

SUPPLEMENTARY MATERIALS

Vaccination Against Whipworm: Identification of Potential Immunogenic Proteins in *Trichuris muris* Excretory/Secretory Material

Rebecca K. Shears, Allison J. Bancroft, Catherine Sharpe, Richard K. Grencis* and David J. Thornton*.

Wellcome Trust Centre for Cell-Matrix Research and Manchester Immunology Group, School of Biological Sciences, Faculty of Biology, Medicine and Health, Manchester Academic Health Sciences Centre, University of Manchester, M13 9PT

*Co-corresponding authors

David Thornton, AV Hill Building, Faculty of Biology, Medicine and Health, University of Manchester, Oxford Road, Manchester, M13 9PT

E-mail: dave.thornton@manchester.ac.uk

Richard Grencis, AV Hill Building, Faculty of Biology, Medicine and Health, University of Manchester, Oxford Road, Manchester, M13 9PT

E-mail: richard.grencis@manchester.ac.uk

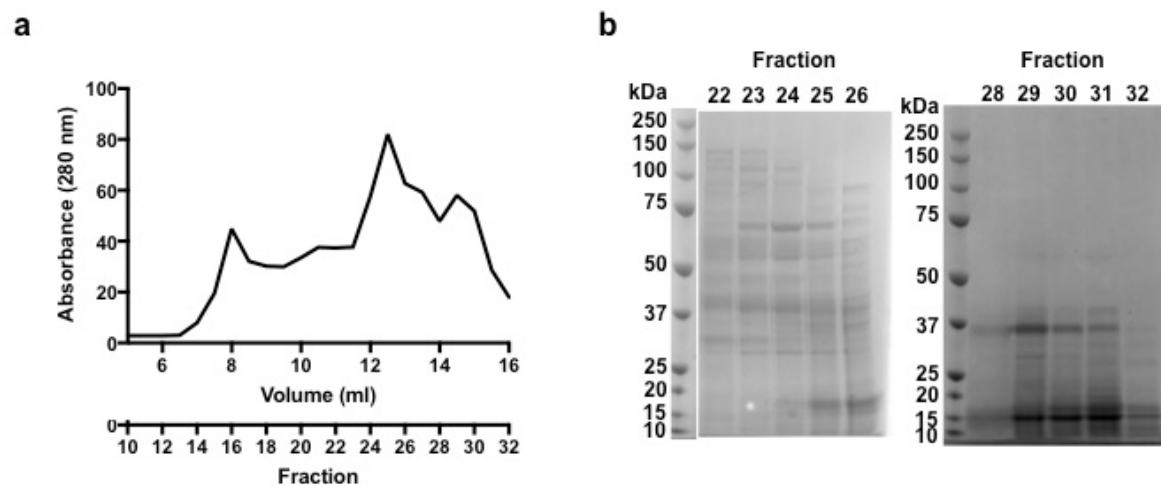


Figure S1. Fractionation of ES using Superdex 75 chromatography media. (a) Shows UV trace (absorbance at 280 nm) across the chromatographic separation, while (b) shows SDS-PAGE analysis of fractions 22 to 32 (left lane shows molecular weight markers in kDa).

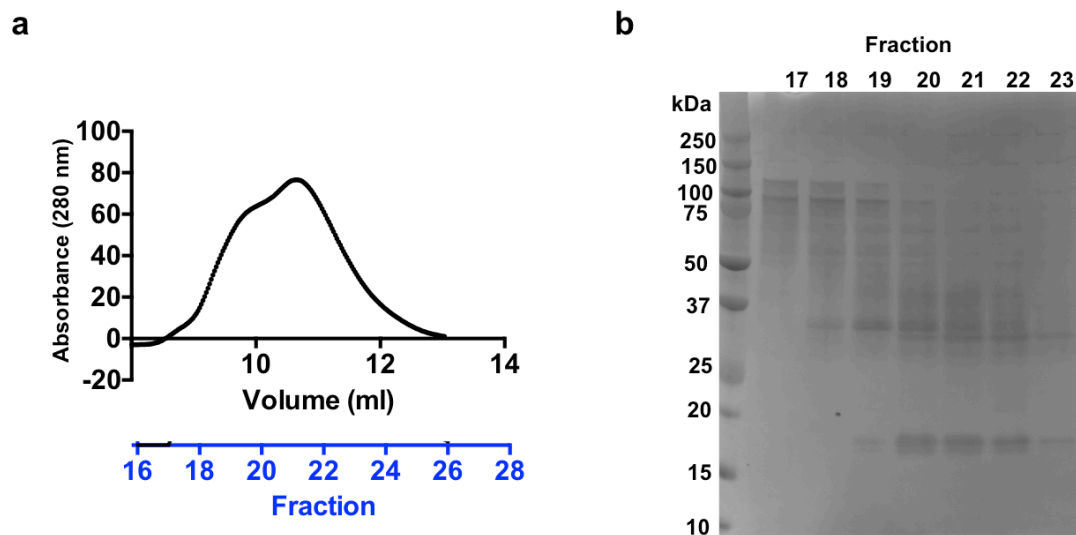


Figure S2. Fractionation of sub-group 3 antigens using Superdex 75 chromatography media. (a) Shows UV trace (absorbance at 280 nm) across the chromatographic separation, while (b) shows SDS-PAGE analysis of fractions 17 to 23 (left lane shows molecular weight markers in kDa).

Table S1

Accession number	Protein	Mw (kDa)	16	17	18	19	20	21	22	Fraction		23	24	25	26	27	28	29	30	31	32
1 TMU1_00327000100	Flam-B 9093-domain containing protein	39	0	0	0	0	0	0	0	38	2	33	46	24	11	7	0	0	0	0	0
2 TMU1_00272006900	myoglobin	18	6	6	0	3	5	0	2	0	2	0	2	0	4	5	19	31	41	18	19
3 TMU1_00165000300	WAP type 'four disulfide core'	48	0	0	0	0	0	0	0	44	33	29	23	12	11	9	16	12	12	10	
4 TMU1_00201000900	Flam-B 9093-domain containing protein	39	0	0	0	0	0	0	0	42	61	36	14	8	5	0	0	0	0	0	
5 TMU1_00103004200	epididymal secretory protein E1	35	0	0	0	0	0	0	0	2	0	0	0	0	13	22	48	25	20	20	
6 TMU1_00102000900	enolase	48	25	19	14	9	9	5	6	0	6	14	14	16	10	2	7	6	6	6	
7 TMU1_00292005700	actin	42	11	11	13	13	5	4	4	5	13	19	18	18	11	3	4	6	8	8	
8 TMU1_00086001700	78 kDa glucose regulated protein	73	0	0	0	0	0	0	0	11	11	10	12	5	0	0	2	3	5	3	
9 TMU1_00012009900	hypothetical protein	45	0	8	34	21	36	3	10	12	9	6	9	7	0	0	0	0	0	0	
10 TMU1_00003006100	hypothetical protein	225	7	5	4	7	6	3	7	6	11	8	9	10	7	5	5	7	3	3	
11 TMU1_00016011400	MULE and Flam-B 516 and WAP-domain containing	71	0	0	0	0	0	0	0	2	10	15	20	29	16	12	12	9	11	11	
12 TMU1_00033007600	WAP type 'four disulfide core'	45	0	0	0	0	0	0	0	10	22	16	18	30	23	12	13	7	8	8	
13 TMU1_00033007100	hypothetical protein	162	5	5	10	15	21	7	4	6	11	6	9	8	8	6	3	4	2	2	
14 TMU1_00256000200	hypothetical protein	70	20	13	13	10	9	0	5	3	4	7	13	12	12	8	6	5	2	2	
15 TMU1_00250000100	hypothetical protein	28	4	0	4	2	3	2	4	15	26	20	17	14	11	4	11	7	7	7	
16 TMU1_00252000100	hypothetical protein	23	4	8	13	7	9	9	14	13	13	13	10	16	10	8	7	8	6	6	
17 TMU1_00091002200	Fascidin-domain containing protein	81	17	15	13	16	32	14	18	0	0	0	0	0	0	0	0	0	0	0	
18 TMU1_00005007100	protein mig c; protein mig b; protein mig a	234	27	25	23	27	20	9	4	0	0	0	0	0	0	0	0	0	0	0	
19 TMU1_00090129000	hypothetical protein	52	19	20	24	19	12	7	12	5	0	0	0	0	0	0	0	0	0	0	
20 TMU1_00033006400	CAP-domain containing protein	35	3	2	3	2	11	54	53	0	0	0	0	0	0	0	0	0	0	0	
21 TMU1_00081001900	protein disulfide isomerase	55	0	0	0	0	0	0	0	18	33	25	24	10	9	6	0	4	2	2	
22 TMU1_00033006600	Flam-B 13663-domain containing protein	164	6	5	5	10	8	0	2	15	9	3	4	7	3	5	8	6	5	5	
23 TMU1_00034001200	conserved hypothetical protein	43	4	3	2	6	6	9	26	17	12	5	6	4	13	2	4	2	4	4	
24 TMU1_00040002000	chymotrypsin inhibitor	16	0	0	0	0	0	0	0	0	0	0	2	18	39	14	13	8	4	4	
25 TMU1_00049005700	protein crumbs	382	8	10	16	20	25	12	10	0	0	0	0	0	0	0	0	0	0	0	
26 TMU1_00246000600	conserved hypothetical protein	41	0	0	0	0	0	3	19	20	25	10	0	0	0	0	0	0	0	0	
27 TMU1_00014002400	conserved hypothetical protein	39	8	0	4	0	2	0	5	7	7	8	8	8	4	11	6	8	0	0	
28 TMU1_00175000100	Flam-B 9093-domain containing protein	34	25	12	19	10	15	7	3	0	0	0	0	0	0	0	0	0	0	0	
29 TMU1_00245000500	VWD and Vitellogenin N and DUF1943-domain conta	202	12	13	13	11	15	8	19	0	0	0	0	0	0	0	0	0	0	0	
30 TMU1_00191000800	Trypsin-domain containing protein	79	0	6	8	0	0	0	0	26	27	9	8	7	6	3	13	7	12	12	
31 TMU1_00033008500	conserved hypothetical protein	36	8	9	5	5	4	3	5	13	16	7	5	5	2	3	4	3	0	0	
32 TMU1_00028000200	Phosphoenolpyruvate carboxykinase GTP	80	0	0	0	0	0	0	0	12	19	14	16	13	9	2	4	0	5	5	
33 TMU1_00256000600	conserved hypothetical protein	48	16	10	12	3	6	0	0	3	9	8	10	12	0	0	9	6	0	0	
34 TMU1_00252000300	hypothetical protein	64	0	0	0	0	0	0	0	5	18	25	17	14	9	0	7	3	2	2	
35 TMU1_00081002200	protein L isospartate(D aspartate)	51	0	0	0	0	0	0	0	0	0	0	3	6	10	13	24	16	13	13	
36 TMU1_00111003300	protein disulfide isomerase A3	65	0	0	0	0	0	0	0	8	16	15	14	9	6	0	9	2	4	4	
37 TMU1_00083002200	poly cysteine and histidine labeled protein	43	0	0	0	0	0	0	0	2	6	4	7	6	3	0	13	7	12	12	
38 TMU1_00002015700	Vitellogenin N and VWD and CB and DUF1943-doma	354	19	6	19	16	13	2	0	0	0	0	0	0	0	0	0	0	0	0	
39 TMU1_00177000800	heat shock protein 70	71	0	0	0	0	0	0	0	11	9	14	11	7	6	3	4	3	3	3	
40 TMU1_00373003800	NAD(P) dependent malic enzyme, mitochondrial	71	24	17	10	5	4	4	20	0	0	0	0	0	0	0	0	0	0	0	
41 TMU1_00050005600	DUF200-domain containing protein	42	0	0	0	0	0	0	0	6	2	6	4	7	6	3	10	2	2	2	
42 TMU1_00016004100	Serpin protein	177	13	12	12	11	9	4	5	0	0	0	0	0	0	0	0	0	0	0	
43 TMU1_00033001500	CAP-domain containing protein	40	0	0	0	0	0	0	0	14	24	15	5	9	8	5	4	0	2	2	
44 TMU1_00023000200	Flam-B 9093-domain containing protein	32	4	2	3	4	0	0	0	8	16	13	3	2	0	0	0	0	0	0	
45 TMU1_00003007400	peptidase, S1A subfamily	49	0	0	0	0	0	0	0	4	15	13	14	13	9	4	8	4	2	2	
46 TMU1_00010011900	E3 ubiquitin protein ligase TRIM9	86	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
47 TMU1_00123000300	protein ketn d; protein ketn c; protein ketn b; protein ke	1721	0	0	0	0	0	0	0	3	3	2	4	4	8	2	3	0	0	0	
48 TMU1_00040000600	r nucleosides	66	0	0	0	0	0	0	0	11	22	0	0	0	0	0	0	0	0	0	
49 TMU1_00023000400	Flam-B 9093-domain containing protein	42	0	0	0	0	0	0	0	0	3	9	14	14	8	6	8	6	4	4	
50 TMU1_00208001600	pathogenesis protein 1B	43	26	12	13	8	5	7	9	0	0	0	0	0	0	0	0	0	0	0	
51 TMU1_00015001100	pancreatic alpha amylase	51	10	14	11	14	10	0	0	0	0	0	0	0	0	0	0	0	0	0	
52 TMU1_00040006800	Trypsin-domain containing protein	129	0	0	0	0	0	0	0	4	5	6	3	4	4	4	0	3	3	4	
53 TMU1_00302000300	fructose biphosphate aldolase class I	44	0	0	0	0	0	0	0	28	17	10	11	7	3	0	0	0	0	0	
54 TMU1_00129000500	hypothetical protein	21	3	2	3	0	0	0	0	0	0	0	0	0	0	12	6	11	13	5	
55 TMU1_00070014000	phosphoglycerate kinase	45	19	14	11	5	9	2	2	0	0	0	0	0	0	0	0	0	0	0	
56 TMU1_00003000700	histone H4	11	5	6	0	11	15	6	4	0	0	0	0	0	0	0	0	0	0	0	
57 TMU1_00175001500	porin	54	0	0	0	0	0	5	0	20	29	17	10	15	0	6	7	6	10	10	
58 TMU1_00060008700	thioredoxin	55	5	5	0	5	2	4	5	0	0	0	2	4	8	3	4	2	2	2	
59 TMU1_00033006300	conserved hypothetical protein	45	0	0	0	6	18	13	0	0	0	0	0	0	0	0	0	0	0	0	
60 TMU1_00138000200	A macroglobulin complement component family	165	6	4	4	6	10	8	14	0	0	0	0	0	0	0	0	0	0	0	
61 TMU1_00118000700	Trypsin-domain containing protein	33	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	20	11	8	
62 TMU1_00111003300	calreticulin	46	2	0	0	4	4	4	12	12	12	8	3	0	0	0	0	0	0	0	
63 TMU1_00080001600	DNase II-domain containing protein	42	0	0	0	0	0	0	0	8	4	6	0	0	0	5	6	4	5	5	
64 TMU1_00030007700	DNase II-domain containing protein	31	0	0	0	0	0	0	0	11	14	13	6	7	5	0	2	0	0	0	
65 TMU1_00019005500	topoisomycin	33	0	0	5	8	7	0	4	2	0	3	3	3	0	4	3	3	5	5	
66 TMU1_00031002800	hypothetical protein	17	0	0	0	0	0	0	0	0	0	0	7	12	6	1	0	0	0	0	
67 TMU1_00005004200	malate dehydrogenase	39	0	0	0	0	0	0	0	0	3	5	17	9	3	0	4	0	0	0	
68 TMU1_00187000500	glucose 6 phosphate isomerase	74	0	0	0	0	0	0	0	0	14	14	10	5	3	0	0	0	0	0	
69 TMU1_00269000200	tiophosphatase isomerase	27	0	0	0	0	0	0	0	0	0	0	3	9	4	9	4	3	2	2	
70 TMU1_00005007500	14-3-3 protein	28	0	0	0	0	0	0	0	21	12	11	8	7	0	2	0	0	0	0	
71 TMU1_00058002100	conserved hypothetical protein	26	0	0	0	0	0	0	0	0	0	4	9	7	6	0	4	3	3	3	
72 TMU1_00094001000	glyceraldehyde 3 phosphate dehydrogenase	41	7	12	10	10	7	0	0	0	0	0	0	0	0	0	0	0	0	0	
73 TMU1_00048001600	Trypsin-domain containing protein	215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
74 TMU1_00040417900	WAP-domain containing protein	38	0	0	0	0	0	0	0	7	4	7	6	8	8	0	6	6	12	12	
75 TMU1_000660001200	lon trans 2 and Flam-B 17708-domain containing pro	132	0	0	0	0	0	0	0	0	0	3	6	3	6	3	5	3	5	3	
76 TMU1_00040132200	heat shock protein 80	81	0	0	0	0	0	0	0	9	9	0	0	0	0	3	4	0	0	0	
77 TMU1_00049001500	Trypsin-domain containing protein	139	0	0	0	6	0	4	2	0	0	0	0	0	0	0	0	0	0	0	
78 TMU1_00164001100	Neur chan LBD-domain containing protein	26	0	0	0	11	26	7	4												

158	TMUE_s0007005500	peroxiredoxin 2	121	3	4	4	3	4	4	6	0	0	0	0	0	0	0	0
159	TMUE_s0006004800	nucleoside diphosphate kinase	19	0	0	0	0	0	0	0	2	7	5	4	2	0	0	
160	TMUE_s0037006300	protein unc	808	0	3	4	0	0	0	0	0	0	0	0	0	0	0	
161	TMUE_s0064002600	hypothetical protein	18	0	0	0	0	0	0	0	0	0	2	0	2	2	2	
162	TMUE_s0037006600	rhodopsin	21	0	0	0	0	0	0	0	0	0	0	2	2	0	0	
163	TMUE_s0004017800	porin	41	0	0	0	0	0	0	0	0	2	5	4	3	4	3	
164	TMUE_s0147001700	hypothetical protein	15	8	5	6	3	4	2	0	0	0	0	0	0	0	0	
165	TMUE_s0148001700	Bravo F1GEY anti-pellet and fn-3 and Ig 2-domain conta	16	2	5	3	3	4	6	0	0	0	0	0	0	0	0	
166	TMUE_s0024001300	TSP 1 and Reeler and Spont N and Peptidase M23 s	124	6	6	0	3	3	3	0	0	0	0	0	0	0	0	
167	TMUE_s0003017400	Rab GDP dissociation inhibitor alpha	48	5	6	5	3	4	2	0	0	0	0	0	0	0	0	
168	TMUE_s0040006600	OV 16 antigen	23	0	0	0	0	0	0	0	0	0	0	0	0	2	8	
169	TMUE_s0018001800	conserved hypothetical protein	113	4	4	0	0	7	9	3	0	0	0	0	0	11	0	
170	TMUE_s0074001100	hypothetical protein	53	0	0	0	0	0	0	0	0	4	6	3	5	0	2	
171	TMUE_s0022009800	hypothetical protein	141	0	0	0	0	0	0	0	2	0	0	0	0	4	2	
172	TMUE_s0004003800	hypothetical protein	29	0	0	0	0	0	0	0	0	5	2	5	6	7	5	
173	TMUE_s0042005600	Motile Spem-domain containing protein	24	0	0	0	0	0	0	0	7	8	5	0	4	0	0	
174	TMUE_s0066000700	iron dependent peroxidase	37	0	0	0	0	0	0	0	4	5	6	5	4	0	0	
175	TMUE_s0111002000	fatty acid binding protein	28	0	0	0	0	0	0	0	0	0	0	0	0	4	7	
176	TMUE_s0002011300	hypothetical protein	29	0	2	3	0	0	0	0	0	0	0	0	0	3	4	
177	TMUE_s0115000200	ATP dependent RNA helicase abstrakt	250	0	0	0	0	0	0	0	0	0	0	2	2	0	0	
178	TMUE_s0104003200	NUC194 and PI3 P4 kinase and FATC-domain conta	442	0	0	0	0	0	0	0	3	0	3	3	0	0	0	
179	TMUE_s0242001400	histone H2B, gonadal	24	4	4	5	5	4	0	0	0	0	0	0	0	0	0	
180	TMUE_s0004005300	Trypsin-domain containing protein	64	0	0	0	0	0	0	0	10	9	3	5	2	5	0	
181	TMUE_s0115000200	midasin	563	0	0	2	0	3	0	0	0	0	3	0	0	0	0	
182	TMUE_s0054003300	Spectrin alpha chain	185	0	0	0	0	0	0	0	0	4	2	0	0	2	3	
183	TMUE_s0042008400	Peptidase M2-domain containing protein	40	6	4	5	3	4	2	0	0	0	0	0	0	0	0	
184	TMUE_s0005007100	protein mig c; protein mig b; protein mig a	234	0	4	4	5	0	0	0	0	0	0	0	0	2	7	
185	TMUE_s0028009500	CBM 14-domain containing protein	195	6	4	5	4	2	0	4	0	0	0	0	0	0	0	
186	TMUE_s0012010600	EGF-domain containing protein	78	0	0	0	0	0	0	8	8	3	5	0	2	0	0	
187	TMUE_s0085004400	H3 histone, family 3A	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
188	TMUE_s0328000400	hypothetical protein	19	4	4	0	0	3	0	0	0	0	0	0	4	0	2	
189	TMUE_s0016007600	hypothetical protein	23	2	0	0	0	0	0	0	0	3	8	5	4	0	4	
190	TMUE_s0106000600	Moesin ezrin radixin 1	69	8	5	7	5	4	0	0	0	0	0	0	0	0	0	
191	TMUE_s0038007500	DOE Trp IS1595 and Plam-B 9093-domain containin	25	7	0	0	0	0	0	0	0	0	0	0	0	0	0	
192	TMUE_s0208001500	CAP-domain containing protein	30	10	0	0	0	0	5	0	0	0	0	0	0	0	0	
193	TMUE_s0015011200	protein unc g; protein unc f; protein unc d; protein unc	761	7	5	0	0	0	0	0	0	0	0	0	0	0	0	
194	TMUE_s0053003800	Trypsin-domain containing protein	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
195	TMUE_s0025005200	Trypsin-domain containing protein	84	0	0	0	0	0	0	9	3	0	0	5	5	0	4	
196	TMUE_s0043002900	hypothetical protein	9	0	0	2	0	3	0	0	0	0	0	0	0	0	4	
197	TMUE_s0045002900	serine protease inhibitor Kazal type 4	8	0	0	0	0	0	0	0	0	2	4	2	3	3	7	
198	TMUE_s0009012600	SapB 2 and SapB 1 and Plam-B 4130-domain contain	58	2	0	5	3	2	5	0	0	0	0	0	0	0	0	
199	TMUE_s0024300200	WAP-domain containing protein	29	0	0	0	0	0	0	0	0	0	0	2	5	8	5	
200	TMUE_s0167001400	porin	25	0	0	0	0	0	0	0	3	3	5	2	2	0	2	
201	TMUE_s0103000900	glutathione S transferase	23	0	0	0	0	0	0	0	0	9	5	2	2	0	2	
202	TMUE_s0117003000	eukaryotic translation elongation factor 1A	49	0	0	0	0	0	0	0	0	0	0	0	6	0	0	
203	TMUE_s0014006600	Motile Spem-domain containing protein	15	6	5	2	2	4	0	5	0	0	0	0	0	0	0	
204	TMUE_s0060004900	DUF1758 and ve and DUF1758 and RVT 1 and Pept	192	0	5	5	0	0	0	0	0	0	0	0	0	0	0	
205	TMUE_s0137000000	conserved hypothetical protein	39	3	0	0	0	0	0	0	0	0	2	3	7	0	0	
206	TMUE_s0167000500	Whey acidic protein	16	0	0	0	0	0	0	0	0	13	13	18	8	5	5	
207	TMUE_s0010002900	calreticulin	76	0	2	0	0	0	0	7	8	0	0	0	0	0	0	
208	TMUE_s0012011300	neurogenic locus notch protein 2	103	0	0	0	0	0	0	0	2	2	4	2	2	0	0	
209	TMUE_s0071007100	cathenin F	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
210	TMUE_s0050007000	dynein heavy chain	563	0	0	0	0	0	0	0	0	0	0	0	0	4	0	
211	TMUE_s0087001400	nucleobindin 1	67	0	0	0	0	0	0	0	0	2	2	2	3	0	5	
212	TMUE_s0141002100	Actin depolymerizing factor 1, a,b	19	0	0	0	0	0	0	0	0	0	0	0	0	2	7	
213	TMUE_s0095000400	Kinase and TRAPP-domain containing protein	205	0	0	0	0	0	0	0	0	0	0	3	0	0	5	
214	TMUE_s0020003500	conserved hypothetical protein	123	0	0	0	0	2	0	0	3	2	0	2	0	0	0	
215	TMUE_s0027000900	disorganized muscle protein 1	31	0	0	0	0	0	0	0	3	5	2	3	4	0	2	
216	TMUE_s0005016100	peptidyl prolyl isomerase FKBP4	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
217	TMUE_s0197001000	multiple epidermal growth factor domains	113	0	0	2	0	4	8	6	0	3	0	0	0	0	0	
218	TMUE_s0059002100	Spectrin beta chain	266	0	0	0	0	0	0	0	0	0	0	4	0	0	2	
219	TMUE_s0033011400	Cadherin and EGF CA and Laminin G 2-domain conta	499	0	0	0	0	0	0	0	0	0	0	0	0	3	2	
220	TMUE_s0023000400	phosphorylcholine binding protein	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
221	TMUE_s0044005700	Plam-B 4743 and Plam-B 7628-domain containing pr	386	0	0	0	0	0	0	0	0	2	2	3	3	0	2	
222	TMUE_s0051004900	sulfhydryl oxidase 1	70	0	0	0	0	0	0	0	0	6	5	0	0	0	2	
223	TMUE_s0016000700	hypothetical protein	11	0	0	0	0	0	0	0	0	0	0	0	0	7	6	
224	TMUE_s0210000100	Vascular protein sorting associated protein 13A	369	0	0	0	0	0	0	0	0	0	0	0	2	0	0	
225	TMUE_s00690001000	Trypsin-domain containing protein	62	0	0	0	0	0	0	8	12	6	0	0	0	0	0	
226	TMUE_s0041004600	26S proteasome non ATPase regulatory subunit 10	27	0	0	0	0	0	0	0	0	4	2	0	3	0	2	
227	TMUE_s0009009900	protein estradiol	28	0	0	0	0	0	0	0	0	0	0	0	0	2	3	
228	TMUE_s0003000700	coagulation factor IX	15	0	0	0	0	0	0	0	2	4	7	4	3	0	0	
229	TMUE_s0013012700	Motile Spem-domain containing protein	14	0	0	0	0	0	0	0	0	0	2	4	7	5	4	
230	TMUE_s0040112200	T complex protein 1 subunit zeta	358	0	0	1	0	0	0	0	0	0	0	0	0	2	2	
231	TMUE_s0115002700	Predilin and WAP-domain containing protein	6	5	4	4	0	2	0	0	0	0	0	0	0	0	0	
232	TMUE_s0059005200	reverse transcriptase	31	0	0	0	0	0	0	0	0	0	0	0	2	0	3	
233	TMUE_s0010181700	hydroxyacylglutathione hydrolase	30	0	0	0	0	0	0	0	0	0	0	0	4	5	7	
234	TMUE_s0076002200	Proteasome subunit beta type 5	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
235	TMUE_s0069000100	Plam-B 3281 and Trypsin-domain containing protein	71	0	0	0	0	0	0	12	4	2	0	0	0	0	0	
236	TMUE_s0213000400	serine protease	50	0	0	0	0	0	0	0	0	0	0	0	0	0	6	
237	TMUE_s0105000400	myoglobin	24	0	0	0	0	0	0	0	0	0	0	0	0	2	5	
238	TMUE_s0020006900	tumor necrosis factor alpha induced protein	28	0	0	0	0	0	0	0	0	0	2	2	0	2	3	
239	TMUE_s0071001300	stress induced phosphoprotein 1	59	0	0	0	0	0	0	0	2	0	3	4	3	0	3	
240	TMUE_s0117000900	transmembrane serine protease 8	36	5	5	3	2	3	0	0	0	0	0	0	0	0	0	
241	TMUE_s0021000200	neurofascin	321	0	0	0	0	0	0	0	0	3	0	0	0	0	0	
242	TMUE_s0118001200	Glyco hydro 18 and CBM 14-domain containing prote	81	4	4	5	4	4	4	0	0	0	0	0	0	0	0	
243	TMUE_s0029002700	L lactate dehydrogenase	90	0	0	0	0	0	0	3	3	3	0	0	0	2	0	
244	TMUE_s0203000700	Plam-B 2117-domain containing protein	223	0	0	0	2	7	0	0	0	0	0	0	0	0	0	
245	TMUE_s0160003600	methionine RNA ligase, cytoplasmic	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
246	TMUE_s0046002300	hypothetical protein	107	0	0	0	0	0	0	0	2	2	0	0	0	0	2	
247	TMUE_s0008014300	hypothetical protein	20	0	0	0	0	0	0	0	0	2	0	0	0	0	0	
248	TMUE_s0010001600	inositol 1,4,5 trisphosphate receptor type 1	296	0	0	5	0	0	0	0	0	0	0	0	0	0	0	
249	TMUE_s0048003700	E3 ubiquitin protein ligase HLUWE1	450	0														

Table S1. List of proteins identified within T. muris ES^{-polycys}. List was compiled by collating the mass spectrometry data for all the protein-containing Superose 12 fractions (fractions 16 to 32). The total spectral count is displayed for each protein in each fraction (criteria set to 95% protein threshold, 50% peptide threshold, minimum 2 peptides identified). Mw= molecular weight in kDa. Frac = fraction.

Table S2

Accession number	Protein	Mw (kDa)	Spectral count							
			Frac 23	Frac 24	Frac 25	Frac 26	Frac 27	Frac 28	Frac 29	Frac 30
TMJE_s0015001100	Pancreatic alpha amylase	66		7	18	19	8	7		
TMJE_s0005004200	Malate dehydrogenase	39		3	5	17	9	3		4
TMJE_s0256000200	Hypothetical protein	70	3	4	7	13	12	12	8	6
TMJE_s0086000700	78 kDa glucose regulated protein	73	11	11	10	12	5		2	3
TMJE_s0016004100	Serpin protein	177	3	3	7	12	2	5		3
TMJE_s0013010700	NADH dependent fumarate reductase	57			8	11	7	7		
TMJE_s0055003300	Elongation factor 2	91				11	6	5		2
TMJE_s0084003500	CAP-domain containing protein	39	3	6	9	10	7	6		3
TMJE_s0058002100	Conserved hypothetical protein	26			4	9	7	6		4
TMJE_s0093000600	Protein disulfide isomerase A6	48		5	6	8	3	5	2	4
TMJE_s0003017400	Rab GDP dissociation inhibitor alpha	48			6	8	5	4		
TMJE_s0016007600	Hypothetical protein	23			3	8	5	4		4
TMJE_s0036003800	Parathyroid hormone 2 receptor	45	2	6	5	7	6	4		3
TMJE_s0066001200	Ion trans 2 and Pfam-B 17708-domain containing protein	132			3	6	3	6	3	5
TMJE_s0076003900	Trans sialidase	156	3		2	6	3	3		
TMJE_s0074001100	Hypothetical protein	53			4	6	3	5		2
TMJE_s0051004900	Sulphydryl oxidase 1	70				6	5			2
TMJE_s0083000200	Inorganic pyrophosphatase	63		2	5	6	3			
TMJE_s0009001300	Translationally controlled tumor protein	21				6	5	4		2
TMJE_s0165000700	Cysteine glycine protein 2	12			3	5	4	3		5
TMJE_s0293000700	Hypothetical protein	23		2	3	5	4	5		5
TMJE_s0004017800	Porin	41			2	5	4	3	4	3
TMJE_s0106000600	Moesin;ezrin;radixin 1	69	4	2	4	5	3	3		2
TMJE_s0085005000	Venom allergen 5	39			3	5		2		3
TMJE_s0146001900	Trypsin-domain containing protein	52			2	5	3	2		
TMJE_s0072000900	ADP ribose pyrophosphatase, mitochondrial	29				5	2	3		
TMJE_s0012011300	Neurogenic locus notch protein 2	103		2	2	4	2	2		
TMJE_s0002013500	Conserved hypothetical protein	56			3	4	3			
TMJE_s0072003400	Independent phosphoglycerate mutase	46				4	3	4		
TMJE_s0098000400	Protein wos2	21				4		2		3
TMJE_s0217000400	Pfam-B 11092 and MBOAT-domain containing protein	269				4				
TMJE_s0104003200	NUC194 and PI3 P14 kinase and FATC-domain containing protein	442	3			3				
TMJE_s0048003100	Vinculin	123		2	2	3				
TMJE_s0037007000	Pfam-B_927_and_Beach_and_WD40-domain_containing_protein	369				3				
TMJE_s0241001300	Pkinase-domain containing protein	43				3				
TMJE_s0010008400	Disks large 5	208				3				
TMJE_s0019001900	DUF21-domain containing protein	63				3				
TMJE_s0428000200	Lactoylglutathione lyase	20				3		2		
TMJE_s0132001200	Gut specific cysteine proteinase	39				3	2			
TMJE_s0006005400	Autophagy protein 2 protein B	225				3				
TMJE_s0326000200	PAN 1-domain containing protein	34				3				
TMJE_s0071003300	TPD52 domain containing protein	17				3				
TMJE_s0175001100	E3 SUMO protein ligase RanBP2	235				2				
TMJE_s0189000300	Eukaryotic initiation factor 4A	50				2				
TMJE_s0145001100	Pfam-B 10329 and zf-CCHC-domain containing protein	57				2				
TMJE_s0004005500	Trypsin-domain containing protein	33				2				
TMJE_s0009011100	la protein	45				2			2	
TMJE_s0017002000	ve and Pfam-B 10329 and RVT 1 and Pfam-B 2707-domain containing protein	159				2				
TMJE_s0138001500	Arginine glutamic acid dipeptide repeats	148				2				
TMJE_s0004000500	Gut specific cysteine proteinase	48	2			2				
TMJE_s0013011900	Glyco_hydro_38_and_Alpha-mann_mid_and_Glyco_hydro_38C-domain containing protein	126				2				
TMJE_s0037005700	Thioredoxin	18				2				2
TMJE_s0005009900	Pfam-B 1842 and Pfam-B 3141 and tRNA int end N2 and uDENN and DENN and dDENN and Pfam-B 2124-domain containing protein	231				2				
TMJE_s0071006300	Pfam-B 16788-domain containing protein	123				2				
TMJE_s0049001100	Peptidase S9 prolyl oligopeptidase active site	150				2				
TMJE_s0011000700	Dsm-domain containing protein	25				2				
TMJE_s0062003000	Nascent polypeptide associated complex protein	22				2				
TMJE_s0033004300	Probable nuclear transport factor nuclear transport factor	15				2				
TMJE_s0090002300	DEAD and Helicase C and dsRNA bind-domain containing protein	74				2				
TMJE_s0026000400	Alpha amylase	69				2				
TMJE_s0082003700	Pfam-B 2621-domain containing protein	34				2				
TMJE_s0304000500	Phenylalanine 4 hydroxylase	59				2				

Table S2. List of identified proteins with peak abundance around Superose 12 fractions 24 to 27. The protein content of Superose 12 fractions 23 to 32 was analysed by mass spectrometry. The total spectral count is displayed for each protein in each fraction (criteria set to 95% protein threshold, 50% peptide threshold, minimum 2 peptides identified). Proteins were sorted by spectral count in fraction 26 and those with peak abundance around fractions 24 to 27 are displayed here. Bold indicates proteins that were identified in both the Superose 12 and Superdex 75 chromatography steps. Mw= molecular weight in kDa. Frac = fraction.

Table S3

Accession number	Protein	Mw (kDa)	Spectral count						
			Frac 17	Frac 18	Frac 19	Frac 20	Frac 21	Frac 22	Frac 23
TMUE_s0016011400	MULE and Pfam-B 516 and WAP-domain containing protein	71			50	68	77	67	13
TMUE_s000300760	WAP type 'four disulfide core'	41	6	11	34	45	46	37	15
TMUE_s0175001500	Porin	54	13	19	39	34	41	9	
TMUE_s0256000200	Hypothetical protein	70		2	5	16	27	10	7
TMUE_s0090001300	Porin	19				26	27	9	
TMUE_s0269000200	Triosephosphate isomerase	27		2	11	12	19	14	10
TMUE_s0191000800	Trypsin domain containing protein	79		3	8	13	17	4	
TMUE_s0256000600	Conserved hypothetical protein	48				7	17	7	4
TMUE_s0048003500	Serine protease	45			6	13	16	6	5
TMUE_s0103000900	Glutathion S transferase	23				3	14	4	2
TMUE_s0014006600	Motile sperm domain containing protein	15				7	12	9	5
TMUE_s0016004100	Serpin	177		2	3	9	12	2	
TMUE_s0033003400	Trypsin domain containing protein	37					12		
TMUE_s0023000300	Pfam-B 9093-domain containing protein	32			5	10	11	9	5
TMUE_s0208001600	Pathogenesis protein 1B	43	5	4	8	5	11	2	
TMUE_s0003017400	Rab GDP dissociation inhibitor alpha	48			10	17	11	3	0
TMUE_s0012009900	Hypothetical protein	45	2	4	7	5	10		
TMUE_s0009001300	Translationaly controlled tumour protein	21				2	10	4	3
TMUE_s0013010700	NADH dependent fumarate reductase	57			11	11	10	2	
TMUE_s0177000800	Heat shock protein 70	71			6	9	9	4	
TMUE_s0072003400	Independent phosphoglycerate mutase	46			2	7	9	2	2
TMUE_s0078002100	Conserved hypothetical protein	41				2	9		
TMUE_s0047003900	Cap domain containing protein	58			4	4	8	2	
TMUE_s0006008700	Thioredoxin	22				3	8	2	
TMUE_s0031002800	Hypothetical protein	17					8	2	
TMUE_s0005016100	Peptidyl proly cis trans isomerase FKBP4	52			2	3	8		
TMUE_s0042004400	Low density lipo receptor repeat	164			2	5	7	3	
TMUE_s0204000100	Motile sperm domain containing protein	21			4	3	7	3	2
TMUE_s0003007400	Peptidase, S1 subfamily	49			2		7	2	2
TMUE_s0023000500	Pfam-B 9093-domain containing protein	26			2	7	7	2	
TMUE_s0137001000	Hypothetical protein	43				5	7	5	
TMUE_s0016007600	Hypothetical protein	23				7	7	2	
TMUE_s0078004700	Copper:zinc superoxide dismutase	20					7		
TMUE_s0037003400	Pathogenesis protein 1B	41			2	6	6	4	2
TMUE_s0078001400	DUF290-domain containing protein	11			3	5	6		
TMUE_s0010006100	Calmodulin	18				5	6	3	
TMUE_s0007005500	Peroxioredoxin 2	121				2	6		
TMUE_s0085003400	Motile sperm domain containing protein	20					6		
TMUE_s0042005600	Motile sperm domain containing protein	24			4	5	5	3	
TMUE_s002200550	Eukaryotic elongation factor 1 delta	21			3	5	5	2	
TMUE_s0013012700	Motile sperm domain containing protein	14					5		
TMUE_s0074002600	Alcohol dehydrogenase NADP+ A	75					5		
TMUE_s0281000600	CBM 14 and TIL-domain containing protein	202					5		
TMUE_s0132001200	Gut specific cystein proteinase	39			4	4	4		
TMUE_s0004002000	Chymotrypsin inhibitor	16					4		2
TMUE_s0014013200	Heat shock protein 90	81				2	4	2	
TMUE_s0066002300	Hypothetical protein	16				4	4		
TMUE_s0133001900	Heat shod 70 kDa protein 4	95			3	3	4		
TMUE_s0328000400	Hypothetical protein	19				4	4		
TMUE_s0004019100	Major sperm protein 1	14				2	4		
TMUE_s0038007500	DDE Trp IS1595 and Pfam-B 9093-domain containing protein	25				3	3		
TMUE_s0003006100	Hypothetical protein	225				2	3		
TMUE_s0009000200	Pathogenesis protein 1B	19			3		3		
TMUE_s0428000200	Lactoylglutathione lyase	20				2	3		
TMUE_s0007006700	Chymotrypsin inhibitor	15					3		
TMUE_s0071006300	Pfam-B 16788-domain containing protein	123				2	3		
TMUE_s0071003300	TPD52 domain containing protein	17					3		
TMUE_s0146001900	Trypsin domain containing protein	52					3		
TMUE_s0074002400	Alcohol dehydrogenase NADP+ A	37					3		
TMUE_s0066001200	Ion trans 2 and Pfam-B 17708-domain containing protein	132					3		
TMUE_s0045002900	Serine protease inhibitor Kazal type 4	8					2		
TMUE_s0024004400	Conserved hypothetical protein	38					2		
TMUE_s0003007500	Coagulation factor IX	15					2		
TMUE_s0031002200	Uncharacterised transposase protein	39					2		
TMUE_s0136001600		63					2		
TMUE_s0009009900	Protein asteroid	28					2		
TMUE_s0208000600	WAP domain containing protein	25					2		
TMUE_s0005009800	Aminomethyltransferase, mitochondrial	91					2		
TMUE_s0024001300	TSP 1 and Reeler and Spond N and Peptidase M23 and Kunitz BPTI-domain containing protein	124					2		
TMUE_s0071007100	Cathepsin F	55					2		
TMUE_s0078001800	DUF290-domain containing protein	15					2		

Table S3. List of identified proteins with peak abundance around Superdex 75 fractions 20 to 22. The protein content of Superdex 75 fractions 17 to 23 was analysed by mass spectrometry. The total spectral count is displayed for each protein in each fraction (criteria set to 95% protein threshold, 50% peptide threshold, minimum 2 peptides identified). Proteins were sorted by spectral count in fraction 21 and those with peak abundance around fractions 20 to 22 are displayed here. Bold text indicates proteins that were identified in both the Superose 12 and Superdex 75 chromatography steps. Mw= molecular weight in kDa. Frac = fraction.