Supporting Information

Synthetic hookworm-derived peptides are potent modulators of primary human immune cell function that protect against experimental colitis *in vivo*

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Material included

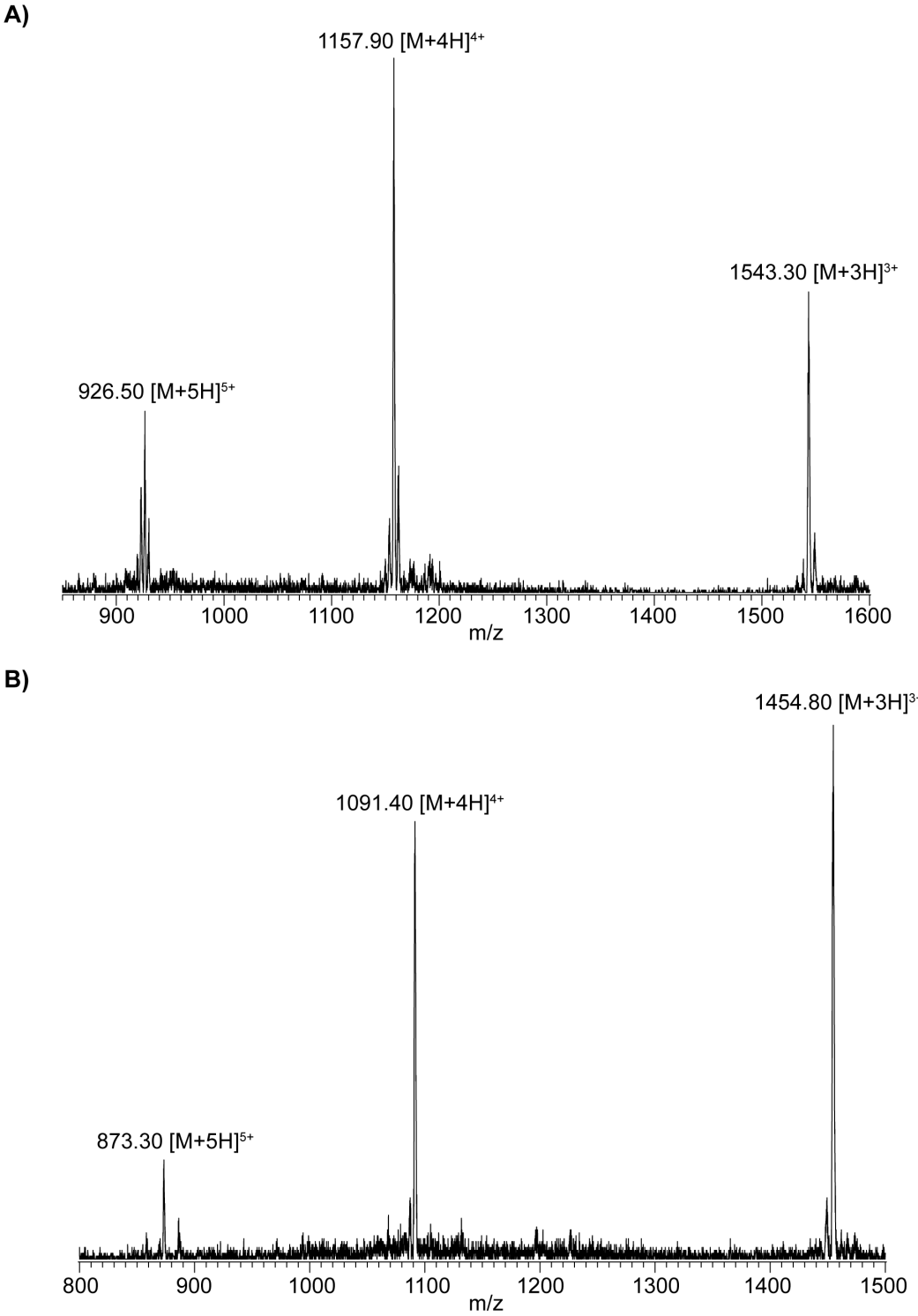


Figure S1: Electrospray ionisation mass spectrometry spectra of final peptides **A**) Acan1 and **B**) Nak1

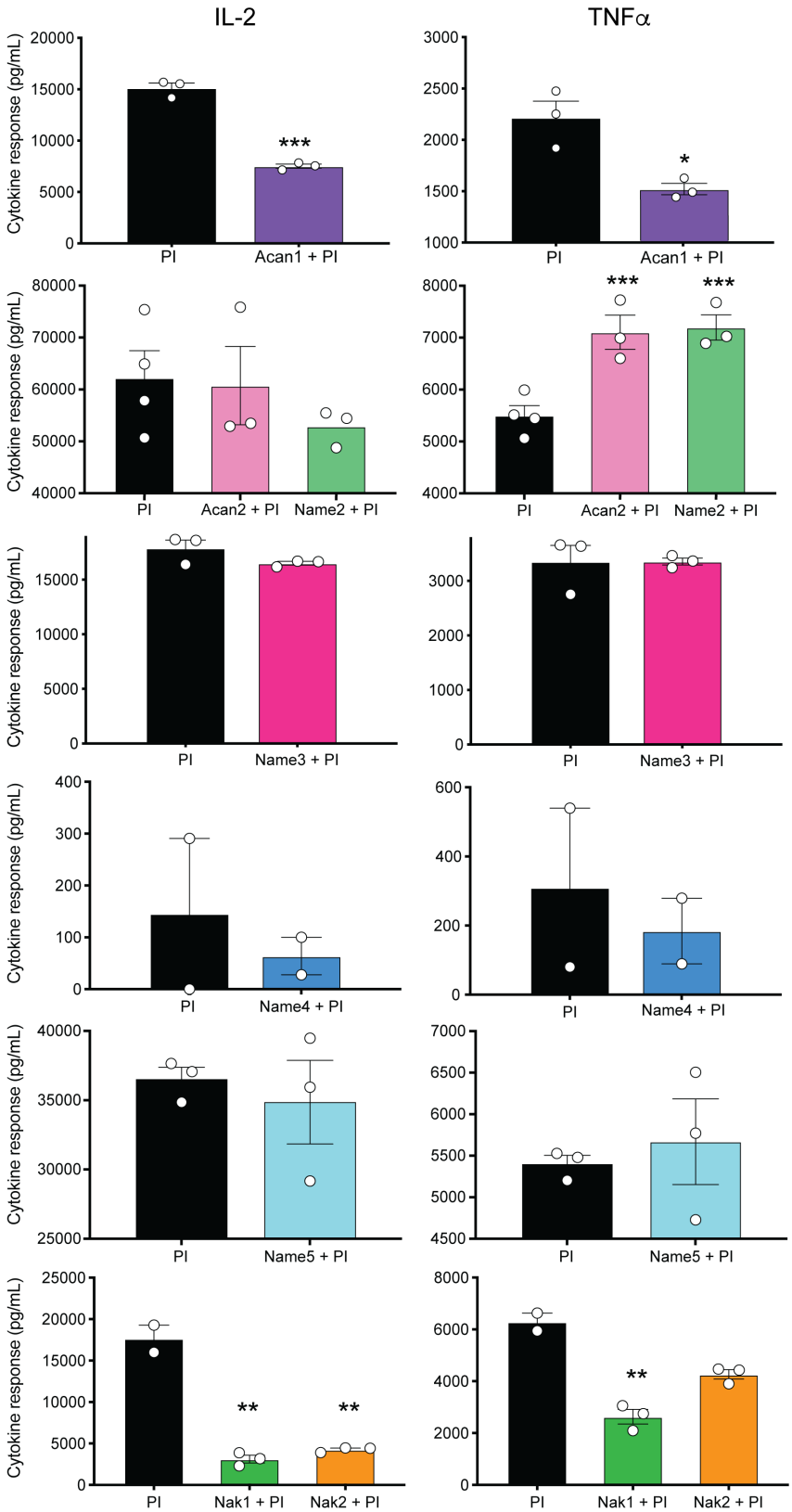
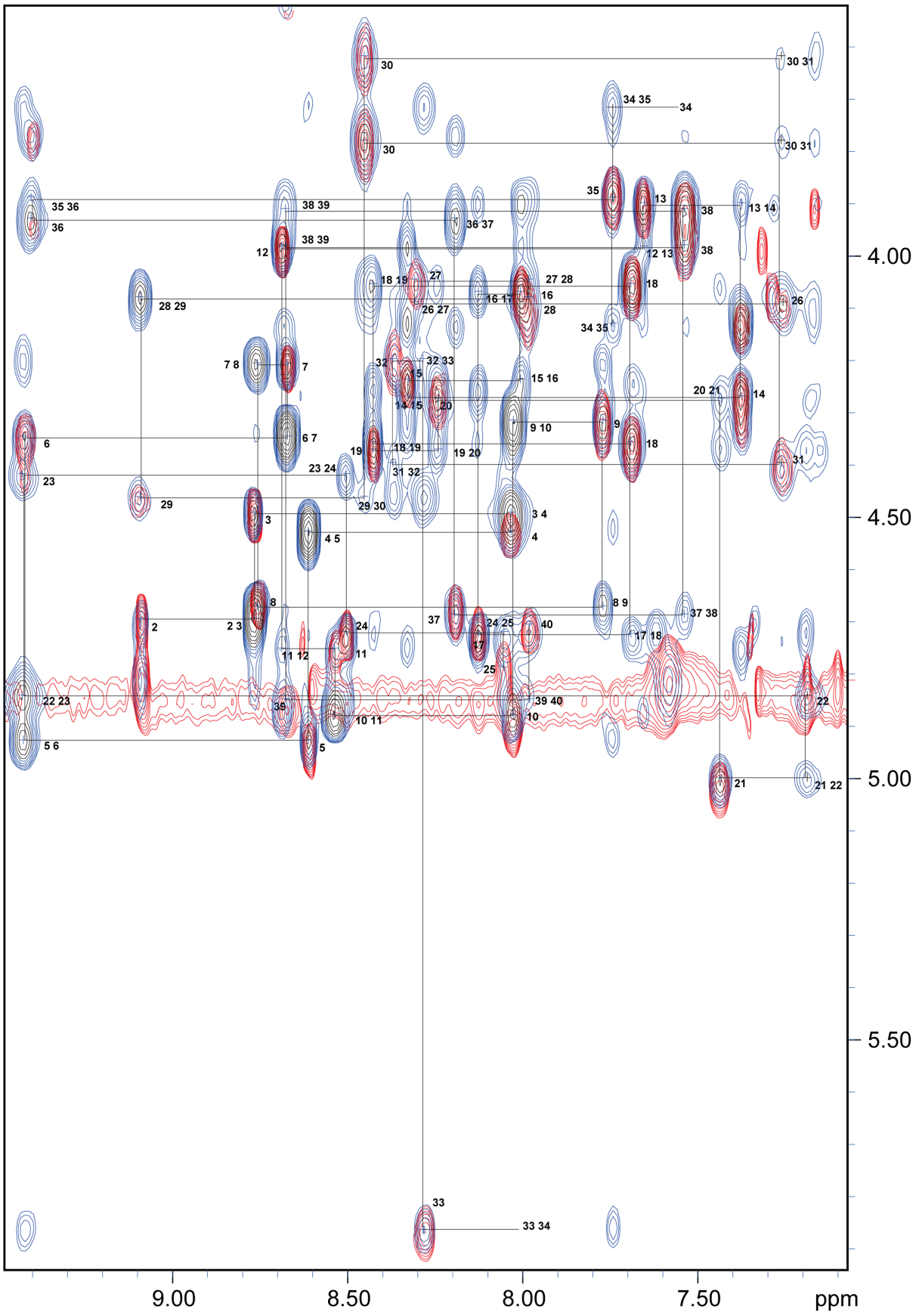


Figure S2: Preliminary functional cytometric bead array (CBA) screening of synthetic hookworm peptides. Human peripheral blood mononuclear cells were stimulated with phorbol 12-myristate 12-acetate (50 ng/mL) + ionomycin (1 µg/mL) (PI) then treated with 100 µg/mL hookworm peptides for 24 h. The concentrations of soluble IL-2 and TNF in the culture supernatant were assessed by CBA and flow cytometry (BD LSRFortessa).

A)



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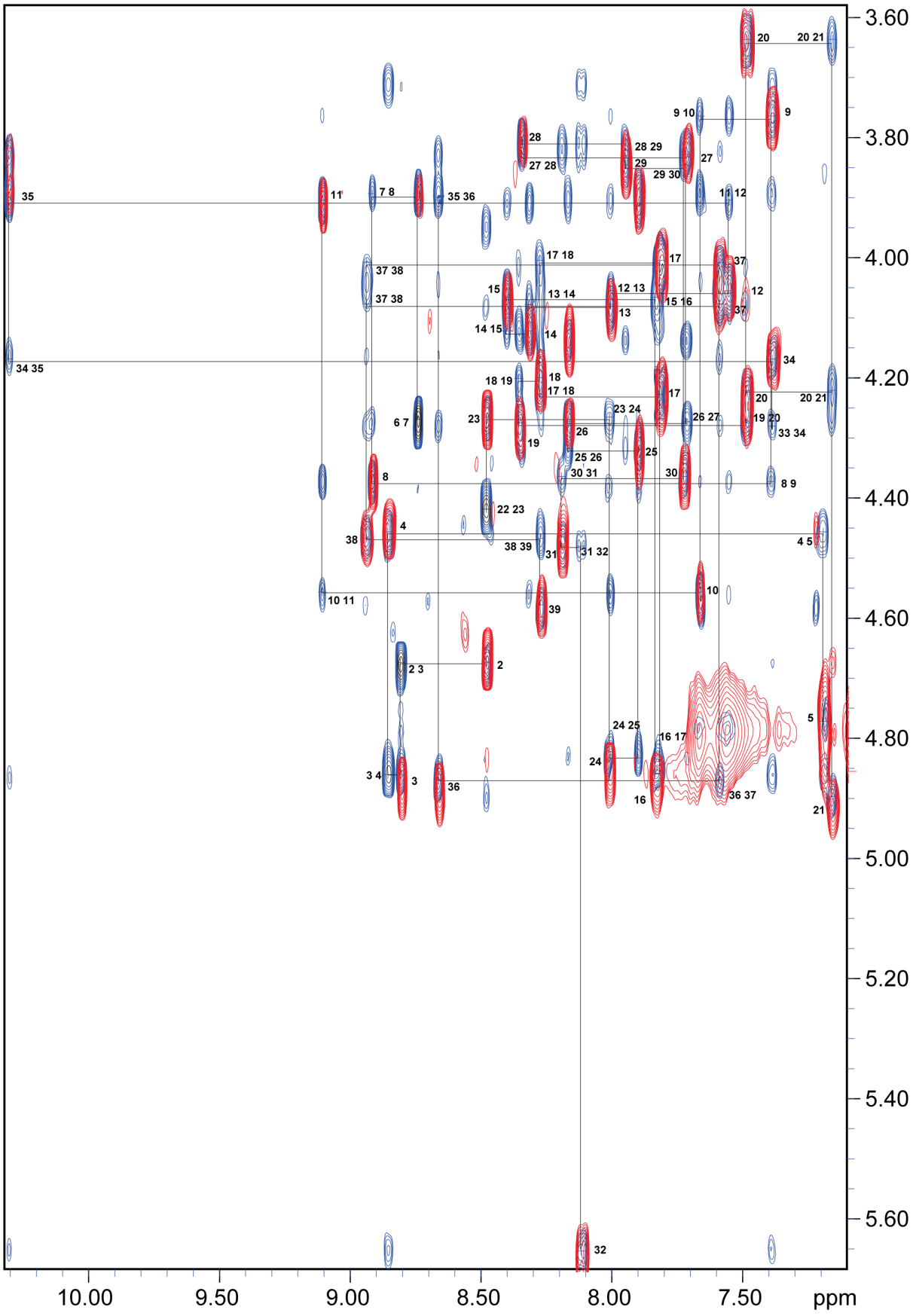
3.60
3.80
4.00
4.20
4.40
4.60
4.80
5.00
5.20
5.40
5.60
10.00
9.50
9.00
8.50
8.00
7.50
ppm

Figure S3: The NOESY and TOCSY spectra overlay of **A**) Acan1 and **B**) Nak1. Hookworm peptide was dissolved in 90% H_2O and 10% D_2O to give a final concentration of 0.5 mM, with data acquired using a Bruker Avance 600 MHz NMR spectrometer. All Spectra were recorded at 298 K. Residue numbers and lines highlight the sequential walk between intra H_α-H_N peaks and sequential H_α-H_{N+1} peaks.

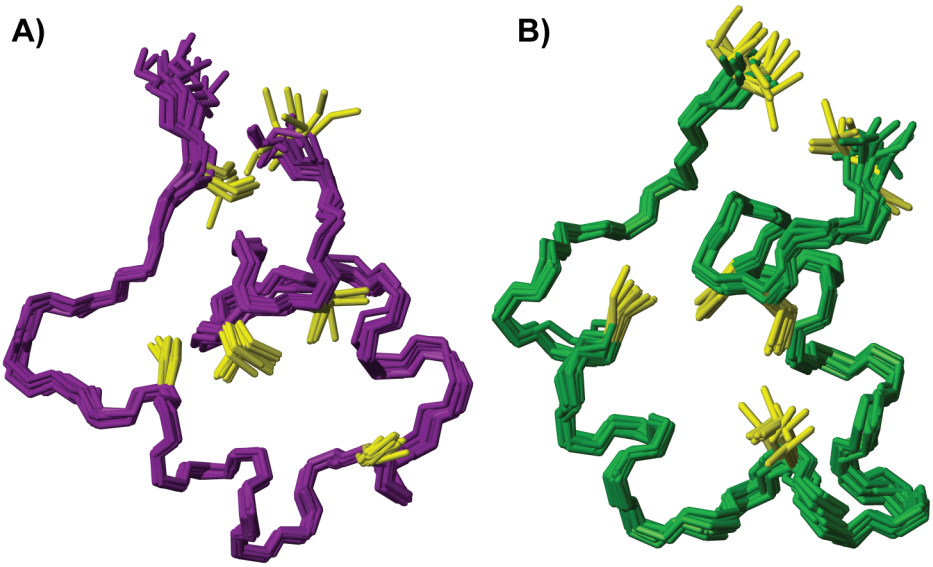

Figure S4: Solution NMR structures of Acan1 and Nak1. The 15 lowest energy structures of **A)** Acan1 and **B)** Nak1 calculated using CYANA without enforcing disulfide bonds. Cysteine side chains are shown in yellow. Images were produced in MOLMOL.

Table S1. NMR distance and dihedral statistics for Acan1 and Nak1

	Acan1	**Nak1**
Distance restraints		
Intra residual (i-j = 0)	167	205
Sequential (/i-j/ = 1)	175	193
Medium range (/i-j/ <5)	116	154
Long range (/i-j/ ≥5)	63	74
Hydrogen bonds (HB)	14 (for 7 HB)	36 (for 18 HB)
Total	535	662
Dihedral angle restraints		
Φ	36	29
χ1	13	19
Ψ	34	29
Total	83	77
Violations from experimental restraints		
NOE violations exceeding 0.2 Å	3	0
Dihedral violations exceeding 2.0°	2	0
Atomic RMSD (Å) ^		
Backbone atoms	0.89 ± 0.24	0.73 ± 0.17
Heavy atoms	1.62 ± 0.20	1.43 ± 0.17
Molprobity		
Clash Score, all atoms	15.24 ± 3.60	14.09 ± 3.5
Poor rotamers	0.300 ± 0.47	0.4 ± 0.5
Ramachandran favoured (%)	95.29 ± 2.73	90.13 ± 14.19
Ramachandran outliers (%)	98.81 ± 1.59	99.59 ± 0.98
Molprobity score	1.83 ± 0.14	1.80 ± 0.19
Molprobity score percentile	82.95 ± 6.32	84.35 ± 7.5
Bad backbone bonds/angles	0 / 0.05 ± 0.22	0 / 0

^ Atomic RMSD calculated over residues Cys3 - Cys40 for Acan1 and Asp3 – Gly37 for Nak1

Table S2. Structural statistics for Acan1 and Nak1 from CYANA

Acan1	DB 1	DB 2	DB 3	Violations	Target function avg	Avg backbone RMSD Å
No bonds	-	-	-	0	0.12	0.54 +/- 0.31
1	3-40	11-33	20-37	0	7.99E-02	0.21 +/- 0.05
2	3-40	11-37	20-33	4 (2 x Cys)	0.53	0.32 +/- 0.07
3	3-40	11-20	37-33	3 (2 x Cys)	0.28	0.53 +/- 0.11
4	3-33	11-40	20-37	3 (1 x Cys)	0.71	0.30 +/- 0.11
5	3-33	11-37	20-40	3	0.30	0.26 +/- 0.05
6	3-33	11-20	37-40	1	0.27	0.86 +/- 0.27
7	3-37	11-33	40-20	3 (1 x Cys)	0.50	0.30 +/- 0.05
8	3-37	11-20	33-40	4 (1 x Cys)	0.59	0.70 +/- 0.22
9	3-37	11-40	33-20	4 (2 x Cys)	0.92	2.06 +/- 0.25
10	3-11	40-33	20-37	3 (3 x Cys)	1.42	0.81 +/- 0.16
11	3-11	40-37	20-33	11 (4 x Cys)	1.59	1.24 +/- 0.47
12	3-11	40-20	37-33	4 (1 x Cys)	0.68	0.61 +/- 0.19
13	3-20	11-33	40-37	3 (1 x Cys)	0.55	0.53 +/- 0.22
14	3-20	11-37	40-33	5 (1 x Cys)	0.69	0.60 +/- 0.09
15	3-20	11-40	33-37	8 (3 x Cys)	1.44	0.54 +/- 0.22

Nak1	DB 1	DB 2	DB 3	Violations	Target function avg	Avg backbone RMSD Å
No bonds	-	-	-	2 (1 x Cys)	0.56	0.40 +/- 0.08
1	1-39	10-32	19-36	3 (1 x Cys)	0.46	0.43 +/- 0.15
2	1-39	10-36	19-32	7 (3 x Cys)	0.96	0.37 +/- 0.09
3	1-39	10-19	36-32	6 (4 x Cys)	1.31	0.32 +/- 0.06
4	1-32	10-39	19-36	9 (2 x Cys)	1.32	0.26 +/- 0.09
5	1-32	10-36	19-39	7 (4 x Cys)	0.69	0.37 +/- 0.09
6	1-32	10-19	36-39	12 (7 x Cys)	1.45	0.45 +/- 0.14
7	1-36	10-32	39-19	13 (4 x Cys)	1.68	0.31 +/- 0.09
8	1-36	10-19	32-39	15 (6 x Cys)	1.49	0.40 +/- 0.09
9	1-36	10-39	32-19	15 (7 x Cys)	1.62	0.47 +/- 0.09
10	1-10	39-32	19-36	6 (2 x Cys)	1.12	0.22 +/- 0.08
11	1-10	39-36	19-32	4 (2 x Cys)	0.69	0.28 +/- 0.21
12	1-10	39-19	36-32	8 (5 x Cys)	1.25	0.39 +/- 0.12
13	1-19	10-32	39-36	17 (8 x Cys)	2.08	0.33 +/- 0.12
14	1-19	10-36	39-32	20 (9 x Cys)	2.68	0.46 +/- 0.10
15	1-19	10-39	32-36	22 (13 x Cys)	3.25	0.28 +/- 0.10

DB – Disulfide bond

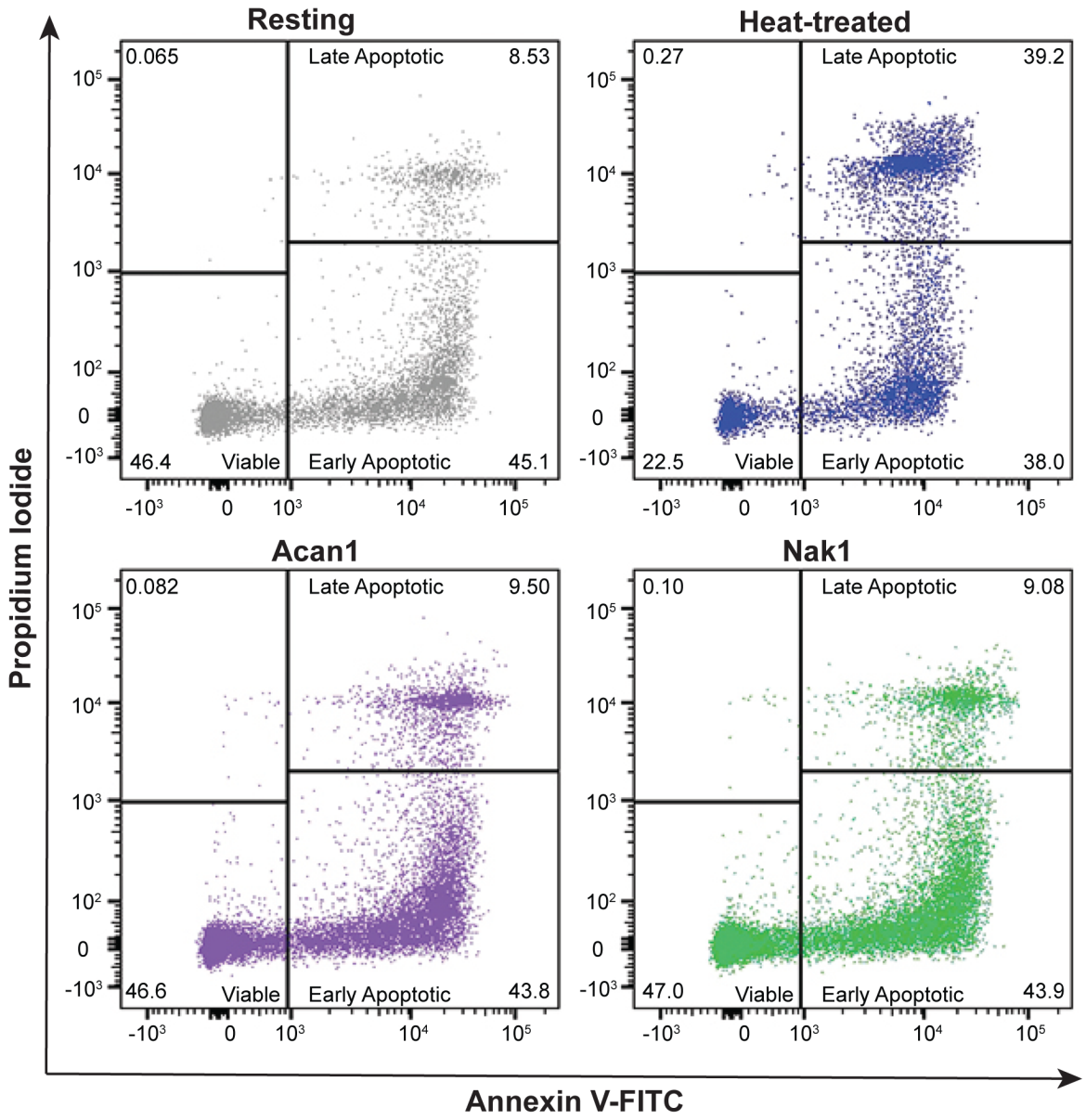

Figure S5: Annexin V apoptosis assay of peripheral blood mononuclear cells (PMBC) incubated with hookworm peptide. Human PBMCs were treated with Acan1 (purple) or Nak1 (green) at 10 μg/mL for 4 hours at 37°C/10% CO_2. A positive control (blue) was generated by heating cells to 56°C for 20 mins. Following treatment, PBMCs were labelled with Annexin V-FITC and propidium iodide and the percentage of apoptotic and necrotic populations assessed by flow cytometry (BD LSRFortessa).

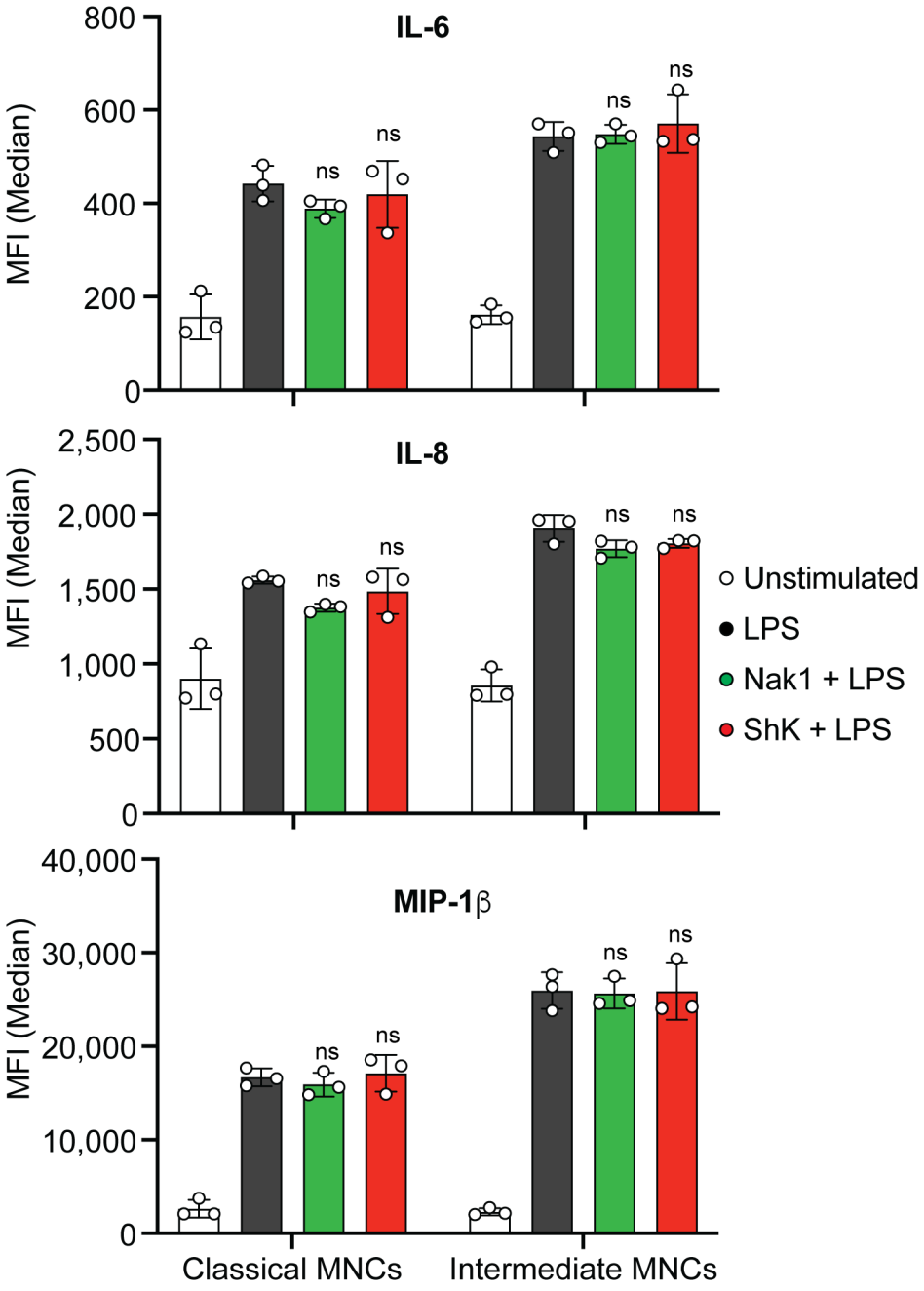

Figure S6: Intracellular cytokine staining for IL-6, IL-8 and MIP-1β in classical ($CD14^+$) or intermediate ($CD14^+/CD16^+$) monocytes (MNCs) exposed to Nak1 or ShK. Human peripheral blood mononuclear cells were stimulated with 10 ng/mL lipopolysacharide (LPS) then treated with Nak1 (100 µg/mL) or ShK (10 µg/mL) peptides for 24 h. Cytokine production was analysed by flow cytometry (BD LSRFortessa). Bars show mean MFI ± SD. Symbols show replicate values. n = 3; ns, no statistical significance; student's t-test comparing LPS to peptide treatment.

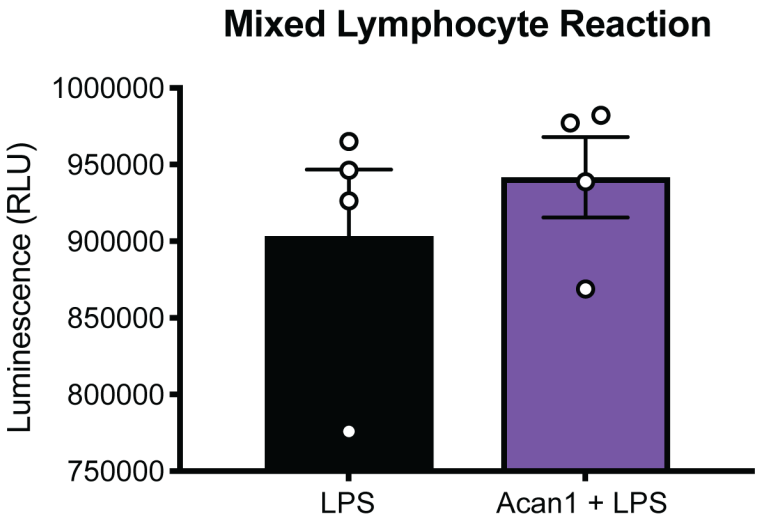

Figure S7: Mixed lymphocyte reaction using Acan1. Monocyte-derived dendritic cells (MoDCs) were generated from peripheral blood $CD14^+$ monocytes cultured with granulocyte-macrophage colony stimulating factor and IL-4 for 5 days. On day 5, $CD14^-$ MoDCs (1×10^4 cells/well) were stimulated with 100 ng/mL lipopolysaccharide (LPS) then treated with Acan1 (100 µg/mL) for 24 h. Following incubation, isolated $CD3^+$ T cells were added to the samples at a ratio of 10:1 (1×10^5 T cells/well). Mixed cultures were incubated for a further 5 days. Metabolically active cells were then determined as a quantitation of ATP luminescence (RLU) using CellTiter-Glo Luminescent Cell Viability Assay. Bars show mean RLU ± SD. Symbols show replicate values.

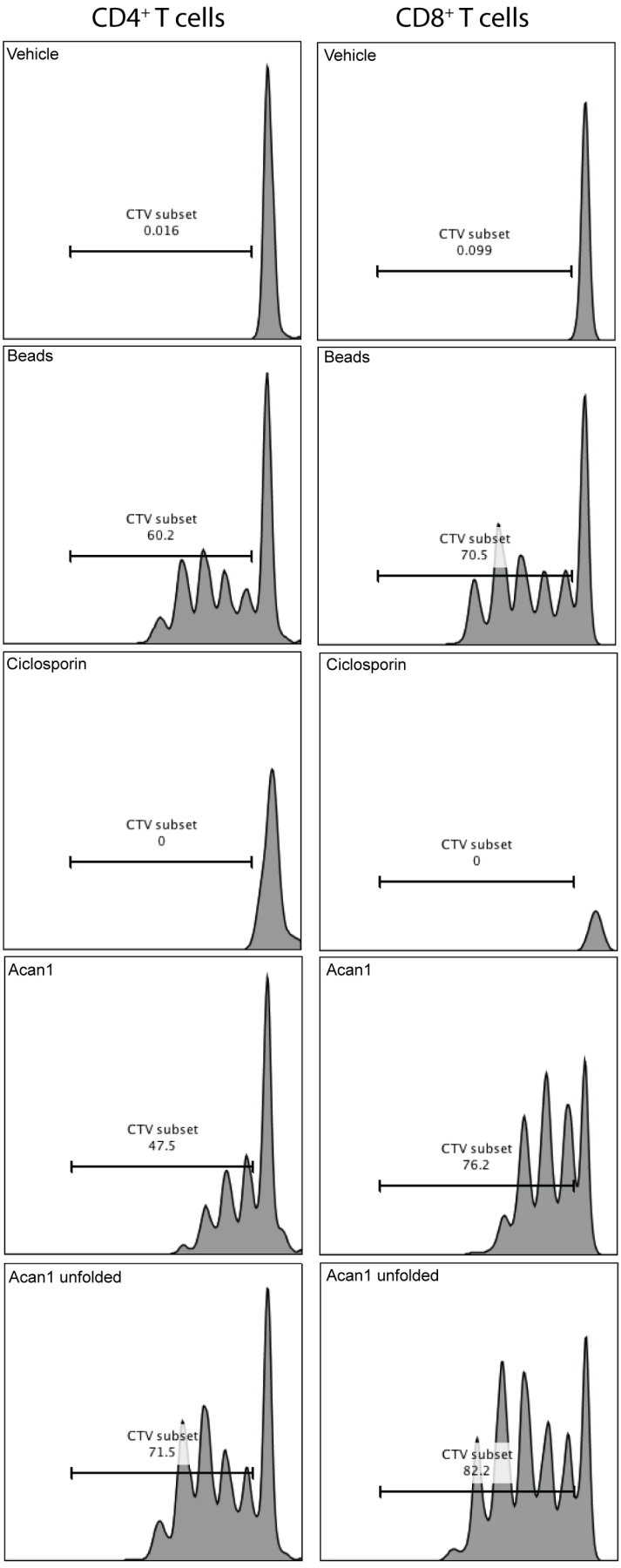

Figure S8: Example gating from CellTrace Violet proliferation assay showing T cell divisions. Purified human T cells were labelled with CellTrace Violet reagent then activated with anti-CD3/anti-CD28 stimulation beads. Activated T cells were treated with 10 µg/mL ciclosporin (suppressive control), 100 µg/mL Acan1, or 100 µg/mL unfolded Acan1 for 4 days at 37°C/5% CO_2. The effect of folded and unfolded peptide on the percentage of live proliferating T cells was assessed by flow cytometry using a BD LSRFortessa (BD Bioscience).

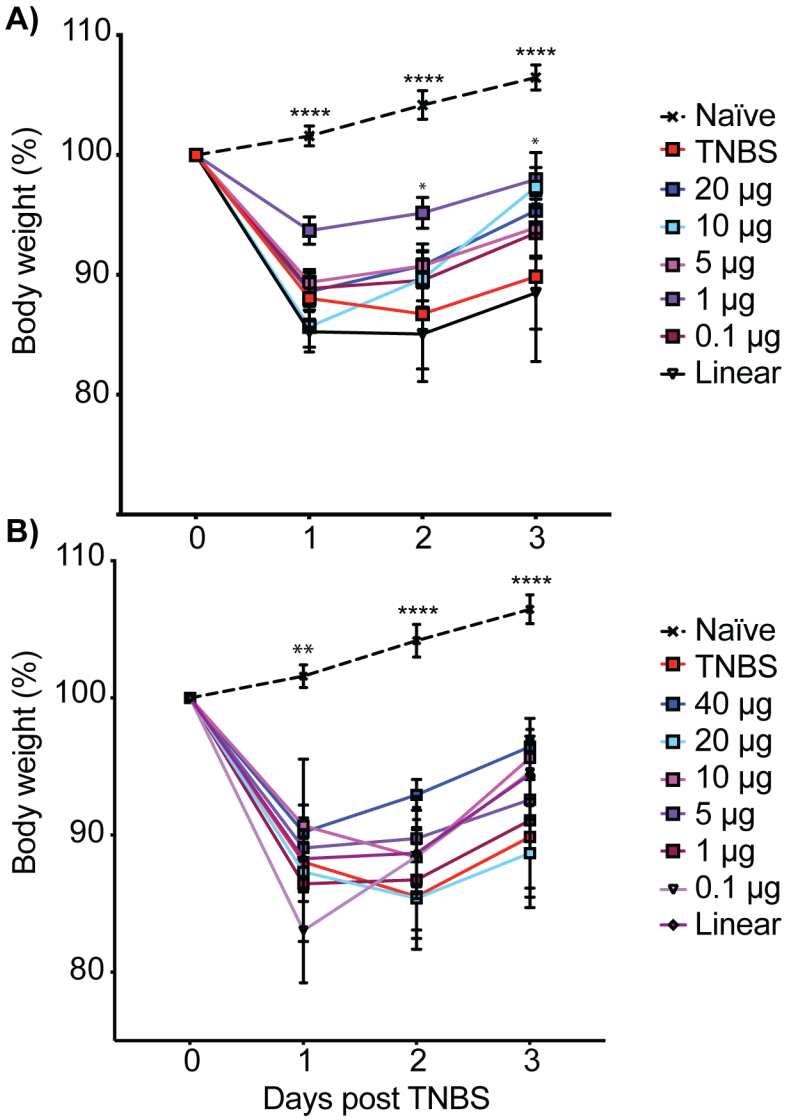

Figure S9: Mouse body weight was recorded daily for the indicated groups. Mice were administered ranging concentrations of **A**) Acan1 or **B**) Nak1 prior to TNBS at day 0 and weighed daily before being euthanised at day four. Data show mean±s.e.m. of a representative experiment out of three with n = 5. Two-way ANOVA with Dunnett's multiple comparisons test was used to compare each group to vehicle over time; *p <0.05; **p <0.01; ***p <0.001; ***p <0.0001.

Table S3: Nanostring custom CodeSet panel

nCounter Elements Design Details

Report Date: 02-Nov-17

Customer Name	Accession	Position	Target Sequence	A Tm	B Tm	Flags	HUGO Gene	Species	NSID	Tag
Actb	NM_007393.3	72-171	AGTTCGCCATGGATGACGATATCGCTGCGCTGGTCGTCGACAACGGCTCCGGCATGTGCAAAGCCGGCTTCGCGGGCGACGATGCTCCCCGGGCTGTATT	80	85	HK	Actb	Mus musculus	NM_007393.3:71	T001
Ahr	NM_013464.4	1328-1427	CTGCAGACATACTTCACTGTGCAGAATCCCACATCCGCATGATTAAGACTGGAGAAAGTGGCATGACAGTTTTCCGGCTTCTTGCAAAACACAGTCGCTG	83	82		Ahr	Mus musculus	NM_013464.4:1327	T002
Ccl11	NM_011330.3	431-530	CAACCTCCTCTCTTGACACTAACCCAGAGCCTAAGAACTGCTTGATTCCTTCTCTTTCCTAAGACGTGCTCTGAGGGAATATCAGCACCAGTCGCCCAAG	80	81		Ccl11	Mus musculus	NM_011330.3:430	T003
Cd274	NM_021893.2	516-615	TGAACTAATATGTCAGGCCGAGGGTTATCCAGAAGCTGAGGTAATCTGGACAAACAGTGACCACCAACCCGTGAGTGGGAAGAGAAGTGTCACCACTTCC	81	82		Cd274	Mus musculus	NM_021893.2:515	T004
Csf2	NM_009969.4	733-832	CTGAATCCAGCTTCTCAGACTGCTGCTTTTGTGCCTGCGTAATGAGCCAGGAACTTGGAATTTCTGCCTTAAAGGGACCAAGAGATGTGGCACAGCCACA	82	82		Csf2	Mus musculus	NM_009969.4:732	T005
Csf2rb	NM_007780.4	4186-4285	ATTGCGTGTCTGCATTGCTATGAGATGGGTTGCCGAGCCACACCTGTCTTTGGGTCCCTGTTTGCAGGGGTCTTTGCTGTAAGTGCACACGTGCCTTTGT	83	83		Csf2rb	Mus musculus	NM_007780.4:4185	T006
Csf2rb2	NM_007781.2	3249-3348	GAGGCCTGTGAGGGTGAGCTCTGCATGGTCTGTTTAGGGTTGAAGAACTCCTGAGGTCTGCTTGTCCACCATAGGCATTGATGATAACACAGCACATTTC	83	81		Csf2rb2	Mus musculus	NM_007781.2:3248	T007
Ctgf	NM_010217.2	2241-2340	GGCTCAGGGTAAGGTCCGATTCCTACCAGGAAGTGCTTGCTGCTTCTTTGATTATGACTGGTTTGGGGTGGGGGGCAGTTTATTTGTTGAGAGTGTGACC	82	81		Ctgf	Mus musculus	NM_010217.2:2240	T008
Ctla4	NM_009843.3	1476-1575	TGGACTCGAGGTCCTGCACCAACTGGCTTGGAAACTAGATGAGGCTGTCACAGGGCTCAGTTGCATAAACCGATGGTGATGGAGTGTAAACTGGGTCTTT	82	79		Ctla4	Mus musculus	NM_009843.3:1475	T009
Cx3cr1	NM_009987.3	2697-2796	TCCTGTGTTGGTTGTGATAACCATTTCAGAAGTCTCTCCCAGCCTGTTGCTCACGGCGGCATGTCTGATATCTCCTTGGCAGTCTGTATGTTTGTGTCGA	79	79		Cx3cr1	Mus musculus	NM_009987.3:2696	T010
Cxcl10	NM_021274.1	116-215	AGGACGGTCCGCTGCAACTGCATCCATATCGATGACGGGCCAGTGAGAATGAGGGCCATAGGGAAGCTTGAAATCATCCCTGCGAGCCTATCCTGCCCAC	82	81		Cxcl10	Mus musculus	NM_021274.1:115	T011
Cysltr1	NM_021476.4	1191-1290	CAACGAACTATCCACCTTCACCTTTTACACAGTGAAACTAGACCCTGTGATTCTGTCCTTAGGATGCAGAAGTCAGTGGTCATAACCTTATCTCTAGCTG	81	79		Cysltr1	Mus musculus	NM_021476.4:1190	T012
Foxo1	NM_019739.2	2531-2630	TTTCCTCAGACTTGGCAACAGCGGCAGCACTTTCCTGTGCAGGATGTTTGCCCAGCGTCCGCAGGTTTTGTGCTCCTGTAGATAAGGACTGTGCCATTGG	81	82		Foxo1	Mus musculus	NM_019739.2:2530	T013
Foxo3	NM_019740.2	2222-2321	GATGCTGACGGGTTGGATTTTAACTTTGACTCCCTCATCTCCACACAGAACGTTGTTGGTTTGAATGTGGGGAACTTCACTGGTGCTAAGCAGGCCTCAT	80	82		Foxo3	Mus musculus	NM_019740.2:2221	T014
Foxp3	NM_054039.2	195-294	TGCCTTCAGACGAGACTTGGAAGACAGTCACATCTCAGCAGCTCCTCTGCCGTTATCCAGCCTGCCTCTGACAAGAACCCAATGCCCAACCCTAGGCCAG	85	85		Foxp3	Mus musculus	NM_054039.2:194	T015
Gata6	NM_010258.3	2066-2165	GGGCTCTGAAGGCCTCATACCACTTGTGTCTGATATTGTCCAGCAGTCCAGATGGCAGCAAAAATGCAGACATAACATTCCTTCGATGCGTGATTTCTGT	81	78		Gata6	Mus musculus	NM_010258.3:2065	T016
Gusb	NM_010368.1	1736-1835	AATACGTGGTCGGAGAGCTCATCTGGAATTTCGCCGACTTCATGACGAACCAGTCACCGCTGAGAGTAATCGGAAACAAGAAGGGGATCTTCACTCGCCA	79	81	HK	Gusb	Mus musculus	NM_010368.1:1735	T017
Hprt	NM_013556.2	31-130	TGCTGAGGCGGCGAGGGAGAGCGTTGGGCTTACCTCACTGCTTTCCGGAGCGGTAGCACCTCCTCCGCCGGCTTCCTCCTCAGACCGCTTTTTGCCGCGA	82	82	HK	Hprt	Mus musculus	NM_013556.2:30	T018
Icos	NM_017480.1	143-242	TTCACAATGGAGGTGTACAGATTTCTTGTAAATACCCTGAGACTGTCCAGCAGTTAAAAATGCGATTGTTCAGAGAGAGAGAAGTCCTCTGCGAACTCAC	79	81		Icos	Mus musculus	NM_017480.1:142	T019
Id2	NM_010496.3	626-725	AAGAAAGCGGAAGGAAAACTAAGGATGATCGTCTTGCCCAGGTGTCGTTCTCCGGCCTGGACTGTGATACCGTTATTTATGAGAGACTTTCAGTGCCCTT	83	80		Id2	Mus musculus	NM_010496.3:625	T020
Ido1	NM_008324.1	522-621	ACATGGACATTCTGTTCTCATTTCCTGGTGGGGACTGCGACAAGGGCTTCTTCCTCGTCTCTCTATTGGTGGAAATCGCAGCTTCTCCTGCAATCAAAGC	82	80		Ido1	Mus musculus	NM_008324.1:521	T021
Mki67	NM_001081117.2	1982-2081	TGATTTGCTCCAAAAGGCGAAGTGGAGCTTCTGAAGCCAACTTGATTGTTGCAAAATCATGGGCTGATGTTGTAAAACTTGGCGTGAAACAAACACAAAC	80	82		Mki67	Mus musculus	NM_001081117.2:1981	T022
Mmp10	NM_019471.2	1051-1150	CAGACTTAGATGCTGCCTATGAGGCTCACAACACGGACAGTGTTCTGATTTTTAAAGGAAGTCAGTTCTGGGCAGTCCGAGGAAATGAAGTCCAAGCAGG	82	82		Mmp10	Mus musculus	NM_019471.2:1050	T023
Mmp2	NM_008610.2	2377-2476	AGTTAACCAGCCTTCTCCTTCACCTGGTGACTTCAGATTTAAGAGGGTGGCTTCTTTTTGTGCCCAAAGAAAGGTGCTGACTGTACCCTCCCGGGTGCTG	81	82		Mmp2	Mus musculus	NM_008610.2:2376	T024
Mmp3	NM_010809.1	1576-1675	TCTTTGTGAAAGGAAGTGCTTTGTTCAGCATGTGCTATGGCAGAACCAAACAGGAGCTATGGATGACACCAGTCAACGTCAAGTTGTCAAAGGATGTTCA	79	82		Mmp3	Mus musculus	NM_010809.1:1575	T025
Mmp9	NM_013599.2	1571-1670	CCTCTACAGAGTCTTTGAGTCCGGCAGACAATCCTTGCAATGTGGATGTTTTTGATGCTATTGCTGAGATCCAGGGCGCTCTGCATTTCTTCAAGGACGG	78	80		Mmp9	Mus musculus	NM_013599.2:1570	T026
Myd88	NM_010851.2	1596-1695	GCTGCAGGCTCAGCTGTTTTCTCCCCAGCAGCGAGGTTTGCATCTTCTTATTCCTTTCACGTTCTCTACCATAGAGGCAATGTCATGGTCCCTCTCAGGG	81	80		Myd88	Mus musculus	NM_010851.2:1595	T027
Nfkb1	NM_008689.2	2126-2225	GTCTTACACTTAGCCATCATCCACCTCCACGCTCAGCTTGTGAGGGATCTGCTGGAAGTCACATCTGGTTTGATCTCTGATGACATCATCAACATGAGAA	83	81		Nfkb1	Mus musculus	NM_008689.2:2125	T028
Nfkb2	NM_019408.2	1151-1250	CCTATCACAAGATGAAGATCGAGAGGCCTGTAACGGTGTTCCTGCAGCTGAAACGCAAGCGTGGGGGCGATGTCTCGGACTCCAAACAGTTCACATATTA	83	79		Nfkb2	Mus musculus	NM_019408.2:1150	T029
Nfkbia	NM_010907.2	647-746	CTGCAGGCCACCAACTACAATGGCCACACGTGTCTGCACCTAGCCTCTATCCACGGCTACCTGGCCATCGTGGAGCACTTGGTGACTTTGGGTGCTGATG	87	87		Nfkbia	Mus musculus	NM_010907.2:646	T030
Nfkbib	NM_010908.4	383-482	GCCAAACAGCCCTGCATCTAGCAGCCATCCTTGGGGAGGCATCTACAGTAGAGAAGTTGTATGCAGCCGGTGCAGGAGTGTTGGTGGCTGAGAGAGGGGG	82	81		Nfkbib	Mus musculus	NM_010908.4:382	T031
Nlrp1a	NM_001004142.2	4071-4170	CAGGGCTGAGGATCATGGGACTGGAAAGTGAGTGTCTTATGAATAGGAAAGGAAGGGGGCTTTTTAAACTCATGTTGTGTGCTCAGAAACAGAGGTGTAG	83	82		Nlrp1a	Mus musculus	NM_001004142.2:4070	T032
Nlrp1b	NM_001040696.1	3659-3758	CCCATCCTCACCTGGTCATGGACCTCTTAGAAAAGTCAGGTGGGGTCTCTTTGGGATCCTGACATTGATAGGAGCCTGGCATCTCTTTTCCTGAGAGGCT	82	82		Nlrp1b	Mus musculus	NM_001040696.1:3658	T033
Nlrp3	NM_145827.3	509-608	ACGTGTACATCACATTCCTCTATGGTATGCCAGGAGGACAGCCTTGAAGAAGAGTGGATGGGTTTGCTGGGATATCTCTCCCGCATCTCCATTTGTAAAA	82	80		Nlrp3	Mus musculus	NM_145827.3:508	T034
Ptger3	NM_011196.2	163-262	GCGCACAGCAACCTGTCAAGTACTACCGACGACTGCGGCTCCGTGTCCGTGGCCTTTCCCATCACCATGATGGTCACTGGCTTCGTGGGCAACGCGCTGG	82	82		Ptger3	Mus musculus	NM_011196.2:162	T035
Ptgs2	NM_011198.3	676-775	CCATCAGTTTTTCAAGACAGATCATAAGCGAGGACCTGGGTTCACCCGAGGACTGGGCCATGGAGTGGACTTAAATCACATTTATGGTGAAACTCTGGAC	79	81		Ptgs2	Mus musculus	NM_011198.3:675	T036
Rel	NM_009044.2	1291-1390	ATGGTACAGTTTTACCAGAAATGCCCAGGTCTTCAGGAGTTCCAGGGCAAGCTGAACCTTACTATTCTTCATGCGGGTCCATCTCGAGTGGATTGCCACA	79	80		Rel	Mus musculus	NM_009044.2:1290	T037
Rela	NM_009045.4	646-745	GAGGCTGACCTCTGCCCAGACCGCAGTATCCATAGCTTCCAGAACCTGGGGATCCAGTGTGTGAAGAAGCGAGACCTGGAGCAAGCCATTAGCCAGCGAA	81	82		Rela	Mus musculus	NM_009045.4:645	T038
Relb	NM_009046.2	2014-2113	TTCTCTTTGAGCCCATTTTACAGAATGCTGAGTCCGAAGAGGAAAAGGGGCTCCTGCAGATGGACCCCTTCTCAGGACAGATTCTCAGAGATTGTACATA	81	83		Relb	Mus musculus	NM_009046.2:2013	T039
Ripk2	NM_138952.3	831-930	CCAGGGACATCGACCTGACACCAGTGAGGAGAATTTGCCATTTGATATACCTCATCGAGGTCTCATGATCTCTCTAATACAGAGTGGATGGGCGCAAAAC	82	83		Ripk2	Mus musculus	NM_138952.3:830	T040
Smad1	NM_008539.3	241-340	ACAGGAGGGACAGTATTTTCTACCTTTCCAAACCGCAGACCAAGAAGCTAAGGAGAAATCTATGTAAATATACTGAAATCTCTGTTGGCTCTGCGCCCAAC	82	82		Smad1	Mus musculus	NM_008539.3:240	T041
Smad3	NM_016769.3	1846-1945	GTGTATCGCCACCTGACTCCTTGTTTAATGACAGAGGTCTGGGATGTCACAGTCCAAAAGGAAAGTGCCTTTCTCCATGGCTGGAGTATGGAGTTTACCT	83	83		Smad3	Mus musculus	NM_016769.3:1845	T042
Smad5	NM_008541.2	2631-2730	ATACCTTTGCTCCTTACCAGACTTGTCATACAAGGACTCGTGCAGTGTAGCCAGTAGAGGCTCTTTGGTTGGCCCAAGAATGAGGCTGTTGGTGTAAGTG	79	81		Smad5	Mus musculus	NM_008541.2:2630	T043
Smad6	NM_008542.2	1169-1268	CACTGGATCTGTCCGATTCTACATTGTCTTACACTGAAACCGAGGCCACCAACTCCCTCATCACTGCTCCGGGTGAATTCTCAGATGCCAGCATGTCTCC	82	83		Smad6	Mus musculus	NM_008542.2:1168	T044
Tbx21	NM_019507.2	545-644	CCCAGGGCCGCGCGAGGACTACGCATTGCCCGCGGGGTTGGAGGTGTCTGGGAAGCTGAGAGTCGCGCTCAGCAACCACCTGTTGTGGTCCAAGTTCAAC	85	85		Tbx21	Mus musculus	NM_019507.2:544	T045
Tgfb1	NM_011577.1	1471-1570	GGAGTTGTACGGCAGTGGCTGAACCAAGGAGACGGAATACAGGGCTTTCGATTCAGCGCTCACTGCTCTTGTGACAGCAAAGATAACAAACTCCACGTGG	82	78		Tgfb1	Mus musculus	NM_011577.1:1470	T046
Tgfb2	NM_009367.1	1686-1785	CCCAAAGCCAGAGTGGCCGAGCAGCGGATTGAACTGTATCAGATCCTTAAATCCAAAGACTTAACATCTCCCACCCAGCGCTACATCGATAGCAAGGTTG	82	79		Tgfb2	Mus musculus	NM_009367.1:1685	T047
Tgfbr1	NM_009370.2	4426-4525	TCAGAAGTAGTGGCCAGCTGTGTCTCTAGTAGGACAGTAAAGGCATGAAGCTCAGCCTGTAATCCTGCTACTACAGTAGTACTCCAGAAGTGCCTTGAGG	82	82		Tgfbr1	Mus musculus	NM_009370.2:4425	T048
Tgfbr2	NM_009371.2	476-575	TGTGCAAGTTTTGCGATGTGAGACTGTCCACTTGCGACAACCAGAAGTCCTGCATGAGCAACTGCAGCATCACGGCCATCTGTGAGAAGCCGCATGAAGT	80	83		Tgfbr2	Mus musculus	NM_009371.2:475	T049
Tnfaip3	NM_009397.2	233-332	GGCTGAACAACTTCTTCCTCAGGCTTTGTATTTGAGCAATATGCGGAAAGCTGTGAAGATACGAGAGAGAACCCCAGAAGACATTTTCAAACCTACCAAT	79	83		Tnfaip3	Mus musculus	NM_009397.2:232	T050
Tnfrsf10b	NM_020275.3	1626-1725	CTGGTTCACATAAGATCCCATATAATGTGCAGGATGGCTAAACTTGCTGAGAGCTGACTCTGTGGTCTCCTGTCCAGATTCTAGCGATATTCATTACTA	81	80		Tnfrsf10b	Mus musculus	NM_020275.3:1625	T051
Tnfrsf14	NM_178931.2	626-725	ACAGACACCACCTGCTCCTCCCAGGTCGTCTACTACGTTGTGTCCATCCTTTTGCCACTTGTGATAGTGGGAGCTGGGATAGCTGGATTCCTCATCTGCA	83	83		Tnfrsf14	Mus musculus	NM_178931.2:625	T052
Tnfrsf8	NM_009401.2	1276-1375	GAGCCCCGGGTATCCACGGAACACACCAATAACAGGATTGAGAAAATCTACATCATGAAGGCCGACACAGTGATCGTGGGCTCTGTAAAAACTGAAGTCC	80	79		Tnfrsf8	Mus musculus	NM_009401.2:1275	T053
Tnfsf15	NM_177371.3	4696-4795	AAGACTCACAAGCCCGAGTTGCAGTTACTTTTCTGAAGCAACATAGTATGTTAATGGAATGGCCAGAACTCTACTCTTGGCACATGGCACTGAATTTGAT	79	82		Tnfsf15	Mus musculus	NM_177371.3:4695	T054
Tslp	NM_021367.1	639-738	CTGTACTGTTAATGACCAGCTTCTGAGAAGTCTTTCTCACCTCCCCTGCACACACCTTACTCTAGGGCAAACCTAACTGTAGTAGGAAGAGAATTGAAAG	81	83		Tslp	Mus musculus	NM_021367.1:638	T055
Wnt1	NM_021279.4	2189-2288	ACCTCACTGCTCCTCTGTTCTGCTCGCCAGTCCTTTTGTTATCCGACCTTTTTTCTCTTTTACCCAGCTTCTCATAGGCGCCCTTGCCCACCGGATCAGT	79	79		Wnt1	Mus musculus	NM_021279.4:2188	T056
Wnt2b	NM_009520.3	1896-1995	ATAGCTAGATGGGTTAGCCACATTGAACAAGGCTCCACATCATGCTTCTACGCAGCTTATAAAGTAGTGGTTTGGTGAGGAGGAAAATCACAATGCTCTA	83	80		Wnt2b	Mus musculus	NM_009520.3:1895	T057
Wnt5a	NM_009524.2	3021-3120	TGGAGGTACGGTAACTTGATGTGTTTTGATGATATCTCTTGGCCCAGGGAGTCCACAGAGGTGTTGCAGCTGTTTGGTTGTTATCCTCCTGCGTTTAGAC	81	78		Wnt5a	Mus musculus	NM_009524.2:3020	T058
Zap70	NM_009539.2	1031-1130	TACGAGAGTCCCTACAGCGACCCTGAGGAACTCAAAGACAAGAAGCTCTTCCTGAAGCGAGAGAATCTCCTCGTGGCGGACATCGAGCTTGGCTGTGGCA	86	85		Zap70	Mus musculus	NM_009539.2:1030	T059
Mmp13	NM_008607.1	191-290	ACAGTGACCTCCACAGTTGACAGGCTCCGAGAAATGCAATCTTTCTTTGGCTTAGAGGTGACTGGCAAACTTGATGATCCCACCTTAGACATCATGAGAA	78	80		Mmp13	Mus musculus	NM_008607.1:190	T060