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Reproduction, Fertility and Development

Supplementary Material

Asian elephant (*Elephas maximus*) seminal plasma: establishing the proteome and effect on spermatozoa when added to cryomedium

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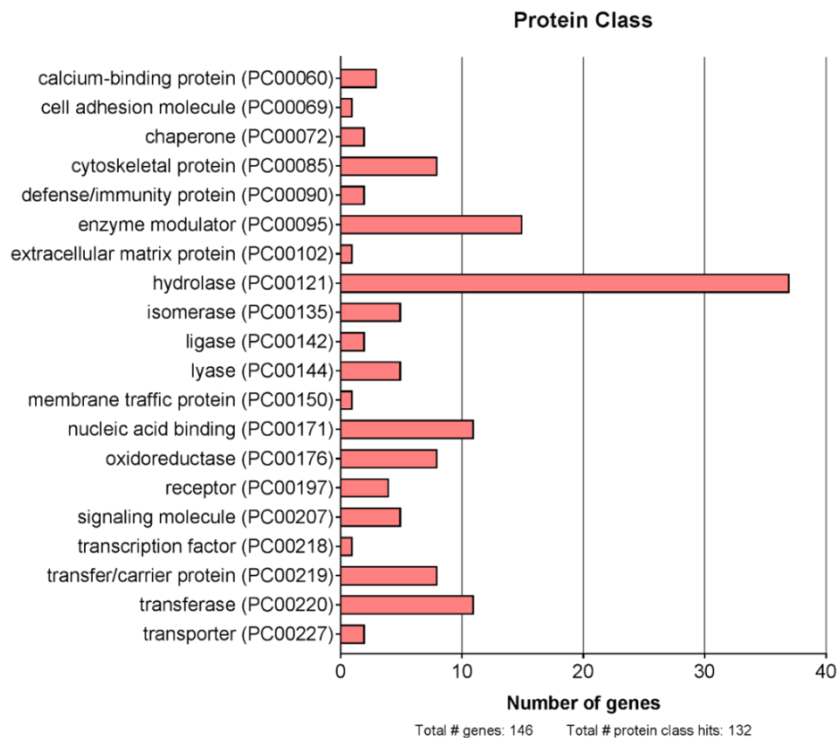
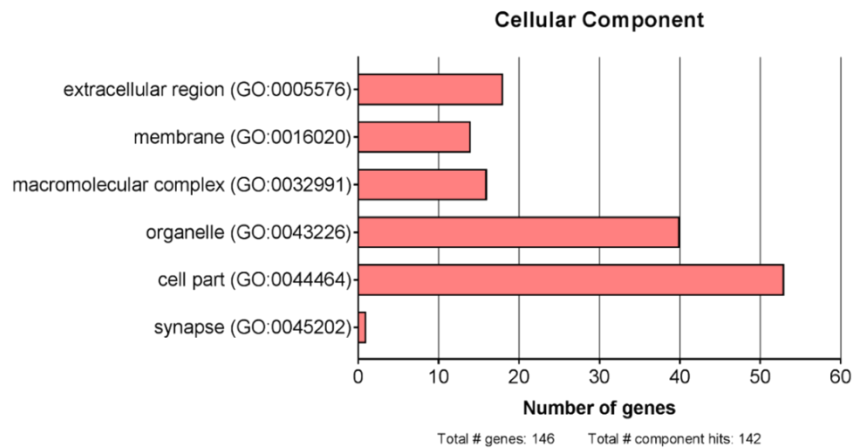
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Supplementary material



Supplementary Figure S1. Cellular component and protein class of Asian elephant seminal plasma proteins. Categorisation of proteins were from Gene Ontology database using PANTHER (version 13.1). The graph plots the number of proteins (genes) identified for each cellular component and protein class (GO accession).

Supplementary Table S1. Asian elephant seminal plasma proteins as assessed by LC-MS/MS from pooled samples.

	UniprotKB Accession	Protein name^A	Gene symbol	Mass (kDa)^B	Protein score^C
1.	G3SMX8	<i>Serum albumin</i>	ALB	68.8	575
2.	G3UD48	<i>Epididymal-specific lipocalin-5</i>	LCN5	21.5	288
3.	G3TBR7	<i>Low density lipoprotein receptor-related protein 2</i>	LRP2	518.1	264
4.	G3T8L4	<i>Apolipoprotein D</i>	APOD	21.6	252
5.	G3SS80	<i>Ribonuclease T2</i>	RNASET2	25.5	230
6.	G3T752	<i>Zonadhesin</i>	ZAN	249.2	192
7.	G3T055	<i>Lactotransferrin</i>	LTF	77.3	188
8.	G3TUH4	<i>Chromosome 1 open reading frame 56</i>	C1orf56	34.1	175
9.	G3T643	<i>Superoxide dismutase [Cu-Zn]</i>	SOD1	15.7	160
10.	G3T3N6	<i>Carboxylesterase 5A</i>	CES5A	64.0	154
11.	G3SZZ0	<i>Enolase 1, (alpha)</i>	ENO1	47.2	146
12.	G3UCL2	<i>Glycosylphosphatidylinositol-anchored high density lipoprotein-binding protein 1</i>	GPIHBP1	20.7	137
13.	G3THY2	<i>Tetraspanin (Fragment)/CD81 molecule</i>	CD81	23.2	134
14.	G3U1Z4	<i>Cathepsin D</i>	CTSD	41.1	132
15.	G3U2L5	<i>Angiopoietin-like protein 5</i>	ANGPTL5	26.0	121
16.	G3UBT6	<i>Heat shock protein 90kDa alpha (cytosolic), class A member 1</i>	HSP90AA1	85.1	117
17.	G3TZ57	<i>Disintegrin and metalloproteinase domain-containing protein 18</i>	ADAM18	60.9	117
18.	G3T9G3	<i>Transferrin</i>	TF	108.2	111
19.	G3SLB1	<i>Glucosylceramidase</i>	GBA	57.6	110
20.	G3T8N4	<i>Protein deglycase DJ-1</i>	PARK7	20.0	107
21.	G3U416	<i>Cystatin</i>	CST6	16.3	104
22.	G3TBY5	<i>Glucose-6-phosphate isomerase</i>	GPI	62.3	104
23.	G3SMQ4	<i>Proteasome subunit alpha type</i>	PSMA8	27.8	102
24.	G3SRG6	<i>Acrosin</i>	ACR	40.0	102
25.	G3SNZ3	<i>Sperm acrosome membrane-associated protein 1</i>	SPACA1	32.8	102
26.	G3U7Z4	<i>A-kinase anchor protein 4</i>	AKAP4	89.3	99
27.	G3T7P8	<i>Gamma-glutamyl hydrolase (conjugase, folylpolygammaglutamyl hydrolase)</i>	GGH	35.9	96
28.	G3UDP9	<i>Disintegrin and metalloproteinase domain-containing protein 21</i>	ADAM21	79.5	95
29.	G3UJ16	<i>Peroxiredoxin 6</i>	PRDX6	25.1	95
30.	G3T7L7	<i>Leucine-rich repeat-containing protein 37A3-like</i>	LRR37A3	151.3	91
31.	P01011	<i>Alpha-1-antichymotrypsin</i>	SERPINA3	47.6	91
32.	G3SLC6	<i>5'-Nucleotidase, Ecto (CD73)</i>	NT5E	50.7	88
33.	G3SV86	<i>Integral membrane protein 2B</i>	ITM2B	29.7	88
34.	G3TKF2	<i>Solute carrier family 3 (amino acid transporter heavy chain), member 2</i>	SLC3A2	59.1	87
35.	G3U5F5	<i>Epididymal-specific lipocalin-8</i>	LCN8	19.5	84
36.	G3SV91	<i>Chromosome 6 open reading frame 10</i>	C6orf10	59.4	84

	UniprotKB Accession	Protein name^A	Gene symbol	Mass (kDa)^B	Protein score^C
37.	P12637	Calsequestrin-2	CASQ2	47.4	82
38.	Q865C5	Ubiquitin-40S ribosomal protein S27a	RPS27A	8.6	82
39.	Q9R013	Cathepsin F	CTSF	51.6	79
40.	P11833	Tubulin beta chain	TUBB	50.0	78
41.	G3SST6	<i>Alpha-1B-glycoprotein</i>	A1BG	54.0	77
42.	Q2T9U2	Outer dense fiber protein 2	ODF2	75.5	72
43.	G3TJD5	<i>Ectonucleotide pyrophosphatase/phosphodiesterase 2</i>	ENPP2	97.6	70
44.	G3SPK7	<i>Coagulation factor V</i>	F5	241.1	70
45.	G3TGX7	<i>Prominin-2</i>	PROM2	92.2	70
46.	G3SPV1	<i>Left-right determination factor 2</i>	LEFTY2	41.2	69
47.	G3SMR6	<i>Cysteine-rich secretory protein 3</i>	CRISP3	20.1	65
48.	G3TE39	Lysozyme D1	LYZL1	16.7	65
49.	G3UIH0	<i>Biotinidase</i>	BTD	49.3	64
50.	G3TJN1	<i>Cylicin, basic protein of sperm head cytoskeleton 2</i>	CYLC2	33.3	64
51.	P04836	Carboxypeptidase E	CPE	53.3	62
52.	Q01813	ATP-dependent 6-phosphofructokinase, platelet type	PFKP	85.5	60
53.	P00517	cAMP-dependent protein kinase catalytic subunit alpha	PRKACA	40.6	60
54.	G3SZT3	<i>Acidic residue methyltransferase 1</i>	ARMT1	50.7	60
55.	G3SX25	<i>cutA divalent cation tolerance homolog (E. coli)</i>	CUTA	18.9	58
56.	G3TGE9	<i>Deoxyribonuclease II, lysosomal</i>	DNASE2	38.1	58
57.	G3SX91	<i>Growth differentiation factor 3</i>	GDF3	41.8	58
58.	G3UDR6	<i>Lymphocyte antigen 6H</i>	LY6H	13.7	56
59.	G3SXD2	<i>Glutathione S-transferase Mu 3</i>	GSTM3	26.6	56
60.	Q60HG7	Cystathionine gamma-lyase	CTH	44.5	56
61.	G3TG74	<i>Endoplasmin</i>	HSP90B1	91.0	55
62.	P62146	Calmodulin-alpha	CALM1	16.0	54
63.	G3SRB2	<i>Epididymal secretory protein E1</i>	NPC2	16.6	52
64.	G3ULD6	<i>Ig gamma-1 chain C region, membrane-bound form</i>	IGHG1	46.6	50
65.	G3T4W3	<i>Glucose-regulated protein, 78kDa</i>	HSPA5	72.3	49
66.	G3TVI3	<i>Thioredoxin domain-containing protein 2</i>	TXNDC2	11.9	47
67.	Q8MI17	Aldehyde dehydrogenase 1 family, member A1	ALDH1A1	54.3	47
68.	P00548	Pyruvate kinase, muscle	PKM	58.0	46
69.	G3TIV6	<i>Collagen, type XVIII, alpha 1</i>	COL18A1	178.9	46
70.	G3SXX4	<i>Angiotensin I converting enzyme</i>	ACE	151.1	46
71.	G3T2H6	<i>N-acylsphingosine amidohydrolase (acid ceramidase) 1</i>	ASAH1	45.1	45
72.	Q8BFZ3	Actin, beta-like 2	ACTBL2	42.0	45
73.	P80724	Brain acid soluble protein 1	BASP1	23.0	45
74.	Q8H339	Cyclin-D1	CCND1	38.5	45
75.	G3SVJ6	<i>Neutrophil gelatinase-associated lipocalin</i>	LCN2	22.4	44
76.	Q0RAR7	<i>50S ribosomal protein L9</i>	MRPL9	15.7	44
77.	Q937N8	<i>Aconitate hydratase</i>	ACO1	94.7	42
78.	G3TIW7	<i>Defensin, beta 129</i>	DEFB129	17.4	42
79.	G3TLL8	<i>Binder of sperm protein homolog 1</i>	BSPH1	15.9	42
80.	G3TNL2	<i>Cofilin 1</i>	CFL1	24.2	42

	UniprotKB Accession	Protein name^A	Gene symbol	Mass (kDa)^B	Protein score^C
81.	Q3T0X5	Proteasome subunit alpha type-1	PSMA1	29.6	41
82.	G3SLN5	<i>Heat shock protein family A (HSP70) member 4 like</i>	HSPA4L	94.7	40
83.	G3TK33	Beta-hexosaminidase subunit alpha	HEXA	60.1	40
84.	B7J7X9	<i>Heat shock 70kDa protein 9 (mortalin)</i>	HSPA9	68.2	40
85.	Q865V6	Macrophage-capping protein	CAPG	38.9	40
86.	G3T214	Phosphoglycerate kinase 2	PGK2	44.7	40
87.	G3SRI4	<i>Rho GTPase activating protein 36</i>	ARHGAP36	67.2	40
88.	P05689	Cathepsin Z	CTSZ	33.9	40
89.	P46199	Mitochondrial translational initiation factor 2	MTIF2	81.3	39
90.	B1XTW6	<i>Guanine monophosphate synthase</i>	GMPS	59.0	39
91.	Q93R93	<i>Ornithine aminotransferase, mitochondrial</i>	OAT	43.4	39
92.	G3TXA1	<i>Coagulation factor X</i>	F10	53.1	38
93.	Q93SF3	Molybdenum cofactor guanylyltransferase	mobA	25.2	38
94.	A8HTY8	<i>DNA-directed RNA polymerase III subunit B</i>	POLR3B	153.0	38
95.	Q6UWU2	Galactosidase, beta 1-like	GLB1L	74.1	38
96.	G3T1X4	Lysosomal alpha-mannosidase	MAN2B1	111.6	38
97.	G3TCM4	Proteasome subunit beta type-4	PSMB4	29.0	37
98.	Q8INB9	RAC serine/threonine-protein kinase	AKT3	68.4	36
99.	G3U506	<i>Heat shock 70kDa protein 1A</i>	HSPA1A	70.3	35
100.	Q9LII9	GDSL esterase/lipase	At3g27950	40.8	35
101.	Q5FL41	<i>ATP binding cassette subfamily B member 5</i>	ABCB5	41.1	35
102.	G3TKN4	<i>Trappin-2</i>	PI3	14.4	34
103.	Q46898	CRISPR system cascade subunit CasD	casD	25.2	34
104.	G3SSY0	<i>Prostaglandin D2 synthase 21kDa</i>	PTGDS	21.3	33
105.	G3SQJ4	<i>Nucleobindin 1</i>	NUCB1	53.7	33
106.	G3TB72	<i>Acrosomal vesicle protein 1</i>	ACRV1	29.8	33
107.	Q3T0Y5	Proteasome subunit alpha type-2	PSMA2	25.9	33
108.	Q1GCQ4	<i>Glycerol-3-phosphate dehydrogenase [NAD(P)+]</i>	GPD1	33.1	33
109.	O14795	Unc-13 homolog B (C. elegans)	UNC13B	180.6	33
110.	A7E3Q8	Plastin-3	PLS3	70.8	33
111.	Q9ZQ74	<i>Pentatricopeptide repeat-containing protein 1, mitochondrial</i>	PTCD1	76.6	33
112.	G3TA75	Proteasome subunit alpha type 4	PSMA4	29.5	33
113.	G3TGJ1	<i>Importin-5</i>	IPO5	123.6	33
114.	O42785	<i>Ras-related protein R-Ras2</i>	RRAS2	24.0	32
115.	A5D5I3	<i>DNA-Directed RNA Polymerase III Subunit A</i>	POLR3A	130.7	32
116.	Q48806	<i>Isocitrate dehydrogenase [NAD] subunit alpha, mitochondrial</i>	IDH3A	67.7	32
117.	Q3J7V2	<i>39S ribosomal protein L33, mitochondrial</i>	MRPL33	6.0	31
118.	P29699	Alpha-2-HS-glycoprotein	AHSG	37.3	31
119.	P57064	Cytidylate kinase	CMPK1	23.8	31
120.	G3T346	<i>Protease, Serine, 8</i>	PRSS8	95.6	30
121.	Q5JPF3	Ankyrin repeat domain-containing protein 36C	ANKRD36C	199.6	30
122.	Q896M5	<i>Glutamate--tRNA ligase, mitochondrial</i>	EARS2	56.1	30
123.	G3SMR5	<i>Sex hormone-binding globulin</i>	SHBG	42.7	30
124.	Q88U40	ATP-dependent helicase/deoxyribonuclease subunit B	rexB	136.2	30

	UniprotKB Accession	Protein name^A	Gene symbol	Mass (kDa)^B	Protein score^C
125.	G3SKX6	<i>Membrane cofactor protein</i>	CD46	31.7	30
126.	Q6P964	Serine/threonine-protein phosphatase 4 regulatory subunit 2	PPP4R2	46.2	29
127.	G3TL56	<i>Carboxypeptidase Q</i>	CPQ	51.2	29
128.	Q758V8	HDA1 complex subunit 3	HDA3	72.6	29
129.	A7HMM7	Protein translocase subunit SecA	secA	99.8	28
130.	A4YCR6	<i>Elongation factor 1-alpha 1</i>	EEF1A1	48.4	28
131.	E5R1Z3	Neutral protease 2 homolog MGYG_00813	MGYG_00813	40.7	28
132.	P20812	<i>Cytochrome P450 2A3</i>	CYP2A6	56.5	27
133.	G5EBH0	<i>1-phosphatidylinositol 4,5-bisphosphate phosphodiesterase beta-4</i>	PLCB4	160.8	27
134.	Q5NN52	<i>Transketolase</i>	TKT	70.3	27
135.	G3U8F0	<i>Mannosidase, alpha, class 2B, member 2</i>	MAN2B2	16.9	27
136.	G3UBQ8	<i>Disintegrin and metalloproteinase domain-containing protein 1a</i>	ADAM1A	53.2	27
137.	G3SVZ7	<i>Phosphatidylethanolamine-binding protein 4</i>	PEBP4	20.1	27
138.	G3U638	<i>Neural precursor cell expressed, developmentally down-regulated 8</i>	NEDD8	9.0	26
139.	G3T7J1	Clusterin	CLU	48.5	26
140.	G3TL28	<i>Beta-hexosaminidase subunit beta</i>	HEXB	59.7	26
141.	A8F448	N-acetyl-gamma-glutamyl-phosphate reductase	argC	38.5	26
142.	A8G243	<i>Antizyme inhibitor 1</i>	AZIN1	73.4	26
143.	P34268	Protein flightless-1 homolog	FLII	144.7	26
144.	P56902	<i>3-oxoacyl-[acyl-carrier-protein] synthase, mitochondrial</i>	OXSM	44.2	26
145.	Q7YRU4	Malate dehydrogenase 1, NAD (soluble)	MDH1	36.4	25
146.	Q9UJX6	Anaphase-promoting complex subunit 2	ANAPC2	93.8	25
147.	G3TM25	<i>Zinc-alpha-2-glycoprotein</i>	AZGP1	34.9	25
148.	G3T653	Glyceraldehyde-3-phosphate dehydrogenase, spermatogenic	GAPDHS	48.1	25
149.	B0T190	<i>Carbamoyl-phosphate synthetase 2</i>	CAD	36.2	24
150.	B8DTX8	Pup-protein ligase	pafA	55.4	23
151.	O74871	<i>SAP domain containing ribonucleoprotein</i>	SARNP	26.8	22
152.	G3SPX1	<i>ADAM metalloproteinase domain 2</i>	ADAM2	81.3	22
153.	G3SVI3	<i>TBC1 domain family member 1</i>	TBC1D1	132.8	22
154.	A5DQP9	<i>Actin, beta</i>	ACTB	40.3	21
155.	G3TTL2	<i>Mucin 19, oligomeric</i>	MUC19	129.4	21

^A Data from *Loxodonta africana* Uniprot database. Proteins that were classified as uncharacterised in Uniprot, or identified from a non-mammalian species, were subjected to Uniprot and NCBI BLAST searching and where an orthologous protein was known in an alternate species, the name was "italicised".

^B Protein mass as predicted by peptides sequenced by MASCOT

^c Ordered by descending protein score. Protein scores are derived from ions scores as a non-probabilistic basis for ranking protein hits. A higher protein score indicates a higher probability of a non-spurious match.