

S4 Fig. Characteristics of the extended C-terminal domain of *Rickettsia* RalF proteins.

All alignments were performed using MUSCLE (default parameters) [1]. (A) Sequence alignment of the variable sequence with Pro-rich region (VPR) and T4SS signal sequence (T4S) across select *Rickettsia* species. *Rickettsia* species are organized based on recent estimated phylogeny [2], with classification scheme as follows: red, ancestral group (AG); blue, transitional group (TRG); aquamarine, typhus group (TG); and brown, spotted fever group (SFG). *R. helvetica* and *R. tamrae* (black) are unclassified following recent recommendations [3]. Red circles denote full-length RalF_R proteins, with NCBI GenBank accession numbers for these proteins provided in [S2 Fig.](#) Accession numbers for all other proteins as follows: *Rickettsia canadensis* str. McKiel, YP_001492434; *R. tamrae*, WP_032139614; *R. helvetica*, WP_010423297; *R. akari* str. Hartford, YP_001493241; REIS (*Rickettsia* endosymbiont of *Ixodes scapularis*), EER21763; *Rickettsia* sp. ISO7, KDO03638; *R. monacensis* str. IrR/Munich, CDI29630; “*Candidatus Rickettsia amblyommii*” str. GAT-30V, YP_005365253; *R. aeschlimannii*, WP_032074125; *R. rhipicephali* str. 3-7-female6-CWPP, YP_005390352; *R. montanensis* str. OSU 85-930, YP_005392197; “*Candidatus Rickettsia gravesii*”, WP_017443103; *R. heilongjiangensis* str. 054, YP_004764228; *R. japonica*, WP_024704516; *R. honei*, WP_032850143 and WP_016916690; *R. philipii* str. 364D, YP_005300602; *R. rickettsii* str. Brazil, YP_005292780 and YP_005292779; *R. slovaca* str. D-CWPP, YP_005426261, YP_005426262 and YP_005426263; *R. conorii* str. Malish 7, NP_360145 and NP_360146; *R. parkeri* str. Portsmouth, YP_005392764; *R. sibirica*, WP_026054964. Multiple accession numbers for several species denote chimeras comprised of multiple fragments corresponding to the full-length VPR sequences; green highlighting demarcates the boundaries of the individual ORFs within these chimeras, with green dots depicting missing sequence. For several proteins, misaligned terminal residues were stitched back to their respective ends (shown in red), though their homology to these positions is doubtful. Above the alignment, the blue bar depicts the VPR, and the orange bar depicts the T4S. Gray shading illustrates the large deletion within the VPR of RalF proteins from TG rickettsiae. Purple shading depicts the Pro-rich region with the VPR, with Pro residues colored purple. (B) Alignment of the T4S across full-length RalF_R proteins. Conserved residues are highlighted yellow, with positively charged residues (Arg, His, Lys) colored blue. One conserved positively charged residue (-12 from the C-terminus) is highlighted blue. (C) The T4S does not affect RalF_{Rt} localization. HeLa cells expressing YFP tagged RalF_{RCTDAT4S} (green, described in [Fig. 2B](#)) were stained with Alexa Fluor 594 Phalloidin probe to label actin (red). DAPI (blue) is shown in the merged image. Cytoplasmic (C) and membrane (M) localization was confirmed via membrane fractionation of

HEK293T cells Lipofectamine 2000 transfected with the indicated plasmids followed by immunoblotting. Immunoblot: 1, primary Ab, rabbit anti-GFP (Life Technologies); 2, rabbit anti-Calnexin (Abcam); 3, mouse anti-GAPDH (Abcam). (D) Alignment of the C-terminal sequences across select RalF_L proteins. NCBI GenBank accession numbers for all proteins are provided in [S2 Fig.](#) For *L. pneumophila* subsp. *pneumophila* str. Philadelphia 1, the Leu residue at position -3 (relative to the C-terminus) is within a black box. This L372 residue has been shown to be critical for RalF translocation via the *dot/icm* T4SS [\[4\]](#). Unlike the C-terminal sequences of RalF_R proteins (panel B), the C-terminal sequences of RalF_L proteins are not conserved, with no other RalF_L sequences harboring a Leu or other hydrophobic residue at position -3, and only some sequences harboring a hydrophobic residue(s) in the terminal five aa positions (colored orange). (E) The VPR sequences across select *Rickettsia* species contain a predicted coiled-coil motif. Conserved residues are highlighted yellow, with residues within predicted coiled-coil motifs colored green. A consensus coiled-coil motif is depicted at the top of the alignment. Red arrows demarcate the region of the VPR that is absent from TG rickettsiae RalF proteins. Coiled-coil motifs were predicted using the COILS server [\[5\]](#). (F) Schema depicting the prototypical RalF_R protein. See text for further details. Alignments provided for the S7D ([S2 Fig.](#)), SCD ([S3 Fig.](#)) and extended C-terminal domain (VPR and T4S) (panel A) provide the delineations of these discrete domains. (G) Breakdown of the amino acid composition within four discrete regions (S7D, SCD, VPR, T4S) for six full-length RalF_R proteins. Within each region, amino acid frequencies were calculated and grouped into four major categories: non-polar/aliphatic (Ala, Gly, Ile, Leu, Met, Val), polar (Asn, Cys, Gln, Pro, Ser, Thr), aromatic (Phe, Trp, Tyr), positively charged (Arg, His, Lys), and negatively charged (Asp, Glu). While non-polar, proline was considered polar since it is typically solvent-exposed, despite having an aliphatic side chain.

References

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doi:10.1073/pnas.0406239101
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A

● <i>R. bellii</i> RML369-C	356	HN--KIKETTAKVQQADPEIPDTKSIPLASETNFQDLKEAEIGIQPAKT-----QPVEPKFKNTPAEELAWRNAQKKQAIDTPVTKNEEPKAQIDNHKKRL
● <i>R. bellii</i> OSU 85-389	356	HN--KIKETTAKVQQADPEIPDTKSIPLASETNFQDLKEAEVGIGIQPAKT-----QPVEPKFKNTLVEELAWRNAQKKQAIDTPVTKNEEPKAQIDNHKKRL
<i>R. canadensis</i> McKiel	...	-----
<i>R. tamrae</i>	...	-----
<i>R. helvetica</i>	...	-----
● <i>R. australis</i> Cutlack	359	HK--NIKEITAIVQQTNQOYPE--KPLASAKSFEDLTQAEIGIKPVEILIKSSSQVPEVKPFNSFIEELAWKSQRKQNIDTPISQNKEPKIQTDNHAKIL
● <i>R. akari</i> Hartford	362	HK--NIKEITEIVQQTNQOYPE--KPLASKEIFEDLTQAEIGIKPVEILIKSSSQVVKPFNSFIEELAWSAQRKQNVDTPINQNKEPKIQTDNHAKVL
<i>R. akari</i> Hartford	...	-----
● <i>R. felis</i> URRWXCal2	363	HK--NIKEITEIVQQTNQOYPE--KPLASAKSFEDLTQAEIGIKPIEILIKSSSQVPEVKPFNSFIEELAWNAQRQQNIDTPISQNKEPKIQTDNHAKIL
● <i>R. typhi</i> Wilmington	359	HK--NIK--TEVVYQ-----
● <i>R. prowazekii</i> Madrid_E	363	HK--NIKYITEIVHQ-----
● <i>R. prowazekii</i> GvV257	359	HK--NIKYITEIVHQ-----
● <i>R. prowazekii</i> Chernikova	359	HK--NIKYITEIVHQ-----
REIS	11	HK--NIQEITKDLRKHDPOIPDTSKKPLASRENFEDLIHSNLG-----KPVRSKPLS--FDEELKKVQSROVKDSSEQQTKITEEKIDNHAKRI
<i>Rickettsia</i> sp. ISO7	7	HK--NIQEITKDLRKHDPOIPDTSKKPLASRENFEDLIHSNLG-----KPVRSKPLS--FDEELKKVQSROVKDSSEQQTKITEEKIDNHAKRI
<i>R. monacensis</i> IrR/Munich	7	HK--NIQEITKDLRKHDPOIPDTSKKPLASRENFEDLIHSNLG-----KPVRSKPLS--FDEELKKVQSROVKDSSEQQTKITEEKIDNHAKRI
<i>Candidatus R. amblyommii</i> GAT-30V	11	HK--NIQEITKDLRKHDPOIPDTSKKPLASRENFEDLIHSNLG-----KPVRSKPLS--FDEELKKVQSROVKDSSEQQTKITEEKIDNHAKRI
<i>R. aeschlimannii</i>	7	HK--NIQEITKDLRKHDPOIPDTSKKPLASRENFEDLIHSNLG-----KPVRNKPLA--FDEELKKVQSROVKDSSEQQTKITEEKIDNHAKRI
<i>R. rhipicephali</i> 3-7-female6-CWPP	7	HK--NIQEITKDLRKHDPOIPDTSKKPLASRENFEDLIHSNLG-----KPVRNKPLA--FDEELKKVQSROVKDSSEQQTKITEEKIDNHAKRI
<i>R. montanensis</i> OSU 85-930	7	HK--NIQEITKDLRKHDPOIPDTSKKPLASRENFEDLIHSNLG-----KPVRNKPLS--FDEELKKVQSROVKDSFERQTKSTEENIDNHAKRI
<i>Candidatus R. gravesii</i>	11	HKNIQNIQEITKDLRKHDPOIPDTSKKPLASRENFEDLIHSNLG-----KPVRNKPLS--FDEELKKVQSROVKDSFEQQTKSTEENIDNHAKRI
<i>R. heilongjiangensis</i> 054	7	NK--NIQEITKGLRKHDPOIPDTSKKPLASRENFDDLIHSNLG-----QPVRNKPLS--FDEELKKVQSROVQDFSEQQTKSTEENIDNHAKRI
<i>R. japonica</i>	7	NK--NIQEITKGLRKHDPOIPDTSKKLLASRENFDGLIHSNLG-----QPVRNEPLS--FDEELKKVQSROVQDFSEQQTKSTEENIDNHAKRI
<i>R. honei</i>	11	HK--NIQEITKDLRKHDPOIPDTSKKTLASRENFDDLIHSNLG-----QPVRNKPLS--FDEEVKKVQSROQIQLDSFEQQTKSTEEEIDNHAKRI
<i>R. philippii</i> 364D	...	-----
<i>R. rickettsii</i> Brazil	7	HK--NIQEITKDLRKHDPOIPDTSKKPLASRENFDDLIHSNLG-----QPVRNKPLS--FDEELKKVQSROVQDFEPOTKSTEENIDNHAKRI
<i>R. slovaca</i> D-CWPP	7	HK--NIQEITKDLRKHDPOIPDTSKKPLASRENFDDLIHSNLG-----QPVRNKPLS--FDEELKKVQSROVQDFEPOTKSTEENIDNHAKRI
<i>R. conorii</i> Malish_7	11	YK--NIQEITKDLRKHDPOIPDASKKPLASRENFDDLIHSNLG-----QPVRNKPLS--FDEELKKVQSROVQDFEPOTKSTEENIDNHAKRI
<i>R. parkeri</i> Portsmouth	...	-----
<i>R. sibirica</i>	...	-----

● <i>R. bellii</i> RML369-C	EELKQKQEDLENKKLEEKKANSNITKEEKWRIVAELEGVTKHLESIKKEHTINTAEEREKFQF-NKSSQSSALKGEPTAADKQQQAAMELIRLRLKEQRLQKEAASKAI
● <i>R. bellii</i> OSU 85-389	EELKQKQEDLENKKLEEKKANSNITKEEKWRIVAELEGVTKHLESIKKEHTINTAEEREKFQF-NKSSQSSALKGEPTAADKQQQAAMELIR-LRKQRLQEEAASKAI
<i>R. canadensis</i> McKiel	-----
<i>R. tamrae</i>	MKEEKIKQQQA-EAV
<i>R. helvetica</i>	MKEEKIKQQQA-EAV
● <i>R. australis</i> Cutlack	EELKQKQKELEDKKKGLEEKKSNSNITREERWKVIAELESINNOQFKAIEKVKYNTINSADREKKFDNKNNPASPPTKGEPTAADLQQQGALAAIKRMKEEKIKQQQA-EAV
● <i>R. akari</i> Hartford	EELKQKQKALEDKKKGLEEKKSNSNITREERWKVIAELESINNOQFQAIKEYNIINSASDREKKFDNKNNPSSPTKGAPTAADLQQQGALAAIKRMKEEKIKQQQA-EAA
● <i>R. akari</i> Hartford	-----MVGTIAIKRMKEEKIKQQQA-EAA
● <i>R. felis</i> URRWXCal2	EELKQKQKELEDKKKGLEEKKANSNITREERWKVIAELESINNOQFKAIEKERSNINSASDREKKFDNKNNPSSPTKGAPTAADLQQQGALAAIKRMKEEKIKQQQA-EAT
● <i>R. typhi</i> Wilmington	-----I
● <i>R. prowazekii</i> Madrid_E	-----I
● <i>R. prowazekii</i> GvV257	-----I
● <i>R. prowazekii</i> Chernikova	-----I
REIS	EELKQKQKELEDRKKGLEEKKL I LILLEKKDGKSLQN-----
<i>Rickettsia</i> sp. ISO7	EELKQKQKELEDRKKGLEEKKL I LILLEKKDGKSLQN-----
<i>R. monacensis</i> IrR/Munich	EELKQKQKELEDRKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAVIKRMKEEKIKQQQA-EAV
<i>Candidatus R. amblyommii</i> GAT-30V	-----
<i>R. aeschlimannii</i>	EELKQKQKELEERKKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAAIKRMKEEKIKQQQA-EVV
<i>R. rhipicephali</i> 3-7-female6-CWPP	EELKQKQKELEERKKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAAIKRMKEEKIKQQQA-EAV
<i>R. montanensis</i> OSU 85-930	EELKQKQKELEERKKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAAIKRMKEEKIKQQQA-EAV
<i>Candidatus R. gravesii</i>	EELKQKQKELEERKKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAAIKRMKEEKIKQQQA-EAV
<i>R. heilongjiangensis</i> 054	EELKQKQKELEERKKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAAIKRMKEEKIKQQQA-EAV
<i>R. japonica</i>	EELKQKQKELEERKKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAAIKRMKEEKIKQQQA-EAV
<i>R. honei</i>	EELKQKQKELEERKKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAAIKRMKEEKIKQQQA-EAV
<i>R. philippii</i> 364D	-----MKEEKIKQQQA-EAV
<i>R. rickettsii</i> Brazil	EELKQKQKELEERKKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAAIKRMKEEKIKQQQA-EAV
<i>R. slovaca</i> D-CWPP	EELKQKQKELEERKKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAAIKRMKEEKIKQQQA-EAV
<i>R. conorii</i> Malish_7	EELKQKQKELEERKKKGLEEKKANSNITREERWKVIAELEAINNQFKAIEKEHNTINSASDREKKFDNKHLTSTKREPTAADLQQQGALAAIKRMKEEKIKQQQA-EAV
<i>R. parkeri</i> Portsmouth	-----
<i>R. sibirica</i>	-----

A (cont'd.)

- *R. bellii* RML369-C
 - *R. bellii* OSU 85-389
 - *R. canadensis* McKiel
 - *R. tamraue*
 - *R. helvetica*
 - *R. australis* Cutlack
 - *R. akari* Hartford
 - *R. akari* Hartford
 - *R. felis* URRWXCal2
 - *R. typhi* Wilmington
 - *R. prowazekii* Madrid E
 - *R. prowazekii* GvV257
 - *R. prowazekii* Chernikova

REIS
Rickettsia sp. ISO7
R. monacensis IrR/Munich
Candidatus R. amblyommiae GAT-30W
R. aeschlimannii
R. rhipicephali 3-7-female6-CWPP
R. montanensis OSU 85-930
Candidatus R. gravesii
R. heilongjiangensis 054
R. japonica
R. honei
R. philippii 364D
R. rickettsii Brazil
R. slovaca D-CWPP
R. conorii Malish_7
R. parkeri Portsmouth
R. sibirica

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- *R. tamraue*
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- *R. australis* Cutlack
- *R. akari* Hartford
- *R. akari* Hartford
- *R. felis* URRWXCal2
- *R. typhi* Wilmington
- *R. prowazekii* Madrid_E
- *R. prowazekii* GvV257
- *R. prowazekii* Chernikova

- Rickettsia* sp. ISO7
- R. monacensis* IrR/Munich
- Candidatus R. amblyommii* GAT-30V
- R. aeschlimannii*
- R. rhipicephali* 3-7-female6-CWPP
- R. montanensis* OSU 85-930
- Candidatus R. gravesii*
- R. heilongjiangensis* 054
- R. japonica*
- R. honei*
- R. philippii* 364D
- R. rickettsii* Brazil
- R. slovaca* D-CWPP
- R. conorii* Malish_7
- R. parkeri* Portsmouth
- R. sibirica*

P			
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B

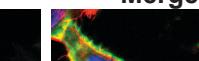
R. bellii RML369-C
R. bellii OSU 85-389

R. australis Cutlack
R. akari Hartford
R. felis URRWXCal2

R. typhi Wilmington
R. prowazekii Madrid_E
R. prowazekii GvV257
R. prowazekii Chernikova

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AIPPKLQ-ETLKTIQTTQDGNKQOGNNNFQDDLRKTLARRNSPTR
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NIVKKEAQDIGKQIPOQEGDKHKEGLVAKAMEAQRKIEKQNSGRGM
NIVKKEAKDIGKQIPOQERDKNKEGLAKAMEAQRKIEID---TGRGM
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NVVKAAKADISKQIPIHERDKHKEELAKALEIQRRKIEKQNSGRVV
NVVKAAKADISKQIPIHERDKHKEELAKALEIQRRKIEKQNSGRVV
NVVKAAKADISKQIPIHERDKHKEELAKALEIQRRKIEKQNSGRVV

C

	Phalloidin	YFP	Merge	C M
Rt CTD ΔT4S				 1 2 3

D

<i>L. shakespeare</i>	-----EQI-----PRESOPEIGNINTPRO-----
<i>L. moravica</i>	STWKSEI-----GEEREAIKQDDSQRTQMOLK-----
<i>L. p. p. Philadelphia 1</i>	----EGV-----PKDPDAEMQKEGRQWKF-----
<i>L. p. Corby</i>	----GAM-----FRTPNAEQQETSKSATKLNTDYDINEDTETIKDESKSSYK-----
<i>L. p. Lens</i>	----GSI-----FRTPNAEQRETRTSKSATRTVNTDYDINEDTVTRKDESRSSSYK-----
<i>L. p. Paris</i>	----GSM-----FRKPNAEQQETSKSATRLNTDYDINEDTVTRKDESRSSSYK-----
<i>L. p. Leg01/11</i>	----GSM-----FRKPNAEQQETSKSATRLNTDYDINEDTVTRKDESRSSSYK-----
<i>L. longbeachae NSW150</i>	----EKLFFFQRPCSEDNKEELMKSNGLK-----
<i>L. sainthelensi</i>	----EKLFFFQRPSKENTQEELMKANEKHNH-----

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E

<i>R. bellii</i> RML369-C	HNKIK----ETTAKVQQADPEIPDTKSIPLASETNQDLKEAEIGIQPAK-----TQPVE
<i>R. bellii</i> OSU 85-389	HNKIK----ETTAKVQQADPEIPDTKSIPLASETNQDLKEAEVGIQPAK-----TQPVE
<i>R. australis</i> Cutlack	HKNIK----EITAIVQQTNQQIPE---KPLASAKESFEDLTQAEIGIKPVEILIKSSSQPVE
<i>R. akari</i> Hartford	HKNIK----EITEIVQQTNQQIPE---KPLASAKEI FEDLTQAEIGIKPVEILIKSSYQQVKE
<i>R. felis</i> URRWXCa12	HKNIK----EITEIVQQTNQQIPE---KPLASAKESFEDLTQAEIGIKPIEILIKSSSQPVE
<i>R. monacensis</i> IrR/Munich	HKNIQ----EITKDLRKHDQPIPDTSKKPLASRENFEDLIHSIDLG-KPVR-----SKPL-
<i>R. aeschlimannii</i>	HKNIQ----EITKDLRKHDQPTDTSKKPLASRENFEDLIHSIDLG-KPVR-----NKPL-
<i>R. rhipicephali</i> 3-7-female6-CWPP	HKNIQ----EITKDLRKHDQPIPDTSKKPLASRENFEDLIHSIDLG-KPVR-----NKPL-
<i>R. montanensis</i> OSU 85-930	HKNIQ----EITKDLRKHDQPIPDTSKKPLASRENFEDLIHSIDLG-KPVR-----NKPL-
<i>Candidatus R. gravisii</i>	HKNIQNIQE EITKNLRKHDQPTDTSKKPLASRENFEDLIHSIDLG-KPVR-----NKPL-
<i>R. heilongjiangensis</i> 054	NKNIQ----EITKGLRKHDQPIPDGTGKKPLASRENFDDLIHSIDLG-QPVR-----NKPL-
<i>R. japonica</i>	NKNIQ----EITKGLRKHDQPIPDTSKKLLASRENFDGLIHSIDLG-QPVR-----NEPL-

<ul style="list-style-type: none"> ● <i>R. bellii</i> RML369-C ● <i>R. bellii</i> OSU 85-389 ● <i>R. australis</i> Cutlack ● <i>R. akari</i> Hartford ● <i>R. felis</i> URRWXCal2 <p><i>R. monacensis</i> IrR/Munich <i>R. aeschlimannii</i> <i>R. rhipicephali</i> 3-7-female6-CWPP <i>R. montanensis</i> OSU 85-930 <i>Candidatus R. gravisii</i> <i>R. heilongjiangensis</i> 054 <i>R. japonica</i></p>	KPKFNTPAEELAWRNAOKKQAIIDTPVTKNEEPKAQI DNHKRLEELKQKQEDLENKKGL KPKFNTLVEELAWRNAOKKQAIIDTPVTKNEEPKAQI DNHKRLEELKQKQEDLENKKGL KPKFNSFIEELAWKSQVRQNIDTPISQNKEPKIQ TDNHAKILEELKQKQKELEDKKGL KPKFNSFIEELAWKSAQRQCNVDTPINQNKEPKIQ TDNHAKVLEELKQKQALEDDKKGL KPKFNSFIEELAWKNAQRORNIIDTPISQNKESKI TDNHAKILEELKQKQKELEDKKGL -----SFDEELK-KKVOSRQVKDSSEQ TKITEEKIDDNHAKRIEELKQKQKELEDRKKGL -----AFDEELK-KKVOSRQVKDSFEQQ TKSTEEKIDDNHAKRIEELKQKQKELEERKKGL -----AFDEELK-KKVQIROVKDSFEQQ TKSTEEKIDDNHAKRIEELKQKQKELEERKKGL -----SFDEELK-KKVOSRQVKDS KDSFEROTKSTEEKIDDNHAKRIEELKQKQKELEERKKGL -----SFDEELK-KKVOSRQVKDSFEQQ TKSTEEKIDDNHAKRIEELKQKQKELEERKKGL -----SFDEELK-KKVOSRQVQDSFEQQ TKSTEEKIDDNHAKRIEELKQKQKELEERKKGL -----SFDEELK-QKVOSRQVQDSFEQQ TKSTEEKIDDNHAKRIEELKQKQKELEERKKGL
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<ul style="list-style-type: none"> ● <i>R. bellii</i> RML369-C ● <i>R. bellii</i> OSU 85-389 ● <i>R. australis</i> Cutlack ● <i>R. akari</i> Hartford ● <i>R. felis</i> URRWXCal2 	<i>R. monacensis</i> IrR/Munich <i>R. aeschlimannii</i> <i>R. rhipicephali</i> 3-7-female6-CWPP <i>R. montanensis</i> OSU 85-930 <i>Candidatus R. gravesii</i> <i>R. heilongjiangensis</i> 054 <i>R. japonica</i>	CCCCCCCCCC E E K K A N S N I T KEEKW R I V A E L E G V T K H L E S I K K E H N T I N T A E E R E R K F - N K S S Q S S A I L K G E E K K A N S N I T KEEKW R I V A E L E G V T K H L E S I K K E H N T I N T A E E R E R K F - N K S S Q S S A I L K G E E K K S N S N I T REER W K I V A E L E S I N N Q F K A I E K V Y N T I N S A A D R E K K F D N K N N P A S P T K G E E K K S N S N I T REER W K I V A E L E S I N N Q F Q A I E K E Y N I I N S A S D R E K K F D N K N N P S S P T K G E E K K A N S N I T REER W K I V A E L E S I N N Q F K A I E K E R S N I N S A S D R E K K F D N K N N P S S P T K G E E K K A N S N I T REER W K I V A E L A I N N Q F K A I E K E H N T I N S A S D R E K K F D Y K N K H L T S T K R E E K K A N S N I T REER W K I A A E L K A I N N Q F K A I E K E H N T I N S A S D R E K K F D N K N K H L T S T K R E E K K A N S N I T REER W K I A A E L E A I N N Q F K A I E K E H N T I N S A S D R E K K F D N K N K H L T S T K R E E K K A N S N I T REAR W K I A A E L E A I N N Q F K A I E K E H N T I N S A S D R E K K F D N K N K H L T S T K R E E K K A N S N I T R D E R W K I A A E L E A I N N Q F K A I E K E H N T I N S A S D R E K K F D N K N K H L T S T K R E E K K A N S N I T REER W K I A A E L E A I N N Q F K A I E K E H N T I N S A S D R E Q K F D N K N K Y L T S T K R E E K K A N S N I T REER W K I A A E L E A I N N Q F K A I E K E H N T I N S A S D R E Q K F D N K N K Y L T S T K R
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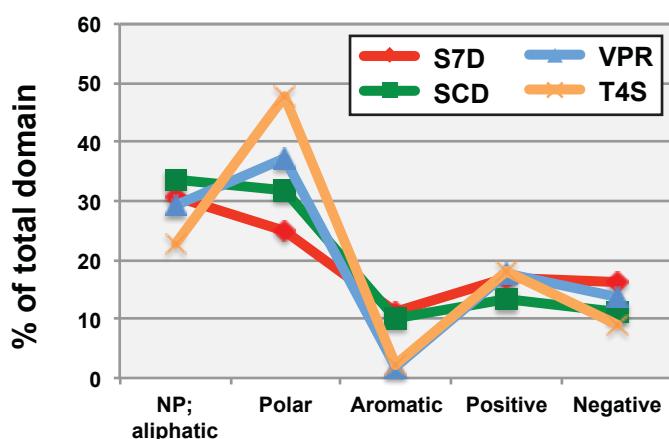
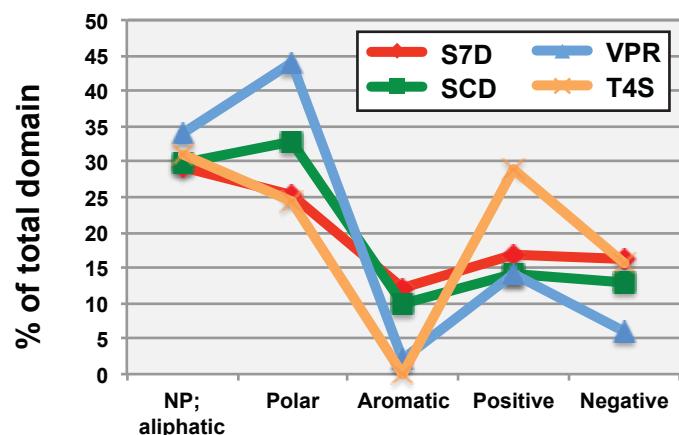
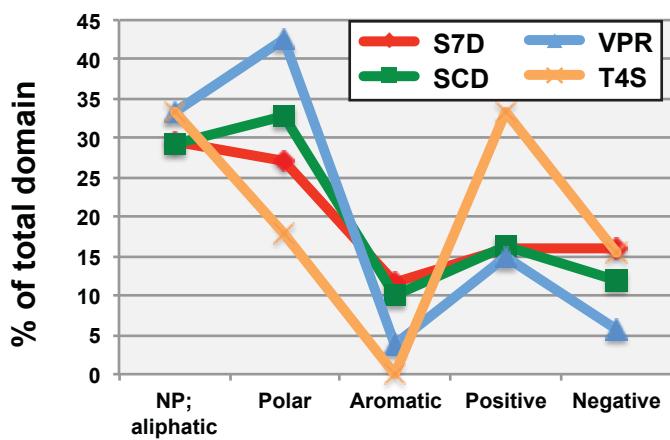
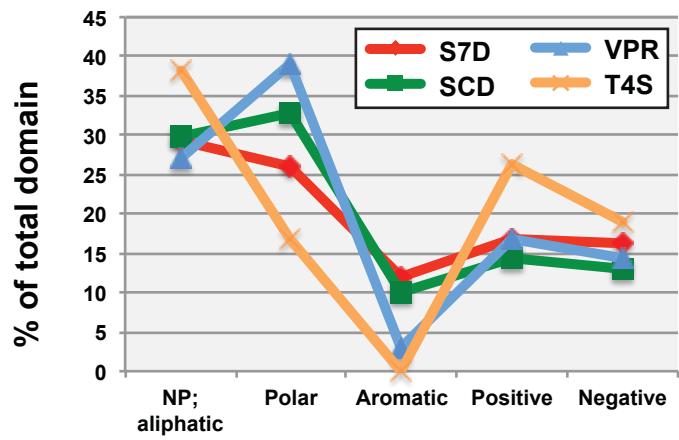
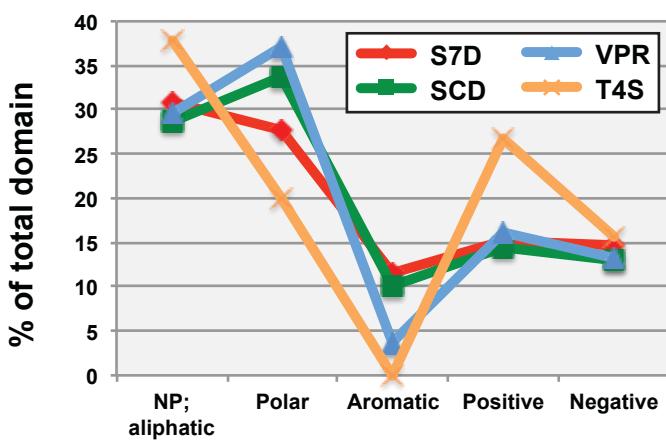
E E K K A N S N I T R E E R W K I A A E L E A I N N O F K A I E K E H N T I N S A S D R E Q K F D N K N Y L T S T E

<ul style="list-style-type: none"> ● <i>R. bellii</i> RML369-C ● <i>R. bellii</i> OSU 85-389 ● <i>R. australis</i> Cutlack ● <i>R. akari</i> Hartford ● <i>R. felis</i> URRWXCal2 <p><i>R. monacensis</i> IrR/Munich <i>R. aeschlimannii</i> <i>R. rhipicephali</i> 3-7-female-6-CWPP <i>R. montanensis</i> OSU 85-930 <i>Candidatus R. gravesii</i> <i>R. heliongjiangensis</i> 054 <i>R. japonica</i></p>	<pre>EPTAACDLQQQAAAMELIRLRKEQLQKEAASKAIIA EPTAACDLQQQAAAMELIR-LRKQRQLQEEAAASKAIIA EPTAACDLQQQGALAAIKRMKEEKIKQQQA-EAVNQ EPTAACDLQQQGALAAIKRMKEEKIKQQQA-EAANQ EPTAACDLQQQGALAAIKRMKEEKIKQQQA-EATNC EPTAACDLQQQGALAVIKRMKEEKIKQQQA-EAVNQ EPTAACDLQQQGALAAIKRMKEEKIKQQQA-EVNQG EPTAACDLQQQGALAAIKRVKEEKIKQQQA-EAVNQ EPTAACDLQQQGALAAIKRMKEEKIKQQQA-EAVNQ EPTAACDLQQQGALAAIKRMKEEKIKQQQA-EAVNQ EPTAACDLQQQGALAAIKRMKEEKIKQQQA-EAVNQ EPTAACDLQQQGALAAIKRMKEEKIKQQQA-EAVNQ</pre>
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R. bellii str. RML369-C*R. typhi* str. Wilmington*R. prowazekii* str. Madrid E*R. felis* str. URRWXCal2*R. akari* str. Hartford*R. australis* str. Cutlack