

## Supplementary materials

*Mass spectrometry of the >250 kDa protein purified with monoclonal antibody 8E3.*

The >250 kDa band from the 8E3 immunoprecipitation was excised from the gel, destained, reduced with dithiothreitol, alkylated with acrylamide and digested with trypsin (Promega). The resulting peptide solution was analyzed on a Micromass CapLC and Q-ToF API US (Manchester, UK) LC-MS system. A peptide trap packed with Poros R2 (Perseptive Biosystems, Foster City, CA, USA) was used for online desalting, followed by separation on a 0.075 x 100 mm reverse phase column packed with Vydac C18 (Vydac, Hesperia, CA, USA). Peptides were eluted from the column with a linear gradient of 3-45% solvent B (solvent A: H<sub>2</sub>O, 2% ACN, 0.1% formic acid; solvent B: ACN, 2% H<sub>2</sub>O, 0.1% formic acid) at a flow rate of ~300 nL/min. The standard Micromass nanospray source with blunt tip 90 mm OD, 20 mm ID fused silica emitter was held at 80° C, capillary voltage +3.4 kV, cone voltage 32 V. Data acquisition was performed in data dependent mode, with up to 3 precursors for MS/MS selected from each MS survey scan. The .pkl files generated by Micromass ProteinLynx software were searched against the *Neospora* database (<http://www.sanger.ac.uk/sequencing/Neospora/caninum/>) using the Mascot MS/MS Ion Search (<http://www.matrixscience.com>). Ten tryptic peptides were identified that matched a region of the translated genome. The resulting regions containing tryptic peptides were subjected to BLAST analysis of the *Toxoplasma* genome (<http://toxodb.org/ToxoDB.html>).

Table S1. MS/MS-identified peptides of *Neospora* 8E3 immunoprecipitated protein.

<u>Peptide Identified</u>	<u>Amino Acid Position</u>
<b><i>KL</i>VSSVPIDDLNAPGVDIGTFK</b>	224-244
<b><i>RLLD</i>VTLPTVITIGGDLTR</b>	291-306
<b><i>RG</i>ENAPEFAYR</b>	338-347
<b><i>KL</i>PTLFVLDDANDR</b>	557-569
<b><i>RMS</i>DEDLQGVADYLIFR</b>	830-845
<b><i>RHL</i>NIPVADVAMSEELNR</b>	1076-1092
<b><i>KF</i>ENVFNFSFEVMDK</b>	1182-1195
<b><i>RSL</i>PEDGQVSFEYR</b>	1520-1532
<b><i>KSL</i>IEGLQPTESTDSVLTAILR</b>	1548-1568
<b><i>KS</i>LLEEIVALLLSK</b>	2043-2054

*Knockout constructs*

For generation of a RON8 deletion vector, upstream DNA regions (amplified with forward primer AGTAGCGGCCGCTGGAAGCAGTGTTTCGCAGTTG and reverse primer GCGCTCTAGAGCGATGCAAGACGATTCAGGC) and downstream DNA regions (amplified with forward primer CAATAAGCTTCATCCGGTGGTGTACGACATC and reverse primer GCCAGGTACCTCGCCTTTCTACGGCATACTG) flanking the coding sequence encoding residues 1-1716 were amplified from *T. gondii* RH $\Delta$ hpt strain genomic DNA and subcloned into the pMini-GFP.ht vector (Arrizabalaga *et al.*, 2004). This vector contains the selectable marker hypoxanthine-xanthine-guanine phosphoribosyl

transferase (HPT) gene, and a GFP cassette located downstream for negative selection of heterologous recombinants. The 5' flank (~3.3 kb) was inserted using NotI and XbaI and the 3' flank (~3.3 kb) was inserted using HindIII and KpnI. The final construct (*RON8 KO*) was sequenced at the junctions, linearized by KpnI digestion, and 30 µg of DNA was transfected by electroporation in seven independent experiments into RHΔ*hpt* parasites. A construct which disrupts the *Toxoplasma* gene encoding PP2C-hn (Gilbert *et al.*, 2007) was used as a positive control. For selection of transformants, the transfected parasites were grown in media containing 50 µg/ml MPA and 50 µg/ml xanthine. No *RON8* knockout parasites could be detected by PCR or IFA of the seven populations, whereas PP2C-hn knockouts were readily recovered in multiple trials carried out in parallel.

#### *Toxoplasma and Neospora RON8 sequence alignment*

The *Toxoplasma* *RON8* sequence agrees with gene model 541.m00141 and was confirmed by EST and cDNA sequencing. The *Neospora* *RON8* sequence was determined *in silico* using the *Toxoplasma* *RON8* sequence as a model and visual examination of intron/exon boundaries. The two sequences were aligned using Clustal W at <http://www.ch.embnet.org/software/ClustalW.html>. (\*) = identity, ( . or :) = similarity

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TgRON8      MVATTLHSLPSRYLYTLLMSFLFVCGALALHESPDGLPEAPDRPQNAESGDGPPTLVLT
NcRON8      MVAATLRSSRTRYLYTFLLATLFVCGDLALHKSANASSEAREDSQDAVSDDGFTTLVLT
***:*:* * :*****:*: ***** ***:*.:. .** : .:* * .** .*****:

TgRON8      DPEYAGKSEEFaftaeyfppTESSKNEdGAQQSFVETPNRRLPGTFDPMSSSDVRSEVQL
NcRON8      DPEDSGKSEEFaftaeyfppWEASKNDD-VKQSFfeAPNRGLPGKFDPMSPSDVRSVQL
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TgRON8      RVTTQQMERGLLAEI VVLQEGQMVSgFRASLQTKEQaALLHRLADLTNDPNIHFRVEWRG
NcRON8      RVTTQQTERGLHAEVIVLQEGQMIsgFRASLQTKEQaALLQRLADLTSDPNIHFRVEWRG
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TgRON8 RGDGTGGLYIRTAVHLLATAYKPSVHFKNLHQGTGARGARETIKLLSSVPIDDLNAPGVD  
NcRON8 RGDGSGSVIIRTAVHLLATAYKPSVHFNLNLHQIGPGGVRQTIKLVSSVPIDDLNAPGVD  
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TgRON8 IGTLKQLIVDHAEPENILTGPGSFSIKRMFKESDPKNANTQEATLVPWLLRLLDLASPV  
NcRON8 IGTFKQLISDHAEPENITGPGSFSIKRMYNESDPKNVNTQEATLVPWLLRLLDVTLPVT  
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TgRON8 IVGDLTRNREFSTVLPQGPANWNDLLLYTGMGDAANRQONAPDFAQREPGYRPGSIFLS  
NcRON8 IGGDLTRNREFSTVLPQGPANWNDLLHLYTGMGDAANRGENAPEFAYREPGYRGGSLFLS  
\* \*\*\*\*\*:\*\*\*\*\*:\*\*\*:\*\*\* \*\*\*\*\* \*\*:\*

TgRON8 PDGFRGAHLGDHQPDRKQFWRQGETGLNPGDIEHYYSPLFGRSYDTSNNPLLILDMY  
NcRON8 PEGLRGAARLGDHQPDRKKEYWRQGETGLNPGDIEHYYGPLFGRTYDTSNNPLLLDMH  
\*:\*:\*\*\*:\*\*\*\*\*:\*\*\*\*\*.\*\*\*\*\*:\*\*\*\*\*:\*\*\*:

TgRON8 GNPVYSEGGVPKFIVGPGENDLTKLPDHVSGMVLPSVSARFLFPDKRSFTEFINPARPWN  
NcRON8 GNPLYSPNGVPRFTVGPQTDLSKLPDHVSGMVLPSVQTRFAFPGNRGFSEYINPARPWS  
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TgRON8 DISKGWKALMAKHKMKFNIREPGLVGVSVNGNWyGLTSEFIQTYPTLLHLLGSLAQSTPG  
NcRON8 DINNGWKALMAKHKMKFDREPGLVGVSVNGNWyGLTGDFVENYPTLLHLLGSLAQSTPG  
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TgRON8 FSLEDVTLHFDDKLPKLPKLPFLVLDADHRQIPWCAFEFVIPLSPRGTVNIKSLAKGKS  
NcRON8 FSVEDLTFHFDDKLPKLPKLPFLVLDANDRQVPWCAFEYVVPITARGETVNIKSIMAKGKA  
\*\*:\*.\*:\*:\*\*\*\*\*.\*\*\*\*\*:\*\*\*:\*\*\*\*\*:\*:\*:\*\*\*.\*\*\*\*\*:\*\*\*:

TgRON8 AAESPKGCNFRKGFHFTTVHRWGFVESRNPLSIQWHGVLDYTGSKQECALLGNVLKDAH  
NcRON8 AAESPKGCNFRERGFHFTTVHRWGVVESRTPKIEWHGILDYHGSKEECSLGKVLKDAH  
\*\*\*\*\*:\*\*\*\*\*:\*\*\*.\*.\*:\*\*\*:\*\*\* \*\*\*\*\*:\*\*\*:\*\*\*\*\*

TgRON8 LAGRQIAVSFHAHKATVPIVIEFTGPDGELLKSKPKPVTATVQFGDDLPLGLLYDFHKP  
NcRON8 LARRQIAVSFHAHKATVPIVLEFTGPDGQRLTAKPKPVTATVQFGDDLPGILDFHKP  
\*\* \*\*\*\*\*:\*\*\*\*\*: \*.\*:\*\*\*\*\*:\*\*\*:\*\*\*\*\*

TgRON8 FQKKKVPVVYPFLQGQGGGS--RDALNGGVLGEEYHRPRKTKITMRPEIPIINHTDFT  
NcRON8 FQKKKVPVVYPFLPGRGQGGPQDALNQGVLGEDYHRPQKTRIMMRPEIPIINAHDTF  
\*\*\*\*\*:\*\*\*.\*.\*:\*\*\* \*\*\*\*\*:\*\*\*\*\*:\*\*\*:\* \*\*\*\*\*:\*\*\*

TgRON8 VDGSGHPNVPFVPIPLTAGPQQHLAPLKAQRWLRKEYPGSQLPFKLDMSDEDLLGIA  
NcRON8 VDGSGHPNVPFVPIITGQQHLAPLKAQRWLRRTAYPGSQLPFNLDRMSDEDLQGVA  
\*\*\*\*\*.\*\*\*\*\*:\*\*\*:\*\*\* \*\*\*\*\*:\*\*\*.\*.\* \*\*\*\*\*:\*\*\*\*\* \*:\*

TgRON8 DHLVFRFPDGTTEATLRSIFGPEVFSFNWATMNPDAYQKLMVDLTPKPKVYLAKNFRIVVT  
NcRON8 DYLIFRFPNGREASLRAIFGPELFSFNWATVNPEAYRNLMDLIAQPKPKVYLAKNFRIVVT  
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TgRON8 DVDGQQIPFDIQIEPGDTWAKTLDDFFKAHPNLKPANVKLVLYDDKDTALRQFDINLDMY  
NcRON8 DADGRQIPFDIQIEPGDTWAKTLDAFLKAHPTIKPANIKLVLYDDKDSALRQFDINLDMY  
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TgRON8 ASPYTEAVDQQHMKGLOITLETAPIVSCYQADPARPGQCLAVDMKRIFCGRVNPAKMVS  
NcRON8 SSPYTEAVDQQHMKGLOITLETAPIVSCYQTDPARPGQCLAVDMKRIFCGRVSPAKMLS  
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TgRON8 RAWNEECTAAWIARADLGEVEDRYLMGPDDVRARSIRDLLTSAKNALKQRNPEKAKHLNI  
NcRON8 RAWNEECTAAWIAHADLGEIEDRYLMGQDDVRARSIRDLLTSAKNALKQKHPERVRHLNI  
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TgRON8 PVADVTESEELNRKMRERTELAMKSGKTLEDLDRRLHLKFEIRTLQROGELQWAKLVGAT  
NcRON8 PVADVAMSEELNRKMRERAELTVKSGKTLEELDRRLQLKFEIRSLQROGELQWARLTGAT  
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TgRON8 ITTTEKKGKPAERHIRLDPKFFLNDKLWKVFKELAAQVPGLKFENVFNFSEFVMNKEARE  
NcRON8 IRTTENGKPVVERHILNPKKFFVNDKLWKVFKDLAAQVPGLKFENVFNFSEFVMDKDARE  
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TgRON8 QWKKEQTTVTKEAKQMRSQKTVDVIFVGPDSALFRDIGVELRQLSDEALGRLSKGDK  
NcRON8 QWKKEQTAVAKEAKKQVKAQKTVDVMFIGPDSALFQDMGVELRHLSDALGRLSKGDK  
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TgRON8 RGLINQLAKRYDIPROYFIRRGGFPSAAVNGTKWVITAMLGLVGGAGKGLASLLKDPHA  
NcRON8 RGLITQLAKVYNI PRHFFIRRGYPSATVSGTKWLITVMLGLVGGPDKGLSSLFKDPQA  
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TgRON8 FVTHLQSAGGFSPDITVTVLVDNNGSVLDPVLSQLPDQDLGSLAEIYFPWKKTAGQAQEEK  
NcRON8 FAANLQSAGGFKPTDITVRLVFDNGTAADVPIDSLPQDLGSLSEIYFPWRKTAGQAQVEK  
\* . . : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \*

TgRON8 KKAVESKVAEGSGIMRKLEVTVMQPSLWPEVFGAWLSDLHEMDLFDGPIILLQVRPEGAQ  
NcRON8 KKAVETKAAEGAGILRKVEVTVMQPSLWPEVFGTWLSDLHEMDLFDGPIITLQIRPEGAK  
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TgRON8 KGQVIRCSVKTLGELYQALNKPEIIRSKCPGMADLKKPFTFELSIRTPAEQYKLYNRSR  
NcRON8 KGQVIRCAVKTLGELYQALNNPEMIRLKCPCMGDLKKPFTFELAVRTPVEQFYKLFNRSR  
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TgRON8 SPEDQRRTAAVLLKLDHIRNLPDDGQVIFEYRRIKRTLTPQELQQLKALIEGLQPNENT  
NcRON8 SPEDQRRTAAVLLKLDHIRSLPEDGQVSFEYRKNKRPLTLQELQQLKSLIEGLQPTST  
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TgRON8 DDVLTAILRLLGISDQDIKSGRLRFGIKQAPTSSEQOMLREGSITAVVEDFQGGRRKAT  
NcRON8 DSVLTAAILRLLGISDQDIKSGRLRFGIKKAPTSSEQOMLREGSITAVVEDLQGGRRKAT  
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TgRON8 VRISIPEEELRLGASAQNYQVHMSLFSKNAQHLNTPCGSKSGAEVAKATWGQLCRWCNL  
NcRON8 VRISVPENEALRLGASAQNYQVHATLFSKNAQQLNTPCGSKSGADVAKATWGQVCQWCNF  
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TgRON8 KLADLPGLGHPTLYIRIISNEKTQTVRGGQPVTNVDGHPVVYDIRMPGDRSASGMPKS  
NcRON8 KLADLPGLGHPTLYIRIVSNEKTQTVRGGQPVTNIDGHPVVYDIRMPGDRSSTGMPES  
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TgRON8 VFWNLVERPGSNELGPVWHQSIPKADGGLRKDYSDPNPGAWDPTLFGPSSGTFPQNR  
NcRON8 IFWNLVERPGSNELGPVWHQSIPKADGGLRQDYSDPNPRMWDPKLFGPSSGAFPRNR  
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TgRON8 AGIDIVTNPPEAMETGDAYAPPPIRFGFGFRNWDRDAVKPQFNMMVSGIAPQERDLYKVYI  
NcRON8 AGIDIVTNPPEAMESGDAYNPPPIRFGFGFRNWDRDVKPQFNMMVSGIAPQERNLYQVYI  
\* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \*

TgRON8 QIPKGDGNYPCSGVDINLFMQLTKEQIARACGIHPSLLEAPFGVYLLKETPTYARAQPS  
NcRON8 QVPKGDGKYYPCTGIDINQFLQLTREQVARACGLHSSLLDAPFGLYLLKETPTYTRSQPS  
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TgRON8 FPLFFVDGEGQEHPSLGHWTDAKAFSPHLRGASPNSLIQLEFAPGVTCHLTQOELMSL  
NcRON8 FPLFYVDTGREGHPSVGQWTDSPAKFFIPHLRGFSPSSLIQLEFAPGVTCHLTQOELMAL  
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TgRON8 HTWEALLKRCNIDAGKERPATITTRIVPMFSTPNVTVKVPNELLOPLLQHRGISPDQLF  
NcRON8 HTWEAILKRCNMDIGKERPATITARVPMYSTPNVTVKVPNELLOPLLREHGGVSPDQFF  
\* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \* : \* \* \* \* \*

TgRON8 RQKPLEEVVALLLSNAHLGLYHVGLKYIDGTDQPYSECPHEHLRQLPPSQIPGLQHIYIVP  
NcRON8 RRKSLEEVVALLLSKAHLGLYHVGLQFNDGTEQPYSECPQHLRELPPSQIAGLRHIFIVP  
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TgRON8 ASEGEDFP-GVFRGGTLGDMMKGMNLSPTTYGDFVRTVKKKINSPEGLTIPGVRQHV  
NcRON8 AKEREGAFPVFRGGSLNDLLKGMHMSPTSYGDFVRTVTKNINSPGGLEVPGIPQHIG  
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TgRON8 GSGRPAQQI IDFDFAFPESPPGAAGKPGWEATWRPATVGAFFDNMPIGDIDREMHHPFLV  
NcRON8 GTTRPGQSAVIDFDFAAPDSPASGGQPGWSASWRPATVGAFFDNMPIGEIEKDLHHPFLV  
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TgRON8 FTTG-HPPKYDLNGLAAYGQPFREETHLDASLRNLVEWMKDSLGISDPNGILAEIVID  
NcRON8 FVTTGRAPKYDLYGIASYGGRPYHEEMKHLASLRNLVEWMKDSMGIPDPNGILADVVID  
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TgRON8 TIRCPFPLSAAQLISATIGHLLHHCQVNDLEMSHSIYVTPTPVPGYTATPKRNGPQ-IVI  
NcRON8 TIRCPPLPLTAAQLFSLTVGHLLHCHVTDLETSHSIYVTPTPVAGFTAAPKRNGPQQIVI  
\*\*\*\*\*:\*.\*\*\*:\*\*\*:\* \*.\*\*\*:\*\*\*:\*.\*\*\* \*\*\*\*\*.\*\*\*:\*\*\*:\*\*\*\*\* \*\*

TgRON8 NGHNYGAPGTAPRDFGQLFNLPGRPGARPLNQDLEVSFSPLPGKPPVRGVLPGDVLPLLO  
NcRON8 NGHKYGAPGTAPRDFGQLFNLPGTRPLKQDLEISFSPVPGKPPVRGVLPGDVLPLLO  
\*\*\*:\*\*\*\*\*.\*\*\*\*\* \*:\*\*\*:\*\*\*:\*\*\*:\*\*\*\*\*:\*\*\*\*\*:\*\*\*\*\*

TgRON8 SISDKHGQPGVAVVNLFLRQLHALAELPPGATLNIDTKLIPSPQQLYAPDQVPQPGPW  
NcRON8 SISDKHGQPGVTVVLNLFRLHALAELPPGADFNIDTKLIPSPQQLYLPEVPPQPGPW  
\*\*\*\*\*:\*\*\*\*\*:\*\*\*\*\* :\*\*\*\*\* \*\*.:\*\*\*\*\*

TgRON8 IAGPTGGGRFPGGGVVNESGRRRPGGSAAVKFMPTLRLPLLROPSVELPRNSMLRGS  
NcRON8 LTGPVG-----PGSRVGNLLPSGLRLPLLROPSVQLPRNSMLRGS  
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TgRON8 IGGVGLPRTEFVVPILPSQKSMPIEQVLKFFGIAPAAVQTLDVQEKPEQGAIIIESGTV  
NcRON8 IGGVGLPRTEFVVPILPSQKSMPIEQVLKYFGIAPAAVQTLDVQEKPEEGLITVTSKGV  
\*\*\*\*\*:\*\*\*\*\*:\*\*\*\*\*:\*\*\*:\*\*\*:\*\*\*

TgRON8 TFVPLKGTFTVSMKKINATDKNTLATLLKAAGRSIIDLVGASDGTQPLVLKIVVDHGAV  
NcRON8 TFVPLQGPAFSISMSKINSTDNNSLAALLKAAGRSVADLIGAAASTQPLVLKIIDHGAT  
\*\*\*\*\*:\*.\*\*\*:\*\*\*.\*\*\*:\*\*\*:\*\*\*:\*\*\*\*\*: \*\*.\*: .\*\*\*\*\*:\*\*\*.

TgRON8 SPTKVITTPVGTTPSHARSAMEGLTIWNLLPPLIDVHSVKTITIRVQAAKAFQAAKAAAAA  
NcRON8 SPTKVITTPVGTTPSHAKSALEGLTVWKLPLIKVHSVQTVTIKVQVAKFQTAKAAAAA  
\*\*\*\*\*:\*\*\*:\*\*\*:\*\*\*:\*\*\*\*\*.\*\*\*:\*\*\*:\*\*\*:\*\*\*.\*\*\* \*\* \*\*\*\*\*

TgRON8 EGTEGDSAGEPLSRPNKNEPAVRTKFKNKIPELPAAFKPRQRTVSEINGAPNPKLVIFVE  
NcRON8 EGAEAGAAGESATRP-KAAPEASTKFSNKLPLPAAFVPRQRDASEIEGGDPNLLIFLE  
\*\*:\*..:\*\*\*. \*\*: . \* .\*\*\*.\*\*\*:\*\*\*\*\* \*\*\*\* .\*\*\*:\*.\*\*\*:\*\*\*:\*\*\*:

TgRON8 QDGQKTIRFTFPSRVNDVVIGQSTVSVVLDALLPNPGTWHRTFWGALSPDGTSCKPTMEF  
NcRON8 QNGQTTIKFNLSRINDAVIGQSTVSRMLDVLPQPNSWHRIFWGLQT-DGRACRPTLEF  
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TgRON8 QYPHWLQTKMAELPVPNHSSCLLIREVSLNIKQRPNFFIKPYIFHSPLVIFALOGKQRI  
NcRON8 AYQHWLQTVSALPVPNQSTCLLIREVPLNIKQPPTFFPKPYIFHSPIVILALOGQKQTS  
\* \*\*\*\*\*: : \*\*\*\*\*:\*\*\*\*\*.\*\*\*\*\* \*.\*\* \*\*\*\*\*:\*\*\*:\*\*\*\*\*: : .

TgRON8 IFEEQVDPVAVTSQPLTALLEQLGIPKTLQDILQCSSTNIDAPGECPSDSSSTVDPETVI  
NcRON8 IYEEQVDPVAVTSQPVTVLLKQLGIPDQLGTVLQCSSTNIDAPGECPSGSSVTVDPETTV  
\*:\*\*\*\*\*:\*.\*\*\*:\*\*\*. \*\*.\*:\*\*\*\*\*:\*\*\*\*\*.\*\*\*.\*\*\*\*\*.:

TgRON8 PDAVATQSAFLVVTGKQKQAPGSFLQVLWRRQRRRNSIQKRITSH---  
NcRON8 LDTVATKSAFLIVNGK--EASGSFLQVLWRRQRLNAVRKRKASQEYI  
\*:\*\*\*:\*\*\*:\*.\*\* :\*.\*\*\*\*\* \*\*::\*\* :\*

*RON5 protein sequence:*

The entire RON5 coding region was determined by EST and cDNA sequencing, and was used to generate the protein sequence below.

MAEFTWRPLLMSLPKMIAFFHILLFSGALAAAAGSPAADLVASVQTVSNERKDL  
YARDTQPTARTGIDIGVSFTQQASGNARTFEIRQHSGGPPRPAPRRAAVADDIF  
GSEDFSPPMNVAGAPLRDMGVHFLECQATDGKIECTGQGAGARPPFFRGGVDP  
TEIHEIVQSRTVGPADYDEERPEQTPDYLSPTDVVTLQRFVSSANASNSPLLEDPV  
QVCLSRKPTYTCHLLHEFAATSVIVEESGNLVCEDKAPLTVAEKRKINDAVKA  
GRTPQATGGQSSRPPNPTVSPSKAGAAPQNAASRQPVSFVEQENSEASMPTANTE  
QASATTEDTKIASAATDSGDYGEAAAGESAQEGDRPPPYNPDADEAGVPRAVQE  
AYEEARPLQEATIDKFKQDAAAAEEAADHFAQVSAFNAMQSALTKISAGYHLR  
AGSHVVL SACKRLVEAVAANPPGPGTVIPLEELRMQLVATLTQDFALAQAFIDY  
AIHIVHSAIETLTPQMVANALLELSGIEELINHTARVKSRLAARGQDSPANVRKEI  
VQESFRQLKVELFQEIVTRVCELMDDPESFLKTVPIIVGTTPTAPLRTGGHLGADY  
IIHLRNDLCDVTASDAQIFPSAPADEGLQGFPRHNLGERLVGWMDVMARTKTAR  
KEVFKIIDFTKAKDVLLFASETWKARYATLQAPAAPAPSFYGITTSGRNVNDIM  
KSKFFDMYLHQSGFMKLQRHGNDNSRQRFMHRVTLLQNDGILPQLPLEADYEL  
MELNAAMQKNFVAANKSIFSRRAARHSKYGYLDLCDVACYQKIDRLHNDVMT  
NVFFSLDTTLMKIVAKVHRSYGIKAFQQLGARQHIIADPNLGMWARRLFVHW  
ASHNEVKMQGQKVVKNYENLRHGEFTLDTVRMRDALVRYTNMLKADPITR  
DLMSLVIHTWIHIRGVRNAAMGFKNSQKLNESMNASAIGAVFAKLWYESDISVV  
APHQELKPFGAPLASMALQIGFFLHTVVEEYKMSLLEKAGAQIKSWFVGMFQKN  
KRRTVPRTWKAVVAATNRAPKVNKAYQGALLVIKTLAKMFRERFLYRFYMQ  
GQGSKVDFTPTLLIHALVASWMDPSLDRLELSSRTIPNAKCLFWYYVWNENG  
PSNAATRIVLTGCKKYTFLLPGVVRVSTSTSEVVEAGSNILKIDKIILKRSSLEAY  
MNHLQATYDDPLTIVQVALDLAARCEGYSAAKDQPAQAMRGPARRATGEST  
TFTIRGGGVQGGTMSFVEAEADDERKEDSEDNTVDLSEQDQDSSFVQLKCLFNR  
RGSSAAGQAVQTDAQPLPKAVQTDAQPLPKVRRGGPDVDASAVILGSRFMLDL  
WCSKYRKMLVEKLSGISTKDATVMQQEISKVFSVSSIKIIPDYKDLWDFSLRC  
DWMDGYPDAAEKMRAARAEMVTYAMAKASTGKRLKRMLQKVR SWIRKKAFA  
AARKLKSLKNRISTAFGRGKPPKAKVPDWA VVNAGMGMWTGKVFSTHLTFNE  
DEM SCNGPHEPIRVM SWKQNHFTTFASSTNAERNYVLVKKGDDSHCWATREA  
LVHKGWSGIPVYQYAEPAGFWLQEVSPSNQPFVNWWDGYLTTSDNLTLDIDIN  
ASSDSLKSHAVMRIVDSNGKTIYQGPPGTGVVQTQGGVVTLSIRNLVSGVHSTG  
DSVEVRVTASGPQLTSVADLDTQFKEIPDLVLR