus leucophaeus*) VRYRMRSLSERPH - - - - - EVHGQQVHGQDQGHNGQEEQGLSPHEHVEVYERTHRGH - SYHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRHRRRHR - - - - - RGCR - TRRR - - - - - RCRRH - - - -
Sooty managabey (*Cercocebus atys*) VRYRMRSLSERPH - - - - - EVHGQQVHGQDQGHNGQEEQGLSPHEHVEVYERTHRGH - SYHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRHRRRHR - - - - - RGCR - TRRR - - - - - RCRRH - - - -
Red guenon (*Erythrocebus patas*) VRYRTRSLSERPH - - - - - EVHGQQVHGQDQGHNGQEEQGLSPHEHVEVYERTHRGH - SHHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRHRRRHR - - - - - RGCR - TRRR - - - - - RCRRY - - - -
Green monkey (*Chlorocebus sabaeus*) VRYRTRSLSERPH - - - - - EVHGQQVHGQDQGHNGQEEQGLSPHEHVEVYERTHRGH - SPHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRHRRRHR - - - - - RGCR - TRRR - - - - - RCRRY - - - -
Northern plains gray langur (*Otolemur garnettii*) VRYRMRSLSERPH - - - - - EVHGQQVYQEQGHNGQEEQGLSPHEHVEVYERTHRGH - SHHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRHRRRHR - - - - - RGCR - TRRR - - - - - RCRRY - - - -
Olive baboon (*Papio anubis*) VRYRMRSLSERPH - - - - - GQQVHGQDQGHNGQEEQGLSPHEHVEVYERTHRGH - SYHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRHRRRHR - - - - - RGCR - TRRR - - - - - RCRRH - - - -
Venezuelan red howler (*Alouatta seniculus*) VRYHVRSPSERPH - - - - - REYRQLVNGQEQRHGQEEQGLSPEGVEYGRTHGCG - YGYRRLCSRRLRHRVHRR^{RQR} - - - - - R - - - - - CGRYRRNR - - - - - RGCR - TRRT - - - - - CRRH - - - -
Marmoset (*Callithrix jacchus*) VRYRVRSPSERPH - - - - - EYRQLVNWQEQRNGQEEQGLSPEGVEYGRTHGCG - SSYRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - SCRYRRPR - - - - - RGCR - SRRR - - - - - RCRRY - - - -
Black-capped squirrel monkey (*Saimiri boliviensis*) VRYRVRSPSERPH - - - - - EYRQLVNRQEQRNGQEEQGLSPEGVEYGRTHGCG - YHRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - CCRYYRRR - - - - - RVCK - SRRR - - - - - RCRRY - - - -
Northern greater galago (*Otolemur garnettii*) VRYRVRSPSEHAN - - - - - QGLRQEGH - - - - - QDEGQNELPVEVYGRTHRGH - HRRHRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - RCRHRRRRLSFPKGCRRRR - - - - - RCRRY - - - -
Panamanian white-throated capuchin VRCRLRSPSERPH - - - - - EYRQLVNGQEQRNGQEEQGLSPEGVEAYGRSHRVC - YRYRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - CCRYYRRRYR - - - - - RGS - SRRR - - - - - RCRRY - - - -
(*Cebus capucinus imitator*)

Artiodactyls

Eurasian wild pig (*Sus scrofa*) VRCRVRSPSESP - - - - - QQSGGQQR - - - - - ENERQDQDQLRPEDVPVYGRTHRGR - YHYRHR - - - - - HTRRR^{RSCRRRR} - - - - - ACRHRHR - - - - - RGCRIRRRR - - - - - RCRRL - - - -
Domestic bull (*Bos taurus*) VRCRVKSPTESPPPGQQGSGQQG - - - - - EXEHXDAQARELRPEDIPVYGRTHRGR - YHYRHR - - - - - HTRRR - PYRRRRR - - - - - ACRHRHR - - - - - RGCRMRRRR - - - - - RCRQL - - - -
European red deer (*Cervus elaphus hippelaphus*) VRCRVKSPTESPPPGQQGSGQQG - - - - - ETERPDQARELRPEDIPVYGRTHRGR - YHYRHR - - - - - HTRRR - PCRRRRR - - - - - ACRHRHR - - - - - RGCRMRRRR - - - - - RCRQL - - - -

Perissodactyls

Horse (*Equus caballus*) VRYRVRSPSERPQ - - - - - SGPGQQHGGE - - - - - DQQQESGHTPENIEA - ARRTAGSYRYRRRRCSRRLRHR IHRRRHRS^{RRRRRR} - - - - - RPCRHRHR - - - - - RVCRRVRRR - - - - - RCRRY - - - -
Donkey (*Equus asinus*) VRYRVRSPSERPQ - - - - - SGPGQQHGGE - - - - - DQQQESGHTPENIEA - ARRTAGSYRYRRRRCSRRLRHR IHRRRHRS^{RRRRRR} - - - - - RPCRHRHR - - - - - RVCRRVRRR - - - - - RCRRY - - - -

Carnivores

Domestic cat (*Felis catus*) VRCGRSPPSGHPRQGEHG - QH - - - - - ECQDKEREQAVNAEDIQVDQRTHKG - - - - - CCYRHRSSQRRRYRARRRRRSCQRRR - - - - - RQ - - - - - RGHRVTR - - - - - RCQRH - - - -
Domestic dog (*Canis lupus familiaris*) VRCRGRSPEHP - - - - - QHGHEQQR - - - - - QCQEQQEEQAVNPEDIPTAEGRTNKD - YHYRHRCSRRLRHRVHRRRR^{RSCRRRR} - - - - - ACRHRHH - - - - - RGSRRVRRR - - - - - YRCH - - - -

Bats

Little brown bat (*Myotis lucifugus*) VRHNAARLSQRQP - - - - - QEQGE - - - - - QEQDPNAEDGQV - DGRTLRCGYHYRRRRCSRRLRHRVHRRRRSCRRRRR - - - - - RCCRRRRR - - - - - RGCRRRRYR - - - - - RCR - - - -

Rodents

Lesser hedgehog tenrec (*Echinops telfairi*) VRYRVRSPSEHPQ - - - - - EGCRQQGYGQQGHEDGEQEORLSPERVQDYGRTHRGH - - - - - RRRRRCSRRLRHR IHRRRHRS^{CRRRRH} - - - - - RCCRRRRR - - - - - RGCR - - - - - MRR - - - - - RCRRYRY
Syrian hamster (*Mesocricetus auratus*) VRYRMRSPSERPH - - - - - QGPGQEHGR - - - - - EEQGQGGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRRH - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRHHH - - - -
Southwestern water vole (*Arvicola sadipus*) VRYRMRSPSEHP - - - - - QGPGQDHP - - - - - DEQQGGGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -
European water vole (*Arvicola terrestris*) VRYRMRSPSEHP - - - - - QGPGQDHP - - - - - DEQQGGG?SPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - S?RHRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -
Bank vole (*Clethrionomys glareolus*) VRYRMRSPSEHP - - - - - QGPGQDDH - - - - - KDQGRQGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGGRCRRRR - RCRRCRRRY - - - -
European snow vole (*Chionomys nivalis*) VRYRMRSPSEHP - - - - - QGPGQDDH - - - - - DEQQGGGGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -
Cabrera's vole (*Microtus cabraerae*) VRYRMRSPSEHP - - - - - QGPGQDYG - - - - - NEQQG - - - - - LSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -
Field vole (*Microtus agrestis*) VRYRMRSPSEHP - - - - - QGPGQDDH - - - - - DEQQGGGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRY - - - -
Common vole (*Microtus arvalis*) VRYRMRSPSEHP - - - - - QGPGQDDH - - - - - DEQQG - - - - - LSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRY - - - -
Gerbe's vole (*Microtus gerbei*) VRYRMRSPSEHP - - - - - QGPGQDNR - - - - - DEQQGGGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRY - - - -
Mediterranean pine vole (*Pitymys duodecimcostatus*) VRYRMRSPSEHP - - - - - QGPGQDNR - - - - - DEQQGGGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRY - - - -
Lusitanian pine vole (*Pitymys lusitanicus*) VRYRMRSPSEHP - - - - - QGPGQDNR - - - - - DEQQGGGGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRY - - - -
Hispid cotton rat (*Sigmodon hispidus*) VRYRTRSPSEHL - - - - - QGPGQEHGR - - - - - EEQG - - - - - QGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRR - RCRRCRRRH - - - -
Bush rat (*Rattus fuscipes*) VRYRMRSPSEHP - - - - - QGPGQDHER - - - - - EEQQGQGLSPERVEDYGRTHRGH - - - - - RHRRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCHHRHR - - - - - RGCRSRRRR - CKCRKRRH - - - -
Tunney's rat (*Rattus tunneyi*) VRYRMRSPSEHP - - - - - QGPGQDHER - - - - - EEQQGQGLSPERVEDYGRTHRGH - - - - - RHRRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCHHRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -
Campbell's dwarf hamster (*Phodopus campbelli*) VRYRMRSPSERPH - - - - - QGPGQEH - - - - - EEQG - - - - - QGFSERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCHHRHR - - - - - RGCRSRR - RCRRCRRRH - - - -
Roborovskii's hamster (*Phodopus roborovskii*) VRYRMRSPSERPH - - - - - QGPGQEH - - - - - EEQG - - - - - QGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRR - RCRRCRRRH - - - -
Djungarian hamster (*Phodopus sungorus*) VRYRMRSPSERPH - - - - - QGPGQEH - - - - - EEQG - - - - - QGFSERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCCHRRHR - - - - - RGCRSRR - RCRRCRRRH - - - -
House mouse (*Mus musculus*) VRYRMRSPSEHP - - - - - QGPGQDHER - - - - - EEQQGQGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -
Servant mouse (*Mus famulus*) VRYRMRSPSEHP - - - - - QGPGQDHER - - - - - EEQQGQGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -
Macedonia mouse (*Mus macedonicus*) VRYRMRSPSEHP - - - - - QGPGQDHER - - - - - EEQQGQGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -
Steppe mouse (*Mus spicilegus*) VRYRMRSPSEHP - - - - - QGPGQDHER - - - - - EEQQGQGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -
Algerian mouse (*Mus spretus*) VRYRMRSPSEHP - - - - - QGPGQDHER - - - - - EEQQGQGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -
W European house mouse (*Mus musculus domesticus*) VRYRMRSPSEHP - - - - - QGPGQDHER - - - - - EEQQGQGLSPERVEDYGRTHRGH - HHR - RRCRRLRHR IHRRRR - - - - - SCRRRRR - - - - - SCRHRRRHR - - - - - RGCRSRRRR - RCRRCRRRH - - - -

SE Asian house mouse (<i>Mus musculus castaneus</i>)	VRYRMRSPEGPH	QGPGQDHER	EEQGGQGGLSPERVEDYGRTHRGHH-HHRHRRCSRKRLHR IHKRRR	SCRRRRRH	- - -	SCRHRRRHR	- - - -	RGCRRSRRRR	RCRCRKCRHHH
SW Asian house mouse (<i>Mus musculus bactrianus</i>)	VRYRMRSPEGPH	QGPGQDHER	EEQGGQGGLSPERVEDYGRTHRGHH-HHRHRRCSRKRLHR IHKRRR	SCRRRRRH	- - -	SCRHRRRHR	- - - -	RGCRRSRRRR	RCRCRKCRHHH
European wood mouse (<i>Apodemus sylvaticus</i>)	VRYRMRSPEGPH	QGPGQDHER	EEQGGQGGLSPERVEDYGRTHRGHH-HHRHRRCSRKRLHR IHKRRR	SCRRRRRH	- - -	SCRYRRRHR	- - - -	RGCRRSRRRR	RCGCRKCRHHH
Gairdner's shrew-mouse (<i>Mus pahari</i>)	VRYRMRSPEGPH	QGPGQDHER	EEQGGQGGLSPERVEDYGRTHRGHH-HHRHRRCSRKRLHR IHKRRR	SCRRRRRH	- - -	SCRYRRRHR	- - - -	RGCRRSRRRR	RCRCRKCRHHH
Cook's mouse (<i>Mus cookii</i>)	VRYRMRSPEGPH	QGPGQDHER	EEQGGQGGLSPERVEDYGRTHRGHH-HHRHRRCSRKRLHR IHKRRR	SCRRRRRH	- - -	SCRYRRRHR	- - - -	RGCRRSRRRR	RCRCRKCRHHH

Supplemental Figure S3. Amino acid sequences for all known mammalian protamine P2 proteins. The sequences have been aligned relative to human protamine P2. The sequences recognized by 2A11, 5A2, 5D1, and 11C1 are highlighted in blue (SRS), gray (RQR), purple (TRR) and brown (RCC). The sequences recognized by MAb 20D4 are highlighted yellow (RSCRRRRRSC, RSRRRRRRCR, and conserved variants). The YRP sequence recognized by MAb 26B11 is not found in any of the known protamine P2 sequences. The presence of the RSCRRRRRSC and closely related sequences suggest MAb 20D4 should recognize and bind to nearly every protamine P2 sequence. MAb 2A11, 5A2, 5D1, and 11C1 are likely to recognize and bind to only a subset of known protamine P2 sequences. These include the P2's of most primates, artiodactyls and certain carnivores, bats and hedgehogs.