**Source data related to Supplementary file 2: VENTX homeodomain sequences**

>Human\_Ventx/92-152 Ventx

PRVRTAFTMEQVRTLEGVFQHHQYLSPLERKRLAREMQLSEVQIKTWFQNRRMKHKRQMQD

>Squirrel\_Monkey\_Ventx/92-152

PRICTAFSTEQVRALEGVFRHHRYLGPLERKRLAREMQLSELQVKTWFQNRRMKHKQEVQD

>Chimp\_Ventx/92-152 Ventx

PRVRTAFTMEQVRTLEGVFQHHQYLSPLERKRLAREMQLSEVQIKTWFQNRRMKHKRQMQD

>Maquaque\_Ventx/92-152 Ventx

PRVRTAFTTEQVRTLEGVFQHHQYLSPLERKRLAREMQLSEVQIKTWFQNRRMKHKRQMQE

>Gorilla\_Ventx/92-152 Ventx

PRVRTAFTMEQVRTLEGVFQHHQYLSPLERKRLAREMQLSEVQIKTWFQNRRMKHKRQMQD

>Mouse\_Lemur\_Ventx/85-145 Ventx Microcebus griseorufus]

PRVRTAFSTEQLRALEGVFRHHQYLGPLERKKLAREMRLSEVQIKTWFQNRRMKHKRQMQD

>Bushbaby\_Ventx/95-155 Otolemur Garnettii

PRVRTAFSAEQLRALEGVFQHHQYLSPLERKKLAKEMQLSEVQIKTWFQNRRMKHKRQIQD

>Cape\_Golden\_Mole\_Ventx/77-137 Chrysochloris asiatica contig183193

PRVRTAFTAAQVRTLESAFQLHQYLGPQERKKLAKEMCLTEVQIKTWFQNRRMRHKRQMQD

>Hyrax\_Ventx/90-150 Ventx

PRVRTAFTAAQVSTLESAFKLRQYLGPQERKKLAREMCLTEVQIKTWFQNRRMKHKRQVQD

>TreeShrew/90-150 Ventx

PRVRTAFTVEQVSALEGAFQHHQYLGPLERKKLAKEMQLSEVQIKTWFQNRRMKHKRQMQD

>Chinese\_TreeShrew/132-192 Homeobox protein VENTX [Tupaia chinensis] gi|444726785|gb|ELW67305.1|

PRVRTAFTVEQVSALEGAFQHHQYLGPLERKKLAKEMQLSEVQIKTWFQNRRMKHKRQMQD

>Bear\_Ventx/90-150 Ursus maritimus contig2696, whole genome shotgun sequence GenBank: AVOR01002696.1

PRVRTAFTAEQVSTLESAFQHHRYLGPLERGRLAREMRLSEVQIKTWFQNRRMKHKRQLQD

>Microbat\_Ventx/91-151 Ventx

PRVRTAFTEEQVSTLESSFQLHRYLDPQERRRLAQTMGLSEVQIKTWFQNRRMKHKRQLQD

>Mouse\_Eared\_Bat\_Ventx/91-151 Homeobox protein VENTX [Myotis davidii] gi|432115368|gb|ELK36785.1|

PRVRTAFTEEQVSTLESSFQLHRYLDPQERRRLAQTMGLSEVQIKTWFQNRRMKHKRQLQD

>Horse\_Przewalskii\_Ventx/91-151 XP\_008523846

PRVRTAFTVEQVSTLESSFQHRRYLGPLERRRLAREMRLSEVQIKTWFQNRRMKHKRQLQD

>Rinoceros\_Ventx/91-151

PRVRTAFTSEQVSTLESSFQHHRYLGPLERRRLAREMQLSEVQIKTWFQNRRMKHKRQLQD

>Walrus\_Ventx/89-149

PRVRTAFTAEQVSTLESAFQHHRYLGPLERRRLAREMRLSEVQIKTWFQNRRMKHKRQLQD

>Ferret\_Ventx/89-149

PRVRTAFSAEQVSTLESAFQRRRYLGPAERRRLARDMRLSEVQIKTWFQNRRMKHKRQLQD

>Cat\_Ventx/90-150

PRVRTAFTAEQVSTLESAFQHQRYLGPLERRKLAREMRLSEVQIKTWFQNRRMKHKHQLQD

>Tiger\_Ventx/90-150

PRVRTAFTAEQVSTLESAFQHQRYLGPLERRKLAREMRLSEVQIKTWFQNRRMKHKHQLQD

>Aardvark\_Ventx/90-150 Orycteropus afer afer contig064492

PRARTAFTTVQISTLESAFQLHQYLGPQERKKLARQMELTEVQIKTWFQNRRMKQKRQMQD

>Vervet\_Monkey\_Ventx/87-147 Scaffold KE147988.1: 1,807-4,222 ENSP00000357556

PRVRTAFTTEQVRTLEGVFQHHQYLSPLERKRLAREMQLSEVQIKTWFQNRRMKHKRQMQE

>Elephant\_Ventx/91-151

PRVRTAFTTAQISTLESAFKLHQYLGPQERKKLAKEMHLTEVQIKTWFQNRRMKHKRQLQD

>Giant\_Panda\_Ventx/88-148

PRVRTAFTAEQVSTLESAFQHHRYLGPLERRTLAREMRLSEAQIKTWFQNRRMKHKRQLQD

>Weddell\_Seal\_Ventx/89-149

PRVRTAFTAEQVSTLESAFQHHRYLGPLERRRLAREMRLSEVQVKTWFQNRRMKHKRQLQD

>T.Devil\_Ventx/126-186 Ventx

RRLRTAFTTKQISTLESSFKRHHYLGAAERRKLAGKMQLSEVQIKTWFQNRRMKLKRQLQD

>Wallaby\_Ventx/122-182

RRLRTAFTTKQISTLESSFKRHHYLGAAERRKLAGKMQLSEVQIKTWFQNRRMKLKRQLQD

>Opossum\_Ventx2/108-168 LOC103102624 gi|612060062|ref|XP\_007506754.1| PREDICTED: homeobox protein vent1-like [Monodelphis domestica]

RRLRTAFTTKQISTLESSFKRHHYLGAAERRKLAGKMQLSEVQIKTWFQNRRMKLKRQLQD

>King\_Cobra\_Ventx2/167-227

RRLRTAFSLEQISTLESSFKRHKYLGAAERRKLASKMQLSEVQIKTWFQNRRMKLKRQLQE

>Crotalus\_Ventx2/151-211

RRLRTAFSLEQIGTLESSFKRHKYLGAAERRKLASKMQLSEVQIKTWFQNRRMKLKRQLQE

>Phyton\_Ventx2/69-129

RRLRTAFSLEQISTLESSFKRHKYLGAAERRKLASKMQLSEVQIKTWFQNRRMKLKRQLQE

>Anole\_Lizard\_Ventx2.1/144-204

RRLRTAFSLEQISTLESAFQRHRYLGAAQRRKLAAKMRLSEVQIKTWFQNRRMKLKRQMQE

>Anole\_Lizard\_Ventx2.2/20-80

RRLRTAFSLEQISTLESAFQRHRYLGAAQRRKLAAKMRLSEVQIKTWFQNRRMKLKRQMQE

>Ara\_Macao\_Ventx2/97-157 s\_1\_1\_contig94256, whole genome shotgun sequence

RRLRTAFSAEQVSTLESSFQRQQYLGAAERRKLAGRMRLSEVQIKTWFQNRRMKLKRQLQE

>Budgerigar\_Ventx2/60-120

RRLRTAFSAEQVSTLESSFQRQQYLGAAERRKLAGRMQLSEVQIKTWFQNRRMKLKRQLQE

>Chinese\_Turtle\_Ventx2/160-220

RRLRTAFSVEQISTLESSFKRHKYLGSAERRKLAAKMQLSEVQIKTWFQNRRMKLKWQLQE

>Green\_Turtle\_Ventx2/109-169

RRLRTAFSVEQISTLESSFKRHKYLGSAERRKLAAKMQLSEVQIKTWFQNRRMKLKRQLQE

>Chicken\_Ventx2/134-194

RRLRTAFSAEQISTLESSFQRHRYLGAAERRKLAGRMRLSEVQIKTWFQNRRMKLKRQLQE

>Crow\_Ventx2/44-104 >gi|726992252|ref|XP\_010408490.1| PREDICTED: homeobox protein VENTX [Corvus cornix cornix]

RRLRTAFSAEQISTLESSFQRQQYLGAAERRQLAGRMRLSEVQIKTWFQNRRMKLKRQLQE

>Xenopus\_Laevis\_Ventx.2.2/175-235

RRLRTAFTSDQISTLEKTFQKHRYLGASERQKLAAKLQLSEVQIKTWFQNRRMKYKREIQD

>Xenopus\_Trop\_Ventx2.1/190-250

RRLRTAFTSDQISTLEKTFQKHRYLGASERRKLAAKLQLSEVQIKTWFQNRRMKYKREIQD

>Xenopus\_Laevis\_Ventx2.1/185-245 Ventx2.1

RRLRTAFTSDQISTLEKTFQKHRYLGASERRKLAAKLQLSEVQIKTWFQNRRMKYKREIQD

>Platyfish\_Vox/123-183

RRVRTKFTPEQISRLEKIFSKHKYLDAGERVKTAQKLNLTETQVRTWFQNRRMKLKREVQD

>Medaka\_Vox/123-183 Ventx

RRVRTKFTPKQILKLEKVFSKHKYLDAGERVKTAQKLNLSETQVRTWFQNRRMKLKREVQD

>Tongue\_Sole\_Vox\_/128-188 >gi|657786821|ref|XP\_008320431.1| PREDICTED: homeobox protein pv.1-like [cynoglossus semilaevis ]

RRVRTKFTPEQINKLEKIFNKHKYLDAGERVKTAQRLNLTETQVRTWFQNRRMKMKREVQD

>Cod\_Vox/121-181 Vox

RRLRTKFTPEQINKLEKIFNKHKYLDAGERLKTAQKLNLSETQIRTWFQNRRMKLKREVQE

>Coelacanth\_Menadonis\_Ventx/75-135 TSA: Latimeria menadoensis Latmen\_c20573 transcribed RNA sequence

QRLRTAFTSEQIYNLEKTFKRHKYLGASERLKLAAKLQLSEIQIKTWFQNRRMKMKRQLQD

>Coelacanth\_Ventx/115-175

QRLRTAFTSEQIYNLEKTFKRHKYLGASERLKLAAKLQLSEIQIKTWFQNRRMKMKRQLQD

>Spotted\_Gar\_Vox/141-201 Gar ENSGACP00000003761 (Vox)

RRIRTKFTSDQIYKLEKTFSKDKYLGATERLKLAAKLNLSEIQVKTWFQNRRMKLKREMQD

>Cod\_Vent/59-119 Vent1

RRMRTKFTSEQINRLEDTFGRHKYLGATQRRKIAEKLSLSETQVKTWFQNRRMKLKRDLQD

>Astyanax\_Mexicanus\_Vent/104-164 LOC103039812 gi|597732752|ref|XP\_007228709.1| PREDICTED: homeobox protein vent1-like [Astyanax mexicanus]

RRVRTKFTTYQISRLEKTFNKHKYLGATQRKKIAEKLHLSETQVKTWFQNRRMKLKREVQD

>Zebrafish\_Vent/65-125 vent1

RRVRTKFTCDQISGLEKSFSKHRYLGATQRRKIAEKLHLSETQVKTWFQNRRMKLKREVQD

>Astyanax\_Mexicanus\_Vox/126-186 LOC103045048 gi|597732787|ref|XP\_007228723.1| PREDICTED: homeobox protein vent1-like [Astyanax mexicanus]

RRVRTKFTPEQIDKLEKIFNKHKYLDAGERVKTALKLSLSETQVRTWFQNRRMKLKREVQE

>Tilapia\_Vox/33-93 Oreochromis niloticus contig048699

RRVRTKFSPEQVKKLERIFIKQKYLDAGEREKTAQKLNLTETQVRTWFQNRRMKLKREVQD

>Neolamprologus\_brichardi\_Vox/33-93 Neolamprologus brichardi contig049650

RRVRTKFSSEQIKKLERIFIKQKYLDAGEREKTAQKLNLTETQVRTWFQNRRMKLKREVQD

>Maylandia\_Zebra\_Vox/33-93 Maylandia zebra contig021768

RRVRTKFSSEQIKKLERIFIKQKYLDSGEREKTAQKLNLTETQVRTWFQNRRMKLKREFQD

>Spotted\_Gar\_Ved/134-194

RRPRTAFTSEQISRLERTFKKHAYLGTREKEELCRKLNLSEKQIKNWFQNRRMKLKRTLQD

>Astyanax\_Mexiucanus\_Ved/49-109

RRARTAFTAEQIESLERAFKRNAYLGAQDKAELCKRLSLSDKQIRNWFQNRRMKLKRTVQD

>Zebrafish\_Ved/141-201

RRPRTAFSSEQISSLERVFKRNAYLGAQDKAELCRTLKLTDKQIRNWFQNRRMKLKRTVQD

>Astatotilapia\_burtoni\_Vent/1-61 Haplochromis burtoni contig023015

RRLRTKFTSEQVSKLEHTFSKQKYLGATQRRKIAEELNLSETQVKTWFQNRRMKLKREVQD

>Astatotilapia\_burtoni\_Vox/33-93 Haplochromis burtoni contig023015

RRVRTKFSSEQIKKLERIFIKQKYLDSGEREKTAQKLNLTETQVRTWFQNRRMKLKREFQD

>Pundamilia\_Nyererei\_Vox/33-93 Pundamilia nyererei contig020489

RRVRTKFSSEQIKKLERIFIKQKYLDSGEREKTAQKLNLTETQVRTWFQNRRMKLKREFQD

>Stegastes\_partitus\_Vox/127-187 gi|657562942|ref|XP\_008284891.1| PREDICTED: homeobox protein vent1-like [Stegastes partitus] LOC103360771

RRVRTKFTAEQINKLEKIFNKHKYLDAGERVKTAQKLNLTETQVRTWFQNRRMKLKRELQD

>Chinese\_Turtle\_Ventx1/119-179 turle Vent1 ENSPSIP00000004010

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>Zebrafish\_Vox/141-201 Vox

RRIRTKFTPEQIDKLEKIFNKHKYLDAGERVKTALKLGLSETQIRTWFQNRRMKLKREVQE

>Anguilla\_Japonica\_Vox/138-198 contig\_2724, whole genome shotgun sequence

RRARTKFTSEQIYKLEKTFKKHKYLDPTERIKTAEKLNLSETQVRTWFQNRRMKLKRDVQD

>Little\_Skate\_VentxA/181-241 Leucoraja erinacea LER\_WGS\_1\_CONTIG\_1613628

RRVRTAFTAQQIHKLEKKFKRQTYLGASERSKLAALLHLSETQVKTWFQNRRMKVKRIVKD

>Elephant\_Shark\_VentxA1/135-195 SINCAMP00000019661

RRARTAFTAQQIHRLEKRFKRQTYLGGSERVRLAASLHLSETQVKTWFQNRRMKLKRQLQD

>Elephant\_Shark\_VentxA2/123-183 SINCAMG00000012859

RRARTAFTAQQIHRLEKKFTHQKYLGASERVRLAASLHLSETQVKTWFQNRRMKLKRQLQD

>Elephant\_Shark\_VentxB/139-199 SINCAMP00000019665

RRPRTIFSVQQLSILETSFQHQPYPGTCQRQRLAGALSLSETQVKTWFQNRRMKLKQQLQD

>Little\_Skate\_VentxB/39-99 Skate Vx1

RRLRTIFTVEQVRSLEFSFQRQQYPGSCVRRTLAGELRLSEAQVKTWFQNRRMKLKQQLQV

>Anguilla\_Japonica\_Vent/1-61 contig\_2726, whole genome shotgun sequence

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>Coelacanth\_Ved/162-222

RRPRTAFTVEQINKLEKTFNKQKYLASQERQELCRKLNLSEKQIKTWFQNRRMKLKRNIQD

>Tilapia\_Vent/1-61 Oreochromis niloticus contig048699

RRLRTKFTSEQVSKLEHTFSKQKYLGATQRRKIAEELNLSETQVKTWFQNRRMKLKREVQD

>Maylandia\_Zebra\_Vent/5-65 Maylandia zebra contig021767

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>Pundamilia\_Nyererei\_Vent/1-61 Pundamilia nyererei contig020489

RRLRTKFTSEQVSKLEHTFSKQKYLGATQRRKIAEELNLSETQVKTWFQNRRMKLKREVQD

>Neolampromogus\_bichardi\_Vent/1-61 Neolamprologus brichardi contig049650

RRLRTKFTSEQVSKLEHTFSNQKYLGATQRRKIAEELNLSETQVKTWFQNRRMKLKREVQD

>Collared\_Flycatcher\_Ventx2/1-61

RRLRTAFSAEQISTLESSFQRQQYLGAAERRQLAGRMRLSEVQIKTWFQNRRMKLKRQLQE

>Painted\_Turtle\_Ventx2/150-210

RRLRTAFSVEQISTLESSFKRHKYLGSAERRKLAAKMQLSEVQIKTWFQNRRMKLKRQLQE

>Manatee\_Ventx/144-204

PRVRTAFTTAQISTLESAFKLRQYLGPQERKKLAKEMQLTEVQIKTWFQNRRMKHKRQMQD

>Lesser\_Hedgehog\_Tenrec\_Ventx/73-133 Echinops telfairi contig066530

PRLRTAFTAVQLSTLESAFQLHQYLGPQERKTLAQEMQLTEMQIKTWFQNRRMKHKRQMQD

>Sloth\_Ventx/11-71 ENSCHOP00000009883 Ventx

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>Weddell\_Seal-Ventx/13-73

PRVRTAFTAEQVSTLESAFQHHRYLGPlERRRLARELRLSEVQVKTWFQNRRMKHKRQLQD

>Sperm\_Whale\_Ventx/19-79

PRVRTASTAEQVSALEYSFRHRRYLGPLEHRRLAREMRLSEVQLLTWFQNRRVKYKRHVQG

>Puerto\_Rican\_Parrot\_Ventx2/1-61

RRLRTTFSAEQVSTLESSFQRQPYLGAAERRKLSGRMRLSEVQIKTWFQNRRMKLKRQLQE

>Duck\_Ventx1/4-64

RRARTAFTAEQVCRLEKTFQRQKYLGASERRKLAAALQLSEIQIKTWFQNRRMKLKRQIQD

>ZfinchVentx3/57-117

GRPRTKFSAAQLQELERSFREQRYIGAGEKRRLAAVLNLSQSQIKTWFQNRRMKFKRQTQD

>Axolotl\_Ventx1/56-116

RRARTAFSSQQLSRLEQTFAKQQYLPAQERRKLATALQISEMQIKTWFQNRRTKMKRQTLD

>Pseudacris\_Ventx1/2-62

KRIRTAFSPSQLLRLERAFEKNHYVVGAERKQLASSLSLSETQVKVWFQNRRTKYKRQKLE

>Zonotrichia\_Albicollis\_Ventx1/120-180 PREDICTED: homeobox protein vent1-like [Zonotrichia albicollis] gi|542145232|ref|XP\_005481664.1|

RRARTAFTSEQVCRLEKTFQRHKYLGATERRKLAAALQLSEIQIKTWFQNRRMKLKRQIQD

>Alligator\_Mississippiensis\_Ventx1/42-102 VXXX

RRLRTAFTSTQICQLEKTFKRQKYLGAAERRKLAAALQLSEVQVKTWFQNRRMKLKRQIQD

>Painted\_Turtle\_Ventx1/1-60 Chrysemys picta bellii Contig138.15

-RARTAFTPEQVGKLEKTFKRQKYVGAAERRKLAAALQLSEIQVKTWFQNRRMKLKRQIQD

>Platypus\_Ventx1/153-213 LOC100076658 Ventx

RRARTAFSPAQVCLLEKTFKGQRYLGIGDRKKLATNLNLSEVQVKTWFQNRRMKLKRQLQD

>Alligator\_Sinensis\_Ventx1/1-61

RRLRTAFTSTQICQLEKTFKRQKYLGAAERRKLAAALQLSEVQVKTWFQNRRMKLKRQIQD

>Green\_Turle\_Ventx1/14-74

RRARTAFTPEQVGKLEKTFKRQKYVGAAERKKLAAALQLSEIQVKTWFQNRRMKLKRQIQD

>Xenopus\_Ventx3.1/123-183

SRARTKFTPEQLKELERSFKENMYIGSSEKRRLSKVLKLSECQIKTWFQNRRMKLKRQSQD

>RanaVentx3/123-183

SRPRTKFSDEQLRELETSFREQKYIGSNEKKRLSRMLNLSETQIKTWFQNRRMKFKRQNQD

>PseudacrisVentx3/168-228

SRPRTKFTAEQLQELEKSFKEHRYIGSSEKKRLSKVLKLSETQIKTWFQNRRMKFKRQSQD

>Axolotl\_Ventx3/50-109 Ventxx

-RPRTKFSTEQLQELERSFQEQRYIGVAEKRRLARELNLSELRIKTWFQNRRMKFKRQNQD

>Pseudopodoces\_humilis\_Ventx3/101-161 XP\_005520905

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>Chicken\_Ventx3/103-163 XP\_004942219

ARPRTKFSAVQLQELERSFREQRYIGASEKRRLAAALDLSQSQIKTWFQNRRMKFKRETQD

>Painted\_Tutle\_Ventx3/1-60 Chrysemys picta bellii Contig138.15

-RPRTKFSASQLQELERSFREQRYIGASEKRRLSKVLKLSQTQIKTWFQNRRMKFKRQTQD

>Alligator\_Sinensis\_Ventx3/1-61

GRPRTKFSASQLQELERSFQEQRYIGASEKRRLSKVLNLSQTQIKTWFQNRRMKFKRQTQD

>Budgerigar\_Ventx3/1-60

-RPRTKFSAAQLQELERSFREQRYIGTSEKRRLAAVLNLSQGQVKTWFQNRRMKFKRQTQD

>Budgerigar\_Ventx1/117-177 XP\_005144153

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>XenopusVentx1.1/132-192 Ventx1.1

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>Alligator\_Mississippiensis\_Ventx3/1-60 Ventx3

-RPRTKFSTSQLQELERSFQEQRYIGASEKRRLSKVLNLSQTQIKTWFQNRRMKFKRQTQD

>Coelacanth\_Ved/16-76 Ved

RRPRTAFTVEQINKLEKTFNKQKYLASQERQELCRKLNLSEKQIKTWFQNRRMKLKRNIQD

>Anguilla\_japonica\_Ved/1-61 Anguilla japonica contig\_301331

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>Cod\_Ved/4-64

RRPRTAFTAEQVHSLERAFKKNAYLGTQDKSELCRKLNLSDKQIRNWFQNRRMKLKRTVQD

>Medaka\_Ved/1-61 Oryzias latipes DNA, contig84 in scaffold1

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>Tilapia\_Ved/1-61

RRPRTAFTAEQISSLEKAFSISAYLGTQSKAELRKKLHLSDKQIRNWFQNRRMKVKRTMQD

>Cod\_Ved/2-62 Ved

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>platyfishII/126-186

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>Saccoglossus\_Vent1/108-168 Ventx1

KKARTAFTNEQIGLLEKRFRLQKYLSATERVEFAESIGLTDTQVKTWFQNRRMKWKRQKKD

>Saccoglossus2\_Vent2/69-129 VENTX2

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>AmphiVent1/117-177 Jgi Sc.777 Protein ID:290585

RKARTAFTTEQVMALEERFRLQKYLSAADRETLAKATGLTDEQVKTWFQNRRMKLKRQQQD

>AmphiVent1b/117-177 Jgi Sc. 185

RKARTAFTTEQVMALEERFRLQKYLSAADRETLAKATGLTDEQVKTWFQNRRMKLKRQQQD

>AmphiVent2a/114-174 Jgi Sc.777 Protein ID:289443

RKARTAFTTEQVMALEERFRLQKYLSAADRETLAKATGLTDEQVKTWFQNRRMKLKRQQQD

>Amphivent2b/69-129 sc.185

RKARTAFTTEQVMALEERFRLQKYLSAADRETLAKATGLTDEQVKTWFQNRRMKLKRQQQD

>AmphiLcx1/143-203 Jgi Sc.777 Protein ID:290453

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>AmphiLcx2/143-203 Sc.185

KKLRTAFSSHQVHELETRFSTQKYLSASDREELAHALDLTDAQVKTWFQNRRMKWKRQVQD