

Supporting Information

***Ascaris suum* Informs Extrasynaptic Volume Transmission in Nematodes**

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Table S1. The modulatory effects of As-PCF on *Ascaris suum* ovijector tissue preparations.

| Test | Time (p.a.) | Contraction freq. (% 0 min, 2 min prior to min p.a.) | Contraction ampl. (% 0 min, 2 min prior to min p.a.) | Change in tension (mg/mm, 5 min p.a.) |
|---|-----------------------|---|---|---|
| 4 µl As-PCF n=7 | 10 secs | N/A | N/A | Sht 0.002±0.01 |
| | 20 secs | N/A | N/A | Sht 0.001±0.01 |
| | 30 secs | N/A | N/A | Lng -0.02±0.01 |
| | 50 secs | N/A | N/A | Lng -0.02±0.01 |
| | 70 secs | N/A | N/A | Lng -0.001±0.02 |
| | 2 min | ↓ 58.16±12.33 ✓ | ↓ 96.25±7.177 × | Sht 0.04±0.05 |
| | 5 min | ↓ 10.57±7.699 ✓ | ↓ 23.85±17.36 ✓ | Sht 0.08±0.05 |
| | 10 min | ↓ 3.810±3.810 ✓ | ↓ 16.21±16.21 ✓ | Sht 0.11±0.06 |
| | OVERALL | P<0.0001, F=43.61 | P=0.0151, F=3.647 | NS |
| 40 µl As-PCF n=7 | 10 secs | N/A | N/A | Lng -0.02±0.04 |
| | 20 secs | N/A | N/A | Lng -0.05±0.05 |
| | 30 secs | N/A | N/A | Lng -0.08±0.08 |
| | 50 secs | N/A | N/A | Lng -0.08±0.10 |
| | 70 secs | N/A | N/A | Sht 0.05±0.09 |
| | 2 min | ↓ 46.48±9.588 ✓ | ↑ 131.1±23.72 × | Sht 0.10±0.07 |
| | 5 min | ↓ Ceased ✓ | ↓ Ceased ✓ | Sht 0.15±0.05 |
| | 10 min | ↓ Ceased ✓ | ↓ Ceased ✓ | Sht 0.20±0.06 |
| | OVERALL | P<0.0001, F=98.56 | P<0.0001, F=32.80 | NS |
| 4 µl SB (As-FLP-18A) n=6 | 10 secs | N/A | N/A | 0.00±0.00 |
| | 20 secs | N/A | N/A | Lng -0.01±0.01 |
| | 30 secs | N/A | N/A | Lng -0.06±0.04 |
| | 50 secs | N/A | N/A | Lng -0.13±0.07 |
| | 70 secs | N/A | N/A | Lng -0.11±0.07 |
| | 2 min | ↓ 43.00±5.223 ✓ | ↑ 154.5±19.98 | Lng -0.04±0.06 |
| | 5 min | ↓ 8.730±7.817 ✓ | ↓ 81.52±70.6 | Sht 0.03±0.04 |
| | 10 min | ↓ Ceased ✓ | ↓ Ceased | Sht 0.05±0.04 |
| | OVERALL | P<0.0001, F=91.35 | NS | NS |
| 40 µl SB (As-FLP-18A) n=3 | 10 secs | N/A | N/A | Lng -0.26±0.08 |
| | 20 secs | N/A | N/A | Lng -0.26±0.08 |
| | 30 secs | N/A | N/A | Lng -0.23±0.09 |
| | 50 secs | N/A | N/A | Lng -0.22±0.09 |
| | 70 secs | N/A | N/A | Lng -0.20±0.10 |
| | 2 min | ↓ 6.754±0.8874 ✓ | ↑ 389.2±171.3 | Lng -0.18±0.12 |
| | 5 min | ↓ Ceased ✓ | ↓ Ceased | Lng -0.10±0.10 |
| | 10 min | ↓ Ceased ✓ | ↓ Ceased | Lng -0.04±0.07 |
| | OVERALL | P<0.0001, F=12186 | NS | NS |
| 4 µl SA (As-FLP-18A) n=5 | 10 secs | N/A | N/A | Lng -0.01±0.01 |
| | 20 secs | N/A | N/A | Lng -0.02±0.01 |
| | 30 secs | N/A | N/A | Lng -0.03±0.02 |
| | 50 secs | N/A | N/A | Lng -0.04±0.04 |
| | 70 secs | N/A | N/A | Lng -0.002±0.05 |
| | 2 min | ↓ 84.28±15.31 × | ↑ 119.3±15.54 × | Sht 0.008±0.06 |
| | 5 min | ↓ 52.98±25.80 × | ↓ 68.72±19.68 × | Sht 0.04±0.06 |

| | | | | |
|--|---------------------------------------|--------------------------|--------------------------|-----------------|
| | 10 min | ↓ 34.48±21.11 ✓ | ↓ 35.89±22.41 ✓ | Sht 0.05±0.04 |
| | OVERALL | P=0.0149, F=5.285 | P=0.0070, F=6.595 | NS |
| 40 µl SA (As-FLP-18A) n=4 | 10 secs | N/A | N/A | Sht 0.03±0.06 |
| | 20 secs | N/A | N/A | Sht 0.02±0.07 |
| | 30 secs | N/A | N/A | Lng -0.001±0.09 |
| | 50 secs | N/A | N/A | Sht 0.05±0.07 |
| | 70 secs | N/A | N/A | Sht 0.07±0.05 |
| | 2 min | ↓ 37.85±22.51 ✓ | ↓ 41.31±23.90 ✓ | Sht 0.09±0.04 |
| | 5 min | ↓ Ceased ✓ | ↓ Ceased ✓ | Sht 0.11±0.02 |
| | 10 min | ↓ 3.125±3.125 ✓ | ↓ 16.90±16.90 ✓ | Sht 0.10±0.02 |
| | OVERALL | P=0.0004, F=17.29 | P=0.0025, F=10.68 | NS |
| | Negative control (n=3) | 10 secs | N/A | N/A |
| 20 secs | | N/A | N/A | N/A |
| 30 secs | | N/A | N/A | N/A |
| 50 secs | | N/A | N/A | N/A |
| 70 secs | | N/A | N/A | N/A |
| 2 min | | ↑ 100.36±8.567 | ↑ 103.70±4.436 | 0 |
| 5 min | | ↑ 112.02±5.802 | ↓ 92.63±5.689 | 0 |
| 10 min | | ↑ 116.97±14.66 | ↓ 88.94±8.705 | Lng -0.011±0.01 |
| OVERALL | | NS | NS | NS |

% 0 min, values presented as percentage of that recorded at time 0; p.a., post-addition; ↓, denotes decrease; ↑, denotes increase; ×, denotes non-significant Dunnett's post hoc test; ✓, denotes significant Dunnett's post hoc test; NS, not significant; Sht, shortening of tissue; Lng, lengthening of tissue.

Table S2. The modulatory effects of synthetic As-FLP-18A on *Ascaris suum* ovijector tissue preparations.

| Test | Time (p.a.) | Contraction freq. (% 0 min, 2 min prior to min p.a.) | Contraction ampl. (% 0 min, 2 min prior to min p.a.) | Change in tension (mg/mm, 5 min p.a.) |
|-------------------------------|-----------------------|---|---|---|
| 10 μM | 10 secs | N/A | N/A | 0.00 \pm 0.00 \times |
| As-FLP-18A n=13 | 20 secs | N/A | N/A | Sht +0.01 \pm 0.01 \times |
| | 30 secs | N/A | N/A | Lng -0.07 \pm 0.04 \times |
| | 50 secs | N/A | N/A | Sht +0.05 \pm 0.02 \checkmark |
| | 70 secs | N/A | N/A | Sht +0.09 \pm 0.03 \checkmark |
| | 2 min | \downarrow 52.32 \pm 9.931 \checkmark | \uparrow 111.4 \pm 11.55 \times | Sht +0.12 \pm 0.02 \checkmark |
| | 5 min | \downarrow 5.015 \pm 3.097 \checkmark | \downarrow 24.33 \pm 14.28 \checkmark | Sht +0.13 \pm 0.01 \checkmark |
| | 10 min | \downarrow 4.872 \pm 3.897 \checkmark | \downarrow 11.51 \pm 8.354 \checkmark | Lng -0.03 \pm 0.02 \checkmark |
| | OVERALL | | P<0.0001, F=67.76 | P<0.0001, F=25.54 |
| 1 μM | 10 secs | N/A | N/A | 0.00 \pm 0.00 |
| As-FLP-18A n=6 | 20 secs | N/A | N/A | 0.00 \pm 0.00 |
| | 30 secs | N/A | N/A | Lng -0.11 \pm 0.07 |
| | 50 secs | N/A | N/A | Lng -0.13 \pm 0.08 |
| | 70 secs | N/A | N/A | Lng -0.14 \pm 0.08 |
| | 2 min | \downarrow 83.01 \pm 16.35 \times | \uparrow 126.2 \pm 18.34 | Sht +0.02 \pm 0.06 |
| | 5 min | \downarrow 47.66 \pm 18.09 \times | \uparrow 102.7 \pm 30.34 | Sht +0.03 \pm 0.03 |
| | 10 min | \downarrow 34.08 \pm 16.39 \checkmark | \uparrow 119.0 \pm 34.18 | Sht +0.002 \pm 0.02 |
| | OVERALL | | P=0.0489, F=3.521 | NS |
| 0.1 μM | 30 secs | N/A | N/A | Lng -0.002 \pm 0.002 \times |
| As-FLP-18A n=6 | 2 min | \downarrow 95.42 \pm 21.06 \times | \uparrow 130.3 \pm 12.89 \times | Lng -0.27 \pm 0.002 \checkmark |
| | 5 min | \uparrow 128.8 \pm 11.92 \times | \uparrow 167.7 \pm 26.43 \times | Lng -0.28 \pm 0.07 \checkmark |
| | 10 min | \uparrow 104.1 \pm 18.30 \times | \uparrow 224.5 \pm 56.79 \checkmark | Lng -0.20 \pm 0.07 \times |
| | OVERALL | | P=0.3250, F=1.282 | P=0.0340, F=4.025 |
| 0.01 μM | 30 secs | N/A | N/A | Lng -0.04 \pm 0.03 |
| As-FLP-18A n=6 | 2 min | \uparrow 116.3 \pm 11.68 | \uparrow 111.4 \pm 13.26 | Lng -0.07 \pm 0.03 |
| | 5 min | \uparrow 109.6 \pm 11.67 | \uparrow 152.8 \pm 41.98 | Lng -0.08 \pm 0.04 |
| | 10 min | \downarrow 92.57 \pm 10.62 | \uparrow 154.2 \pm 45.03 | Lng -0.05 \pm 0.05 |
| | OVERALL | | NS | NS |
| 1 nM | 30 secs | N/A | N/A | Lng -0.01 \pm 0.01 |
| As-FLP-18A n=6 | 2 min | \uparrow 104.3 \pm 6.685 | \downarrow 92.52 \pm 7.007 | Sht +0.01 \pm 0.01 |
| | 5 min | \downarrow 90.13 \pm 6.395 | \downarrow 97.22 \pm 5.835 | Sht +0.01 \pm 0.01 |
| | 10 min | \downarrow 83.74 \pm 7.552 | \uparrow 105.5 \pm 5.656 | Sht +0.03 \pm 0.01 |
| | OVERALL | | NS | NS |
| -ve control (n=3) | 30 secs | N/A | N/A | N/A |
| | 2 min | \downarrow 96.97 \pm 3.030 | \downarrow 97.72 \pm 3.249 | 0 \pm 0.00 |
| | 5 min | \uparrow 101.96 \pm 1.961 | \downarrow 91.04 \pm 2.207 | 0 \pm 0.00 |
| | 10 min | \uparrow 109.16 \pm 1.911 | \downarrow 82.40 \pm 5.482 | 0 \pm 0.00 |
| OVERALL | | NS | NS | NS |

% 0 min, values presented as percentage of that recorded at time 0; p.a., post-addition; \downarrow , denotes decrease; \uparrow , denotes increase; \times , denotes non-significant Dunnett's post hoc test; \checkmark , denotes significant Dunnett's post hoc test; NS, not significant; Sht, shortening of tissue; Lng, lengthening of tissue.

Figure S1. Alignment of FMRF-amide like peptide 18 (FLP-18) sequelogs

| | 1 | 150 |
|-------------------------|-----|-------|
| A. caninum-FLP-18 | (1) | ----- |
| A. ceylanicum-FLP-18 | (1) | ----- |
| A. duodenale-FLP-18 | (1) | ----- |
| S. vulgaris-FLP-18 | (1) | ----- |
| A. costaricensis-FLP-18 | (1) | ----- |
| H. contortus-FLP-18 | (1) | ----- |
| H. polygyrus-FLP-18 | (1) | ----- |
| N. brasiliensis-FLP-18 | (1) | ----- |
| D. viviparus-FLP-18 | (1) | ----- |
| A. nanus-FLP-18 | (1) | ----- |
| L. sigmondontis-FLP-18 | (1) | ----- |
| H. mephisto-FLP-18 | (1) | ----- |
| D. dipsaci-FLP-18 | (1) | ----- |
| A. cantonensis-FLP-18 | (1) | ----- |
| O. dentatum-FLP-18 | (1) | ----- |
| C. goldi-FLP-18 | (1) | ----- |
| D. destructor-FLP-18 | (1) | ----- |
| A. lumbricoides-FLP-18 | (1) | ----- |
| A. suum-FLP-18 | (1) | ----- |
| T. canis-FLP-18 | (1) | ----- |
| A. simplex-FLP-18 | (1) | ----- |
| P. univalens-FLP-18 | (1) | ----- |
| A. viteae-FLP-18 | (1) | ----- |
| L. loa-FLP-18 | (1) | ----- |
| E. elaphi-FLP-18 | (1) | ----- |
| D. immitis-FLP-18 | (1) | ----- |
| B. malayi-FLP-18 | (1) | ----- |
| B. timori-FLP-18 | (1) | ----- |
| B. pahangi-FLP-18 | (1) | ----- |
| W. bancrofti-FLP-18 | (1) | ----- |
| O. flexuosa-FLP-18 | (1) | ----- |
| O. ochengi-FLP-18 | (1) | ----- |
| O. volvulus-FLP-18 | (1) | ----- |
| C. angaria-FLP-18 | (1) | ----- |
| C. breneri-FLP-18 | (1) | ----- |
| C. tropicalis-FLP-18 | (1) | ----- |
| C. sinica-FLP-18 | (1) | ----- |
| C. elegans-FLP-18 | (1) | ----- |
| C. briggsae-FLP-18 | (1) | ----- |
| C. nigoni-FLP-18 | (1) | ----- |
| C. latens-FLP-18 | (1) | ----- |
| C. remanei-FLP-18 | (1) | ----- |
| C. japonica-FLP-18 | (1) | ----- |
| Csp. 34-FLP-18 | (1) | ----- |
| H. bacteriophora-FLP-18 | (1) | ----- |
| B. xylophilus-FLP-18 | (1) | ----- |
| G. pulchrum-FLP-18 | (1) | ----- |
| P. sambei-FLP-18 | (1) | ----- |
| P. arcanus-FLP-18 | (1) | ----- |
| P. pacificus-FLP-18 | (1) | ----- |
| P. japonicus-FLP-18 | (1) | ----- |
| P. entomophagus-FLP-18 | (1) | ----- |
| P. exspectatus-FLP-18 | (1) | ----- |
| P. mayeri-FLP-18 | (1) | ----- |
| P. fissidentatus-FLP-18 | (1) | ----- |
| P. maxplancki-FLP-18 | (1) | ----- |
| P. giblindavis-FLP-18 | (1) | ----- |
| S. carpocapsae-FLP-18 | (1) | ----- |
| S. carpocapsae-FLP-18#2 | (1) | ----- |
| S. scapterisci-FLP-18 | (1) | ----- |
| S. feltiae-FLP-18 | (1) | ----- |
| S. monticolum-FLP-18 | (1) | ----- |
| S. glaseri-FLP-18 | (1) | ----- |
| D. medinensis-FLP-18 | (1) | ----- |
| T. circumcincta-FLP-18 | (1) | ----- |
| E. vermicularis-FLP-18 | (1) | ----- |
| S. muris-FLP-18 | (1) | ----- |
| M. japonica-FLP-18 | (1) | ----- |
| H. placei-FLP-18 | (1) | ----- |
| N. americanus-FLP-18 | (1) | ----- |
| D. coronatus-FLP-18 | (1) | ----- |
| D. pachys-FLP-18 | (1) | ----- |
| O. tipulae-FLP-18 | (1) | ----- |
| P. redivivus-FLP-18 | (1) | ----- |
| G. pallida-FLP-18 | (1) | ----- |
| G. rostoiensis-FLP-18 | (1) | ----- |
| H. glycines-FLP-18 | (1) | ----- |

MMDKRDPIMLDGYPMSEAFYVNHLSPEEAAAYFEKRG--FEDETSMPGVLRFGKRAQS FVRFRGRS IDKG--AVIKK

FSFQQGTGRFEMQLRSLNHHFFLALVITVIIGLVAEEESHDKSKEDGMEKMKMPFASPLEFNENIYFPEEEGADELNALDKRSPLS FEGDVP GILRFGKRSQS FVRFRGRS GDELSKLVKEK

MPTKCVSPFKDCHRFIFIGHMDHFLLLVLSLGYFTNSLADATSEGH THE DAVSAEGNTD NVP----

LYAYQSKGGSPFSSLLS SSSHSSS--SEALGPLLQ GADASN MVELAAIAVHLFAILCISVSAEIELPKRAQFDDSF L P Y P S S A F M D S D E

MVELAAIAVHLFAILCISVSAEIELPKRAQFDDSF L P Y P S S A F M D S D E

MVTTRQVERHS SSRATSTSSLLQCATPPNSMVDWATIVVHLFAPLFCISVYAEVELPKRAQFDDPFISYYPISTFFDREE

MVDWTSISVVHLLAFICISVYAEVELP-----VLSYYPDSAVVDRDD

-----MTSVSEM

-----MSNQWLLVCVMGVGVCTVQAAFFRGQPKWELFIADDSRADKRS----

MSAATDRAGAF LPFAQSPALFNLSAALI KRSVPHSIHLIPC PFHGVNRERD VRRRRVT VGGDDRLTRLSQLQQA KVP S G S PKAAVFLRGLQ SMLHRVETMQLSNPFCRFL LVLCSLIAASRAAEIEDQEA AEKRA GGFL T ANQVLPGNY

-----MRYSTDTG WYRPRCLS SPSFSLVQSY

-----MERFSVDYIES

-----MPCYTA SFCFL LAVIVSWASAQSTGIDDD E--QQ--Q--

MPILATMKLR TDATCLLVA VAAAAAMSCAAE TSED SQKGQKRMYPFVPTLG----

P. pacificus-FLP-18 (27) SSHHLNQASFPICFFLPQOEIEWILLDYDRRLRKRKTYLESDLQILFTGLDDAESLMIENMYP--SYEDY-HLQDKRDS **IPGVLRFGKRAQAFVRFGKRL**-----SPIE **IKEMPGVLRFGKR**-----NE **IK**SVPEW
 P. japonicus-FLP-18 (1) -----MRLTYLPLINCELDKICIGTPQDGIIVLDRLRSLHCLSRPMDAESLMIEMYP--SYEDY-HLQDKRDS **IPGVLRFGKRAQAFVRFGKRL**-----SPIE **IKEMPGVLRFGKR**-----NE **IK**SVP
 P. entomophagus-FLP-18 (1) -----MKDSTKSSLSADSSSKDGVVDESRLDDGESLMIEMYP--SYEDY-HLQDKRDS **IPGVLRFGKRAQAFVRFGKRL**-----SPIE **IKEMPGVLRFGKR**-----NE **IK**SVP
 P. expectatus-FLP-18 (1) -----MKDSTTKTAPPSEKGVVVELEGQTDIGDIIDRRFRFPLHSCPCGLDDADSLVEMNYP--SYEDY-HIQDKRDS **IPGVLRFGKRAQAFVRFGKRL**-----SPIE **IKEMPGVLRFGKR**-----NE **IK**SVPALL
 P. fissidentatus-FLP-18 (1) -----MKDSTTKTAPPSEKGVVVESESSQSDIPDGIIVLGLSLLRAVHC-----LRADS **IPGVLRFGKRAQAFVRFGKRL**-----SPIE **IKEMPGVLRFGKR**-----NE **IK**SVPIRY--
 P. maxiplancki-FLP-18 (1) -----MKDSTTKTAPPSEKGVVVESESSQSDIPDGIIVLGLSLLRAVHC-----LRADS **IPGVLRFGKRAQAFVRFGKRL**-----SPIE **IKEMPGVLRFGKR**-----NE **IK**SVPIRY--
 P. giblindavisi-FLP-18 (12) DDHIDLPIIDKTYLLVFGTGEIMNSFLMSSILLSLVLISSSETTGYDDVSESSLVDVESP--SYDEPHYITDKRDS **IPGVLRFGKRAQAFVRFGKRL**-----SGIE **IKEMPGVLRFGKR**-----SE **IK**SVP
 S. carpopapuae-FLP-18 (1) MLGHLNEIIVVGVFTLCA-LALVSAEIDSSDAATASAKLEYLVDLPEKDELLLEQLDRPTWYDPEAYDVKRAVGDETS **IPGVLRFGKRAQAFVRFG-R**-----LD **IKEMPGVLRFGKR**-----GE **IK**AVPGVL
 S. carpopapuae-FLP-1842 (1) MLGHLNEIIVVGVFTLCA-LALVSAEIDSSDAATASAKLEYLVDLPEKDELLLEQLDRPTWYDPEAYDVKRAVGDETS **IPGVLRFGKRAQAFVRFG-R**-----LD **IKEMPGVLRFGKR**-----GE **IK**AVPGVL
 S. scapterisci-FLP-18 (1) MLGHLNEIIVVGVFTLCA-LALVSAEIDSSDAATASAKLEYLVDLPEKDELLLEQLDRPTWYDPEAYDVKRAVGDETS **IPGVLRFGKRAQAFVRFG-R**-----LD **IKEMPGVLRFGKR**-----GE **IK**AVP
 S. fellatae-FLP-18 (1) MLGHLNEIIVVGVFTLCA-LALVSAEIDSSDAATASAKLEYLVDLPEKDELLLEQLDRPTWYDPEAYDVKRAVGDETS **IPGVLRFGKRAQAFVRFG-R**-----LD **IKEMPGVLRFGKR**-----GE **IK**AVPGVL
 S. monticolum-FLP-18 (1) MLGHLNEIIVVGVFTLCA-LALVSAEIDSSDAATASAKLEYLVDLPEKDELLLEQLDRPTWYDPEAYDVKRAVGDETS **IPGVLRFGKRAQAFVRFG-R**-----LD **IKEMPGVLRFGKR**-----GE **IK**AVPGVL
 S. glaseri-FLP-18 (1) -----LPHHIIHNSYKCCNFRSIIISR-----RIFSDS **IPGVLRFGKRLN**-----LL-----QGLT **IKEMPGVLRFGKRS**-----GDH **IK**
 D. medienensis-FLP-18 (1) -----MGFRTYWPSSKETGWRDRDKIPGSEPRRSLVPSKTYTVDLGG **IPGVLRFGKRENG**-----VE **IKEMPGVLRFGKRTNK**-----
 T. circumcincta-FLP-18 (1) -----MDFCFTLKLGVTFSIIMATALEQNSDRMLSSYFFVYIDDETGGYFLLKYPLAYLAPYDQMPQLSKRVEKDDVGGKSDLNFRPSAFRFGKRGSVYSDTAAGIPYLV-----
 E. vermicularis-FLP-18 (1) -----LTRHLQPTSAIAFTTIFYISWLPK-----NKLFSDLDGG **IPGVLRFGKRENG**-----VE **IKEMPGVLRFGKRTNK**-----
 S. muris-FLP-18 (1) -----LTRHLQPTSAIAFTTIFYISWLPK-----NKLFSDLDGG **IPGVLRFGKRENG**-----VE **IKEMPGVLRFGKRTNK**-----
 M. japonica-FLP-18 (1) -----MQRNLNIAISQCVITVLLSIAALATQADEVVLSDDFAREYLDNLSIAEEHAYAKRDFDGS **IPGVLRFGKRSYFEDRIS**----- **IKEMPGVLRFGKRSTN**-----E **IK**
 D. coronatus-FLP-18 (1) -----MQRNLNIAISQCVITVLLSIAALATQADEVVLSDDFAREYLDNLSIAEEHAYAKRDFDGS **IPGVLRFGKRSYFEDRIS**----- **IKEMPGVLRFGKRSTN**-----E **IK**
 D. pachys-FLP-18 (1) -----MQRNLNIAISQCVITVLLSIAALATQADEVVLSDDFAREYLDNLSIAEEHAYAKRDFDGS **IPGVLRFGKRSYFEDRIS**----- **IKEMPGVLRFGKRSTN**-----E **IK**
 O. tulpulae-FLP-18 (34) -----QMLMESLAADI-----FYAKRDLGG **IPGVLRFGKRS**-----YLDGMRDRAME **IKEMPGVLRFGKRS**-----IENE **IK**
 P. redivivus-FLP-18 (53) -----FEDSLTVTDEPSPFLDSEDL-----RAAKRSDMAM **IPGVLRFGKRSQ-SFVRFG**-----RSAADELTRIME **IKEMPGVLRFGKRS**-----SSDGGDDLKNE **IK**
 G. pallida-FLP-18 (1) -----MAAMMFSYADLMNFGGSPFLDFTVNGCYMFLDEERPKRE-----DEAVE **IKEMPGVLRFGKRS**-----PFGSDS
 G. rostockiensis-FLP-18 (1) -----MDVTGKMFYADLMNFGGSPFLDFTVNGCYMFLDEERPKRE-----DEAVE **IKEMPGVLRFGKRS**-----PFGSDS
 H. glycyines-FLP-18 (1) -----MNFNFGGSPFLDFTVNGCYMFLDEERPKRE-----DEAVE **IKEMPGVLRFGKRS**-----PFGSDS
 M. arenaria-FLP-18 (1) -----MFILLTSLFLCFGEIIANGEAGHNEEIGMEKRLSYADLMNFGGSPFLDFTVNGCYMFLDEERPKRE-----DEAVE **IKEMPGVLRFGKRS**-----PFGSDS
 M. incognita-FLP-18 (1) -----MFILLTSLFLCFGEIIANGEAGHNEEIGMEKRLSYADLMNFGGSPFLDFTVNGCYMFLDEERPKRE-----DEAVE **IKEMPGVLRFGKRS**-----PFGSDS
 M. javanica-FLP-18 (1) -----MFILLTSLFLCFGEIIANGEAGHNEEIGMEKRLSYADLMNFGGSPFLDFTVNGCYMFLDEERPKRE-----DEAVE **IKEMPGVLRFGKRS**-----PFGSDS
 M. enterolobii-FLP-18 (1) -----MFILLTSLFLCFGEIIANGEAGHNEEIGMEKRLSYADLMNFGGSPFLDFTVNGCYMFLDEERPKRE-----DEAVE **IKEMPGVLRFGKRS**-----PFGSDS
 M. floridensis-FLP-18 (1) -----MFILLTSLFLCFGEIIANGEAGHNEEIGMEKRLSYADLMNFGGSPFLDFTVNGCYMFLDEERPKRE-----DEAVE **IKEMPGVLRFGKRS**-----PFGSDS
 M. hapla-FLP-18 (2) LCYLQMFIVLTLCLLFCGEKFEANGAEAGHEEIGMEKRLSYADLMNFGGSPFLDFTVNGCYMFLDEERPKRE-----DEAVE **IKEMPGVLRFGKRS**-----PFGSDS
 M. graminicola-FLP-18 (1) -----MEKRMFSYADLMNFGGSPFLDFTVNGCYMFLDEERPKRE-----DEAVE **IKEMPGVLRFGKRS**-----PFGSDS
 T. callipaeda-FLP-18 (6) DASEILPN-----HDFNR-ISGLNLYSRHDYG-----IYYPG-YASD----- **IKEMPGVLRFGKR**-----GQE **IK**
 P. trichosuri-FLP-18 (39) -----FFFIDDYEPNYLDISALNGEDFAE-----KRDLEGGVIG **IPGVLRFGKRDYPHLIRFGK**-----RETEFM **IKEMPGVLRFGKRDY**-----NQOO **IK**
 S. papillosus-FLP-18 (39) -----VSVKDDYEPNYLDISALNGEDFAE-----KRDYDEGIVG **IPGVLRFGKRDYPHLIRFGK**-----RETEYM **IKEMPGVLRFGKRDY**-----NQOO **IK**
 S. venezuelensis-FLP-18 (39) -----ASVDDYEPNYLDISALNGEDFAE-----KRDYDEGIVG **IPGVLRFGKRDYPHLIRFGK**-----RETEYM **IKEMPGVLRFGKRDY**-----NQOO **IK**
 S. ratti-FLP-18 (39) -----VSVKDDYEPNYLDISALNGEDFAE-----KRDIDGIVG **IPGVLRFGKRDYPHLIRFGK**-----RETEFM **IKEMPGVLRFGKRDY**-----NQOO **IK**
 S. stercoralis-FLP-18 (39) -----VSVKDDYEPNYLDISALNGEDFAE-----KRDIDGIVG **IPGVLRFGKRDYPHLIRFGK**-----RETEFM **IKEMPGVLRFGKRDY**-----NQOO **IK**
 M. belari-FLP-18 (1) -----MLGRQCCVSSLLIAPASLLILQADNQEKFGVQDQETENFDQFAQMQQPAGFYDSSSHL-----AEKRGDMGSG **IPGVLRFGKRAQS**-----
 R. culicivoxax-FLP-18 (1) -----MIDNSMQTVPEQYNYMASNFKASIESLSTIATALTFYGVVPCAFWYGVLSYHLNYSNNLPKIVIFFVYV **IKEMPGVLRFGKRAQS**-----AEKRGDMGSG **IPGVLRFGKRAQS**-----
 T. muris-FLP-18 (1) -----MDFKCLFVGLRQNSQRFDPLDSFGCEAMFNWKAFCFVTKIDRSASSTLRIGNDPRKYGG-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 S. baturini-FLP-18 (1) -----MKSYSISLQSIMFVLGVVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. britovi-FLP-18 (1) -----MKSYSISLQSIMFVLGVVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. patagoniensis-FLP-18 (1) -----MKSYSISLQSIMFVLGVVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. spiralis-FLP-18 (1) -----MKSYSISLQSIMFVLGVVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 Tsp. 8-FLP-18 (1) -----MKSYSISLQSIMFVLGVVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. murrelli-FLP-18 (1) -----MKSYSISLQSIMFVLGVVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 Tsp. 6-FLP-18 (1) -----MKSYSISLQSIMFVLGVVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 Tsp. 9-FLP-18 (1) -----MKSYSISLQSIMFVLGVVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. nativa-FLP-18 (1) -----MFVVGWVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. nelsoni-FLP-18 (1) -----MFVVGWVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. papuae-FLP-18 (1) -----MFVVGWVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. pseudospiralis-FLP-18 (1) -----MKSYSISLQSIMFVLGVVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. zimbabwensis-FLP-18 (1) -----MKSYSISLQSIMFVLGVVFLCSIS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. suis-FLP-18 (1) -----MRFRSASRDVENPVSSCTCGVVAVGIGQSAFTALNLYYSQII **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. trichiura-FLP-18 (1) -----RTQWKYVGG **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 Rhaditophanes-FLP-18 (1) -----MTPNCPFRSYCVTVGADGIFNCTYDADYAPSEELVGLLNGEGDYSTESKRNLEEDGAG **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 A. caninum-FLP-18 (90) -----S **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 A. ceylanicum-FLP-18 (90) -----S **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 A. duodenale-FLP-18 (90) -----S **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 S. vulgare-FLP-18 (90) -----S **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 A. costaricensis-FLP-18 (89) -----S **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 H. contortus-FLP-18 (91) -----S **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 H. polygyrus-FLP-18 (98) -----S **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 N. brasiliensis-FLP-18 (32) -----G **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 D. viviparus-FLP-18 (32) -----S **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 A. nanus-FLP-18 (191) -----D **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 L. sigmodontis-FLP-18 (5) -----D **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 H. mephisto-FLP-18 (228) -----D **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 D. dipsaci-FLP-18 (102) -----D **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 A. cantonensis-FLP-18 (67) -----S **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 O. dentatum-FLP-18 (51) -----S **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 C. goldi-FLP-18 (1) -----KRS **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 D. destructor-FLP-18 (155) -----A **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 A. lumbricoides-FLP-18 (158) -----D **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 A. suum-FLP-18 (116) -----D **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 T. canis-FLP-18 (149) -----D **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----
 A. simplex-FLP-18 (147) -----D **IKEMPGVLRFGKRAQS**-----IAPMAG **IKEMPGVLRFGKRAQS**-----

P.univalens-FLP-18 (29) -----AVPGVLRFGKRG-----DIPGVLRFGKRS-----DIPGVLRFGKSS-----IPGVLRFGR-----
 A.viteae-FLP-18 (74) -----DVPGVLRFGKREG-----DIPGVLRFGKRN-----DIPGVLRFGK-----RSPILVLRFGGR-----
 L. loa-FLP-18 (97) -----DIPGVLRFGKREG-----DIPGVLRFGKRN-----DIPGVLRFGK-----RSIPGVLRFGR-----
 E. elaphi-FLP-18 (39) -----DVPGVLRFGKREG-----DIPGVLRFGKRN-----DIPGVLRFGK-----DIPGVLRFGKDEDPGVLRFGKRSAPGVLRFGR-----
 D. immitis-FLP-18 (36) -----DVPGVLRFGKREG-----DIPGVLRFGKRN-----DIPGVLRFGK-----RSIPGVLRFGR-----
 B. malayi-FLP-18 (102) -----DVPGVLRFGKREG-----DIPGVLRFGKRN-----DIPGVLRFGK-----RSAPGVLRFGR-----
 B. timori-FLP-18 (40) -----DVPGVLRFGKREG-----DIPGVLRFGKRN-----DIPGVLRFGK-----RSAPGVLRFGR-----
 P. pahangi-FLP-18 (54) -----DVPGVLRFGKREG-----DIPGVLRFGKRN-----DIPGVLRFGK-----RSAPGVLRFGR-----
 W. bancrofti-FLP-18 (44) -----GIPGVLRFGKREG-----DIPGVLRFGKRN-----DIPGVLRFGK-----RSAPGVLRFGR-----
 O. flexuosa-FLP-18 (44) -----S-APGV-----DIPGVLRFGKRI-----EIPGVLRFGR-----QTKGVLRFGR-----
 O. ochengi-FLP-18 (11) -----AVPGVLRFGKRE-----IPGVLRFGRAS-----EIPGVLRFGR-----RSEEPVLRFGGR-----
 O. volvulus-FLP-18 (85) -----AVPGVLRFGKRE-----IPGVLRFGRAS-----EIPGVLRFGR-----RSEEPGVLRFGR-----
 C. angaria-FLP-18 (106) -----VPGVLRFGKRS-----SDILDKRSEIPGVLRFGRKATIQ-----EIFDKRSEIPGVLRFGRK-----NIPGVLRFGRS-----DFGEQYAGILLKKSAPGVLRFGRK-----
 C. breneri-FLP-18 (104) -----SVPGVLRFGKRS-----DVPMDKREIPGVLRFGRKDYMT-----ELFDKRSEIPGVLRFGRK-----DIPGVLRFGRS-----DLEEYAGVLLKKSVPGLRFGRK-----
 C. tropicalis-FLP-18 (110) RFGKRSYFDEKKSVPGLRFGKRS-----DVPMDKREIPGVLRFGRKDYMT-----ELFDKRSEIPGVLRFGRK-----DIPGVLRFGRS-----DMEEHYAGVLLKKSVPGLRFGRK-----
 C. sinica-FLP-18 (127) RFGKRSYFDEKKSVPGLRFGKRS-----DVPMDKREIPGVLRFGRKDYMT-----ELFDKRSEIPGVLRFGRK-----DIPGVLRFGRS-----DMEEHYAGVLLKKSVPGLRFGRK-----
 C. elegans-FLP-18 (110) RFGKRSYFDEKKSVPGLRFGKRS-----DVPMDKREIPGVLRFGRKDYMA-----DSFDKRSEIPGVLRFGRK-----DIPGVLRFGRS-----DLEEYAGVLLKKSVPGLRFGRK-----
 C. briggsae-FLP-18 (110) RFGKRSYFDEKKSVPGLRFGKRS-----DVPMDKREIPGVLRFGRKDYTE-----EMFDKRSEIPGVLRFGRK-----DIPGVLRFGRS-----DLEEYAGVLLKKSVPGLRFGRK-----
 C. nigoni-FLP-18 (110) RFGKRSYFDEKKSVPGLRFGKRS-----DVPMDKREIPGVLRFGRKDYTE-----EMFDKRSEIPGVLRFGRK-----DIPGVLRFGRS-----DLEEYAGVLLKKSVPGLRFGRK-----
 C. latens-FLP-18 (110) RFGKRSYFDEKKSVPGLRFGKRS-----DVPMDKREIPGVLRFGRKDYMT-----ELFDKRSEIPGVLRFGRK-----DIPGVLRFGR-----SIEEHYAGVLLKKSVPGLRFGRK-----
 C. remanei-FLP-18 (110) RFGKRSYFDEKKSVPGLRFGKRS-----DVPMDKREIPGVLRFGRKDYMN-----ELFDKRSEIPGVLRFGRK-----DIPGVLRFGR-----SIEEHYAGVLLKKSVPGLRFGRK-----
 C. japonica-FLP-18 (104) RFGKRSYFDEKKSVPGLRFGKRS-----DVPMDKREIPGVLRFGRKDYMA-----ELFDKRSEIPGVLRFGRK-----GIPGVLRFGR-----DFEEHYAGVLLKKSVPGLRFGRK-----
 Csp. 34-FLP-18 (104) -----SVPGVLRFGKRS-----YFDDQKRTIPGVLRFGRKREYIE-----ELFNKRSEIPGVLRFGRK-----DIPGVLRFGR-----FQVFFALVASEFPMDNPKCVNNIQMI-----
 H. bacteriophora-FLP-18 (1) -----KRSIPGVLRFGRK-----TIPGVLRFGR-----DI-----
 B. xylophilus-FLP-18 (116) -----AVPGVLRFGKRS-----DMIPGVLRFGRK-----DGAIPGVLRFGRKSS-----EIPGVLRFGR-----SDMPGVLRFGRKRDMPGVLRFGRK-----
 G. pulchrum-FLP-18 (34) -----NVPGVLRFGKREE-----DIPGVLRFGRK-----EDVIPGVLRFGRK-----DIPGVLRFGR-----NEVPGVLRFGRK-TMPGMLRFGR-----
 P. sambesii-FLP-18 (247) -----AVPGVLRFGKRS-----DIPGVLRFGRK-----DIPGVLRFGR-----DIPGVLRFGRKRDSDM-----PGVLRFGK-----RDMPGVLRFGKRDIPGVLRFGR-----
 P. arcanus-FLP-18 (78) -----AVPGVLRFGKRS-----DIPGVLRFGRK-----DIPGVLRFGR-----DIPGVLRFGR-----
 P. pacificus-FLP-18 (152) ARE---KRIERKASIPALLRIVG-----REYIPGVLRFGRKSV-----GMSDMETLIFGSS-----IPGVLRFGRK-----
 P. japonicus-FLP-18 (115) -----AVPGVLRFGKRS-----DIPGVLRFGRK-----GMSDMETLIFGSS-----IPGVLRFGRK-----HYRFLH-----
 P. entomophagus-FLP-18 (101) -----AVPGVLRFGKRS-----DIPGVLRFGRK-----GMSSEMELIFGSS-----IPGVLRFGRK-----
 P. exspectatus-FLP-18 (27) -----AVPGVLRFGKRS-----DIPGVLRFGRK-----GMSSEMELIFGSS-----IPGVLRFGRK-----
 P. mayeri-FLP-18 (122) R-----KVG-----KEYIPGVLRFGRKSPA-----MDSDIMEGLVIFGSS-----IPGVLRFGRK-----KFNANFALSHSWLLTARGIVGAGKSLTATLPPITLLSLSPPPDKL-----
 P. fissidentatus-FLP-18 (73) -----AVPGVLRFGKRS-----DIPGVLRFGRK-----MDGSDMEGLIFGSS-----IPGVLRFGRK-----
 P. maxplancki-FLP-18 (97) -----AVPGVLRFGKRS-----DIPGVLRFGRK-----DIPGVLRFGR-----DIPGVLRFGR-----
 P. giblindavis-FLP-18 (135) -----AVPGVLRFGKRS-----DIPGVLRFGRKSS-----DIPGVLRFGRKSS-----IPGVLRFGRK-----
 S. carpocapsae-FLP-18 (124) R-----FGKREIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 S. carpocapsae-FLP-18#2 (124) R-----FGKREIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 S. scapterisci-FLP-18 (121) -----GKN-----KIPGVLRFGRKRD-----KIPGVLRFGRKRD-----EIPGVLRFGRKRN-----IPGVLRFGRK-----
 S. feltiae-FLP-18 (125) R-----FGKREIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 S. monticolum-FLP-18 (122) R-----FGKREIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 S. glaseri-FLP-18 (1) -----KNDVPGVLEIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 D. medienensis-FLP-18 (65) -----KNDVPGVLEIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 T. circumcincta-FLP-18 (75) -----KQSPYIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 E. vermicularis-FLP-18 (112) -----KQSPYIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 S. muris-FLP-18 (1) -----KQSPYIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 M. japonica-FLP-18 (1) -----KQSPYIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 H. placei-FLP-18 (67) -----KQSPYIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 N. americanus-FLP-18 (30) -----KQSPYIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 D. coronatus-FLP-18 (98) -----SVPGVLRFGKRD-----DIPGVLRFGRKRD-----EIPGVLRFGRKSS-----DIPGVLRFGRK-----DFAEDFDGENFVKKSMGVLRFGRK-----
 D. pachys-FLP-18 (43) -----SVPGVLRFGKRD-----DIPGVLRFGRKRD-----EIPGVLRFGRKSS-----DIPGVLRFGRK-----DFAEDFDGENFVKK-----
 O. ttipulae-FLP-18 (98) -----SVPGVLRFGKRD-----DIPGVLRFGRKRD-----EIPGVLRFGRKSS-----DIPGVLRFGRK-----EDMPGVLRFGRK-AVPGVLRFGK-----
 P. redivivus-FLP-18 (139) -----NVPGVLRFGKRS-----DIPGVLRFGRKRD-----EIPGVLRFGRKSS-----DIPGVLRFGRK-----GDMPGVLRFGKRDMPGVLRFGRKSAF-----
 G. pallida-FLP-18 (69) -----VLRFGK-----RGPQHEKKAIPGVLRFGRKRD-----VLRFGK-----KRAIPGVLRFGRKRD-----DIPGVLRFGRK-----
 G. rostochiensis-FLP-18 (92) -----VLRFGK-----RGPQHEKKAIPGVLRFGRKRD-----VLRFGK-----LCPSPILFHSIPGVLRFGRK-----RHSIPGVLRFGRK-----
 H. glycines-FLP-18 (79) -----VLRFGK-----RGPQHEKKAIPGVLRFGRKRD-----VLRFGK-----KRAIPGVLRFGRKRD-----DIPGVLRFGRK-----
 M. arenaria-FLP-18 (119) -----VLRFGKRD-----RVVIEKKAIPGVLRFGRKRD-----ESGAPGVLRFGRKRD-----DIPGVLRFGRK-----
 M. incognita-FLP-18 (119) -----VLRFGKRD-----RVVIEKKAIPGVLRFGRKRD-----ESGAPGVLRFGRKRD-----DIPGVLRFGRK-----
 M. javanica-FLP-18 (125) -----VLRFGKRD-----RVVIEKKAIPGVLRFGRKRD-----ESGAPGVLRFGRKRD-----DIPGVLRFGRK-----
 M. enterolobii-FLP-18 (119) -----VLRFGKRD-----RVVIEKKAIPGVLRFGRKRD-----ESGAPGVLRFGRKRD-----DIPGVLRFGRK-----
 M. floridensis-FLP-18 (119) -----VLRFGKRD-----RVVIEKKAIPGVLRFGRKRD-----ESGAPGVLRFGRKRD-----DIPGVLRFGRK-----
 M. hapla-FLP-18 (126) -----ECSVLR-----KIKRVEQ-----SIPGVLRFGRKRD-----FYDENRSIPGVLRFGRK-----
 M. graminicola-FLP-18 (87) -----VLRFGKRD-----RVVIEKKAIPGVLRFGRKRD-----ESGAPGVLRFGRKRD-----DIPGVLRFGRK-----
 T. callipaeda-FLP-18 (56) -----NVPGVLRFGKRS-----DIPGVLRFGRKRD-----EIPGVLRFGRKSS-----DIPGVLRFGRK-----
 P. trichosuri-FLP-18 (120) -----AVPGVLRFGKRD-MPGV-----LRFGRK-GDIPGVLRFGRKRD-----DIPGVLRFGRKRD-----DIPGVLRFGRKRD-----GILLRFGKRPSSFENFYLDKK-----DMPGLLRFGK-----
 S. papillosus-FLP-18 (120) -----NVPGVLRFGKRS-----DIPGVLRFGRKRD-----EIPGVLRFGRKSS-----DIPGVLRFGRK-----DIPGVLRFGRKRDQIP-----GILLRFGKRP-SYESPIIDKK-----DMPGLLRFGK-----
 S. venezuelensis-FLP-18 (120) -----NVPGVLRFGKRS-----DIPGVLRFGRKRD-----EIPGVLRFGRKSS-----DIPGVLRFGRK-----DIPGVLRFGRKRDQIP-----GILLRFGKRP-SYESPIIDKK-----DMPGLLRFGK-----
 S. ratti-FLP-18 (120) -----AVPGVLRFGKRS-----GVPGL-----LRFGRK-DIPGVLRFGRKRD-----DIPGVLRFGRKRD-----DIPGVLRFGRKRDQIP-----GILLRFGKRP-SFENYMLDKK-----DMPGLLRFGK-----
 S. stercoralis-FLP-18 (120) -----AVPGVLRFGKRS-----GVPGL-----LRFGRK-DIPGVLRFGRKRD-----DIPGVLRFGRKRD-----DIPGVLRFGRKRDQIP-----GILLRFGKRP-SFENYMLDKK-----DMPGLLRFGK-----
 M. belari-FLP-18 (87) -----FIPGVLRFGRK-----SDGMDKKEIPGVLRFGRKSPQ-----EKKSIPGVLRFGRKRD-----DIPGVLRFGRK-----P-----SYDDFLIDKK-----DMPGLLRFGK-----
 R. culicivox-FLP-18 (126) -----NDIPGVLRFGRKRD-----EIPGVLRFGRKRD-----EIPGVLRFGRKSS-----DIPGVLRFGRK-----DIPGVLRFGRKRDQIP-----GILLRFGKRP-SFENYMLDKK-----DMPGLLRFGK-----
 T. muris-FLP-18 (66) -----IADEIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 S. baturini-FLP-18 (85) -----ASMIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 T. britovi-FLP-18 (61) -----QYDIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 T. patagoniensis-FLP-18 (66) -----QYDIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 T. spiralis-FLP-18 (61) -----QYDIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 Tsp. 8-FLP-18 (61) -----QYDIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 T. murrelli-FLP-18 (66) -----QYDIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 Tsp. 6-FLP-18 (66) -----QYDIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 Tsp. 9-FLP-18 (66) -----QYDIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 T. nativa-FLP-18 (51) -----QYDIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----
 T. nelsoni-FLP-18 (56) -----QYDIPGVLRFGRKRD-----EIPGVLRFGRKSE-----IPGVLRFGRKRN-----IPGVLRFGRK-----

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|--------------------------|-------|-------------------|--------------------|---------|-------|--------|-------------|-------|-----------|----------|------------|-------|-------|--------------|-------|
| T. papuae-FLP-18 | (51) | ----- | QGYD | DD | ----- | SAPG | LPFGKRSYS | ----- | QLHDKFG | SDLR | RVVT | ----- | | | |
| T. pseudospiralis-FLP-18 | (61) | ----- | QGYD | DD | ----- | SAPG | LPFGKRSYS | ----- | QLHDKFG | SDLR | RVVT | ----- | | | |
| T. zimbabwensis-FLP-18 | (61) | ----- | QGYD | DD | ----- | SAPG | LPFGKRSYS | ----- | QLHDKFG | SDLR | RVVT | ----- | | | |
| T. suis-FLP-18 | (119) | ----- | YVNAHFAKN | ----- | ----- | G | RYGGLDILQPN | ----- | QMYSRINGP | ITVEPIMS | FQETIYRSRK | ----- | | | |
| T. trichiura-FLP-18 | (19) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | | | |
| Rhabditophanes-FLP-18 | (115) | KKSMPT | GFGSP | LPFGKRS | ----- | FDEEKS | LPFGKRSDFQ | ----- | YYNLNKK | LPFGKRS | ----- | GLSDS | MLK | PKSDMPGKSKVR | ----- |
| | | 451 | | | | | | | | | | | | | 498 |
| A. caninum-FLP-18 | (145) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| A. ceylanicum-FLP-18 | (149) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| A. duodenale-FLP-18 | (145) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| S. vulgaris-FLP-18 | (142) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| A. costaricensis-FLP-18 | (146) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| H. contortus-FLP-18 | (171) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| H. polygyrus-FLP-18 | (178) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| N. brasiliensis-FLP-18 | (84) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| D. viviparus-FLP-18 | (104) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| A. nanus-FLP-18 | (252) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| L. sigmodontis-FLP-18 | (16) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| H. mephisto-FLP-18 | (297) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| D. dipsaci-FLP-18 | (149) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| A. cantonensis-FLP-18 | (96) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| O. dentatum-FLP-18 | (133) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. goldi-FLP-18 | (17) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| D. destructor-FLP-18 | (262) | PGVLRFG | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| A. lumbricoides-FLP-18 | (204) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| A. suum-FLP-18 | (162) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| T. canis-FLP-18 | (195) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| A. simplex-FLP-18 | (192) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. univalens-FLP-18 | (75) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| A. viteae-FLP-18 | (122) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| L. loa-FLP-18 | (145) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| E. elaphi-FLP-18 | (100) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| D. immitis-FLP-18 | (84) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| B. malayi-FLP-18 | (150) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| B. timori-FLP-18 | (88) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| B. pahangi-FLP-18 | (102) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| W. bancrofti-FLP-18 | (89) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| O. flexuosa-FLP-18 | (84) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| O. ochengi-FLP-18 | (57) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| O. volvulus-FLP-18 | (132) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. angaria-FLP-18 | (192) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. breneri-FLP-18 | (191) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. tropicalis-FLP-18 | (209) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. sinica-FLP-18 | (226) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. elegans-FLP-18 | (209) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. briggsae-FLP-18 | (209) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. nigoni-FLP-18 | (209) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. latens-FLP-18 | (208) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. remanei-FLP-18 | (208) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| C. japonica-FLP-18 | (191) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| Csp. 34-FLP-18 | (194) | SLFSLQSVSPNSLNHDI | CLVFTMILYVVNSRAPYD | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| H. bacteriophora-FLP-18 | (28) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| B. xylophilus-FLP-18 | (189) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| G. pulchrum-FLP-18 | (106) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. sambesii-FLP-18 | (333) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. arcanus-FLP-18 | (78) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. pacificus-FLP-18 | (210) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. japonicus-FLP-18 | (149) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. entomophagus-FLP-18 | (135) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. exspectatus-FLP-18 | (27) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| F. mayeri-FLP-18 | (210) | LLYHPA | WIKD | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. fissionatus-FLP-18 | (106) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. maxplancki-FLP-18 | (97) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. giblindavisi-FLP-18 | (166) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| S. carpocapsae-FLP-18 | (175) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| S. carpocapsae-FLP-18#2 | (175) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| S. scapterisci-FLP-18 | (162) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| S. feltiae-FLP-18 | (176) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| S. monticolum-FLP-18 | (173) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| S. glaseri-FLP-18 | (28) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| D. medinensis-FLP-18 | (117) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| T. circumcincta-FLP-18 | (105) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| E. vermicularis-FLP-18 | (144) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| S. muris-FLP-18 | (14) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| M. japonica-FLP-18 | (23) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| H. placei-FLP-18 | (83) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| N. americanus-FLP-18 | (30) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| D. coronatus-FLP-18 | (159) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| D. pachys-FLP-18 | (93) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| O. tipulae-FLP-18 | (168) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| P. redivivus-FLP-18 | (226) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| G. pallida-FLP-18 | (114) | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |

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| G.rostochiensis-FLP-18 | (154) | ----- |
| H.glycines-FLP-18 | (124) | ----- |
| M.arenaria-FLP-18 | (172) | ----- |
| M.incognita-FLP-18 | (172) | ----- |
| M.javanica-FLP-18 | (178) | ----- |
| M.enterolobii-FLP-18 | (143) | ----- |
| M.floridensis-FLP-18 | (146) | ----- |
| M.hapla-FLP-18 | (169) | ----- |
| M.graminicola-FLP-18 | (140) | ----- |
| T.callipaeda-FLP-18 | (89) | ----- |
| P.trichosuri-FLP-18 | (213) | ----- |
| S.papillosus-FLP-18 | (200) | ----- |
| S.venezuelensis-FLP-18 | (200) | ----- |
| S.ratti-FLP-18 | (211) | ----- |
| S.stercoralis-FLP-18 | (199) | ----- |
| M.belari-FLP-18 | (152) | ----- |
| R.culicivox-FLP-18 | (239) | ----- |
| T.muris-FLP-18 | (116) | ----- |
| S.baturini-FLP-18 | (124) | ----- |
| T.britovi-FLP-18 | (102) | ----- |
| T.patagoniensis-FLP-18 | (107) | ----- |
| T.spiralis-FLP-18 | (102) | ----- |
| Tsp.8-FLP-18 | (102) | ----- |
| T.murrelli-FLP-18 | (107) | ----- |
| Tsp.6-FLP-18 | (107) | ----- |
| Tsp.9-FLP-18 | (107) | ----- |
| T.nativa-FLP-18 | (92) | ----- |
| T.nelsoni-FLP-18 | (97) | ----- |
| T.papuae-FLP-18 | (92) | ----- |
| T.pseudospiralis-FLP-18 | (102) | ----- |
| T.zimbabwensis-FLP-18 | (102) | ----- |
| T.suis-FLP-18 | (169) | ----- |
| T.trichiura-FLP-18 | (19) | ----- |
| Rhabditophanes-FLP-18 | (192) | ----- |

Figure S2. Supplementary References

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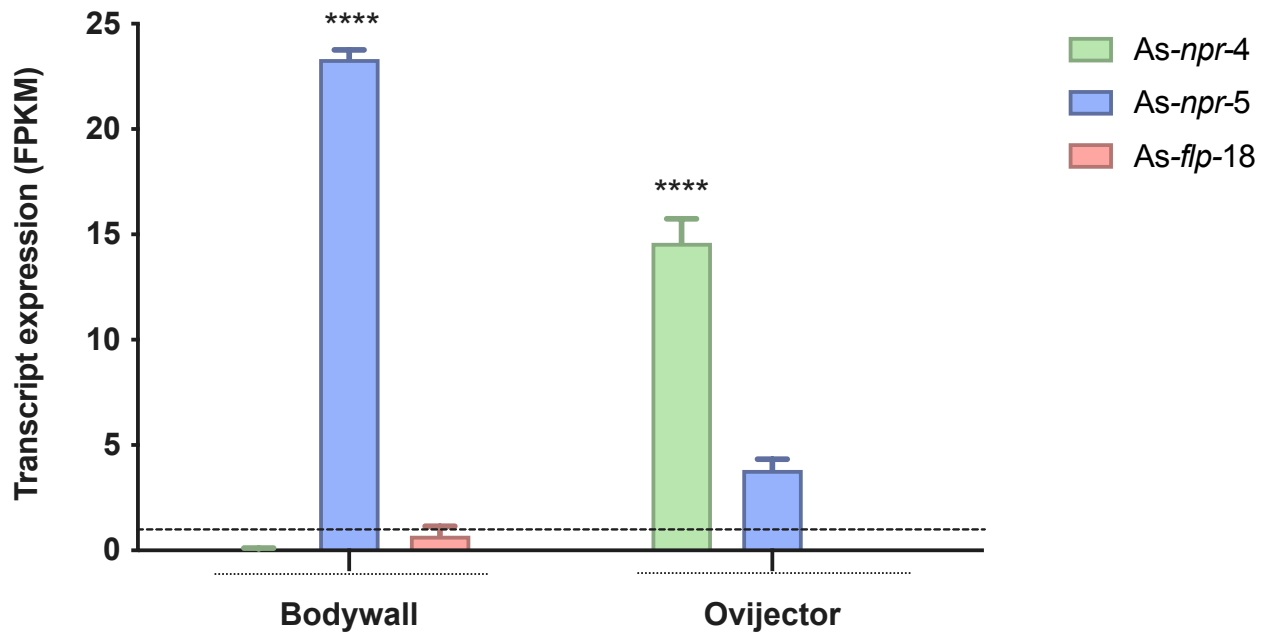
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Figure S3. Differential expression of *As-flp-18* and *As-npr-4* and *-5* in *Ascaris* body wall and ovijector tissue.



Supplementary information for Figure S3: Tissue (ovijector and body wall) was excised from adult female *Ascaris suum*. Body wall tissue contains the neuronal input to the ovijector. Ovijector tissue contains muscle based NP-GPCRs. Total RNA was extracted, quantified and assessed for integrity. The Centre for Genomic Research (Liverpool University) constructed RNAseq libraries and conducted sequencing. Six data files (n=3 for each tissue) containing 120 million, 120bp reads per file/tissue were generated. All data were clipped, groomed and processed through a quality control pipeline (Galaxy.org) prior to analysis. For each RNA-Seq dataset, relevant adapter sequences and low quality regions were trimmed, and reads were filtered based on length and complexity. Remaining, high-quality reads were aligned to *A. suum* genome assembly 23 using Tophat2 (version 2.0.8, default parameters) and the genome annotation (gff3 file) as a guide. The number of reads associated with each gene was tallied using HTSeq-Count. Data are represented in FPKM (threshold for expression 1 FPKM).