Supporting Information

Ex-Vivo Equine Cartilage Explant Osteoarthritis Model - A Metabolomics and Proteomics Study

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Table S1. All proteins identified within culture media, including control and TNF-α/IL-1β treated *ex-vivo* equine cartilage sample wells.

Liquid Chromatography Tandem Mass Spectrometry - Detailed Methods

Tryptic digests were diluted 5-fold in 0.1% (v/v) trifluoroacetic acid (TFA) and 3% (v/v) acetonitrile and analysed individually, in a random order, via liquid chromatography tandem mass spectrometry (LC-MS/MS) using a 60 min liquid chromatography (LC) gradient. A Q Exactive™ quadrupole-Orbitrap mass spectrometer (Thermo Scientific, Hemel Hempstead, UK) coupled to a Dionex Ultimate 3000 RSLC nano-liquid chromatograph (Thermo Scientific) was used for data-dependent LC-MS/MS analyses. Digests were loaded onto a trapping column (Acclaim PepMap 100, C18, 20 mm x 75 µm) using a loading buffer of 0.1% (v/v) TFA and 2% (v/v) acetonitrile in water for 3 min at a flow rate of 5 µl min^{-1}. The trapping column was then set in-line with an analytical column (Easy-Spray PepMap® C18, 15 cm x 75 µm, 2 µm) with peptide elution carried out using a linear gradient of 96.2% A (0.1% (v/v) formic acid):3.8% B (0.1 % (v/v) formic acid in water:acetonitrile (80:20) (v/v)) to 50% A:50% B over 30 min at a flow rate of 300 nl min^{-1}, followed by washing at 1 % A:99% B for 5 min and re-equilibration of the column to starting conditions. Sample digests were interspersed with 30 min blanks (97% (v/v) high performance liquid chromatography grade H_20 (VWR International), 2.9% acetonitrile and 0.1% TFA. The Q Exactive™ was operated in data dependent positive (ESI+) mode with survey scans between *m/z* 300-2000 acquired at a mass resolution of 70,000 (full width at half maximum) at *m/z* 200 after accumulation of ions to $1x10^6$ target value based on predictive automatic gain control values from the previous full scan. The 10 most intense precursor ions with charge states of between 2+ and 5+ were selected for MS/MS with an isolation window of 2 *m/z* units. Higher-energy collisional dissociation (HCD) was used to fragment peptides using normalised collision energy of 30% with a maximum injection time of 100 ms. Dynamic exclusion of *m/z* values to prevent repeated fragmentation of the same peptide was used with an exclusion time of 20 s.

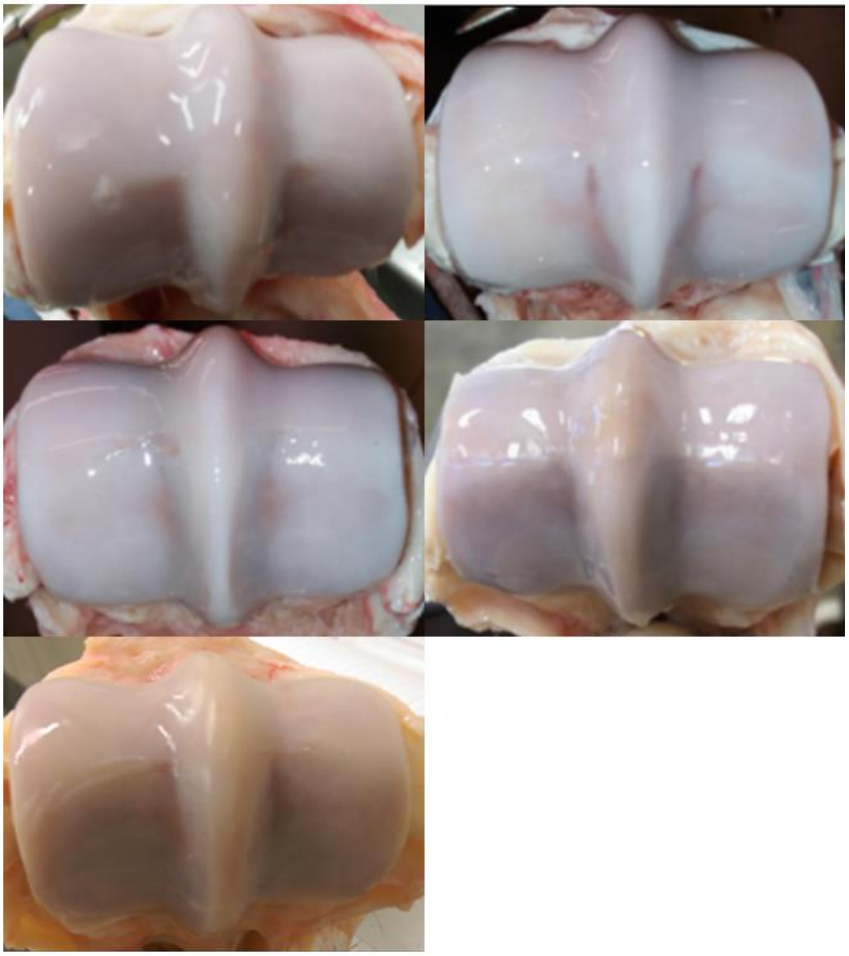

Figure S1. Five post mortem equine metacarpophalangeal joints used for *ex-vivo* cartilage culture. Cartilage collected from all joints was considered macroscopically normal with a score of 0 according to the OARSI histopathology initiative scoring system for horses.

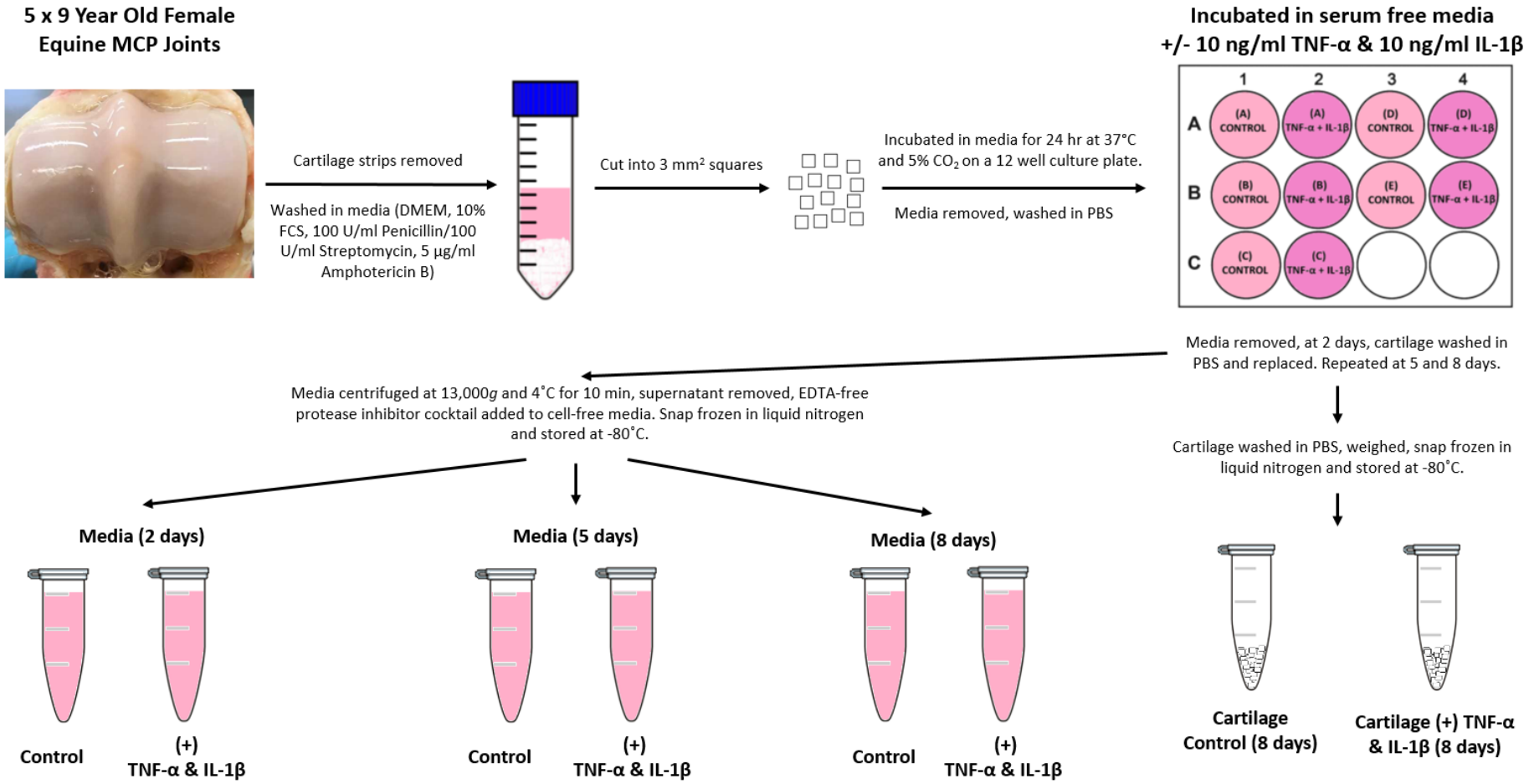

Figure S2. Experimental design for *ex-vivo* equine cartilage culture +/- TNF-α/IL-1β treatment. MCP = metacarpophalangeal.

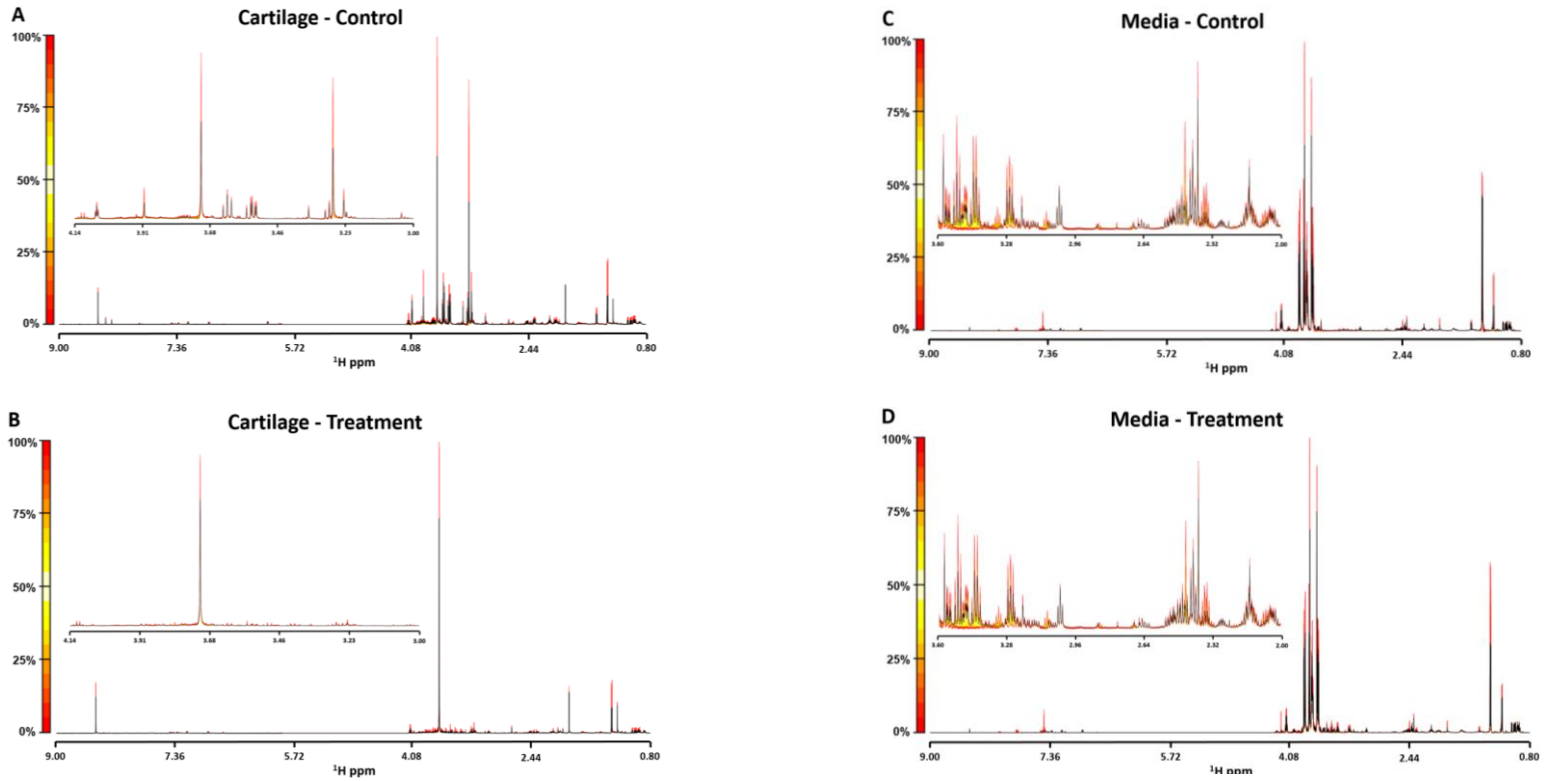

Figure S3. 1D ^{1}H nuclear magnetic resonance spectral quantile plots of (A) cartilage, 8 days in control media (B) cartilage, 8 days in TNF-α/IL-1β treated media (C) control media (all time points combined) and (D) TNF-α/IL-1β treated media (all time points combined). The median spectral plot is depicted by a black line and variation from the median shown as a yellow to red scale for both the full spectral range (9.00-0.80 ppm) and more detailed regions (4.14-3.00 ppm for cartilage and 3.60-2.00 ppm for media). Control (n=5) and TNF-α/IL-1β treatment (n=5).

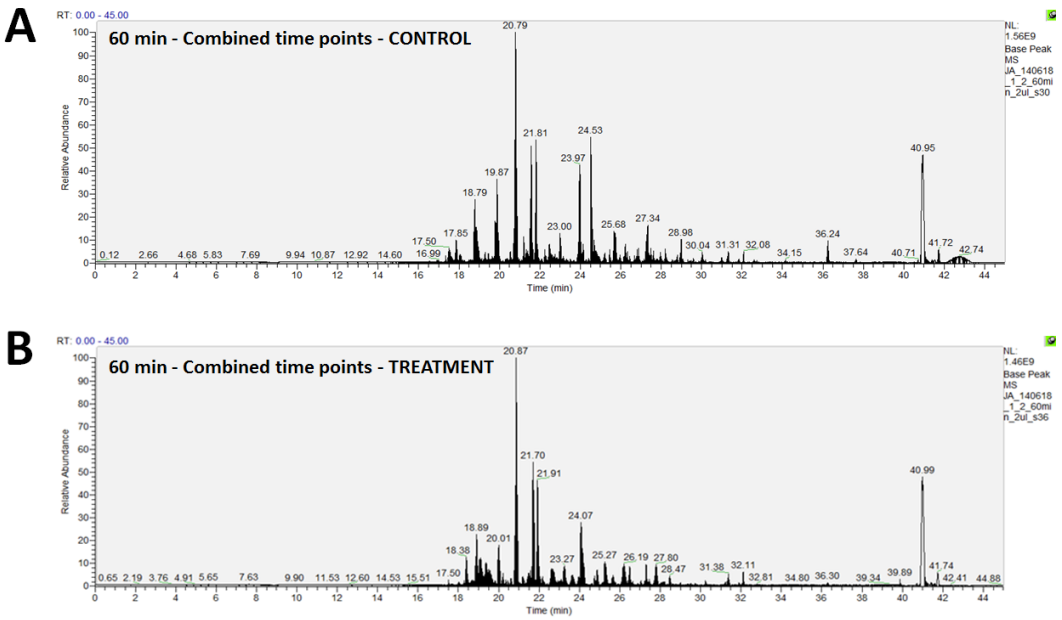

Figure S4. Representative culture media ion chromatograms of combined time points for (A) control and (B) TNF-α/IL-1β treated equine *ex-vivo* cartilage explants using a 60 min liquid chromatography gradient.

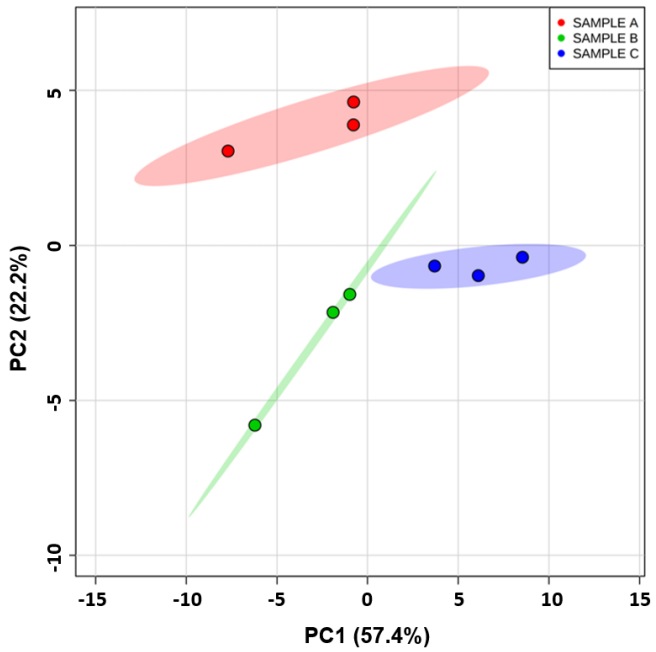

Figure S5. Principal component analysis scores plot identifying high reproducibility of acetonitrile cartilage metabolite extraction (three separate equine donors, technical triplicate for each donor) using 1D ^{1}H NMR metabolome analysis. Shaded regions depict 95% confidence regions.

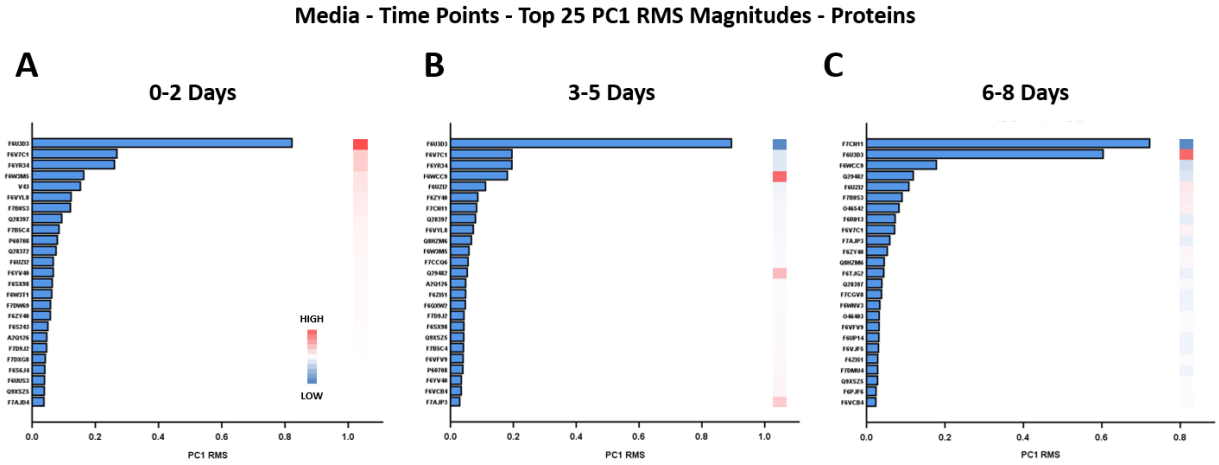

Figure S6. PC1 RMS (Principal component 1 root mean square) values for the 25 components with the highest magnitude for differentially abundant proteins present within culture media at (A) 0-2 days, (B) 3-5 days and (C) 6-8 days following TNF-α/IL-1β treatment of *ex-vivo* equine cartilage. n=5 for each time point. RMS: High = high in treatment with respect to control, Low = low in treatment with respect to control.

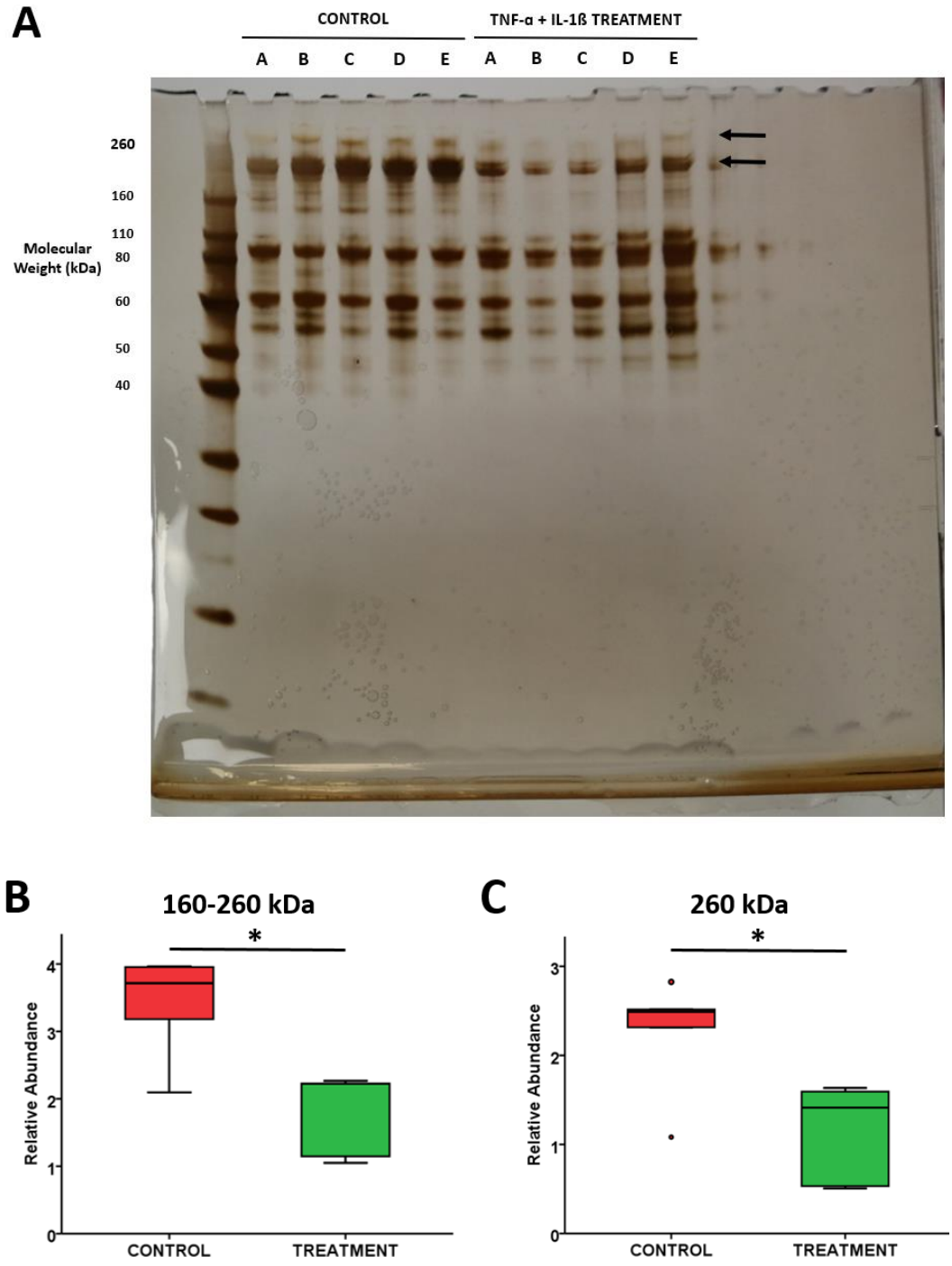

Figure S7. (A) Silver stain identifying media protein profiles (combined for all time points) following incubation of *ex-vivo* equine cartilage for control and TNF-α/IL-1β treated samples. Arrows indicate differentially secreted proteins at approximately 160-260 kDa and 260 kDa. Relative abundances of bands at (B) 160-260 kDa and (C) 260 kDa calculated using densitometry, n=5/group. t-test: * = $p < 0.05$.

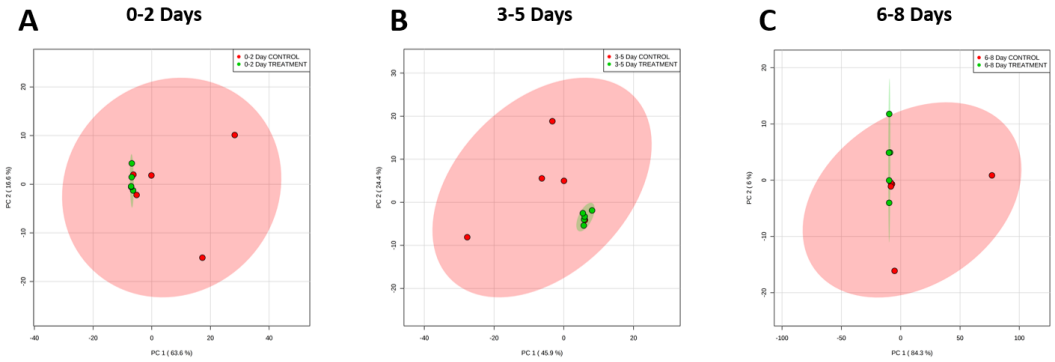

Figure S8. Principal component analyses of semi-tryptic peptide profiles within culture media of control (red, n=5) and TNF-α/IL-1β treated (green, n=5) *ex-vivo* equine cartilage at (A) 0-2 days, (B) 3-5 days and (C) 6-8 days.

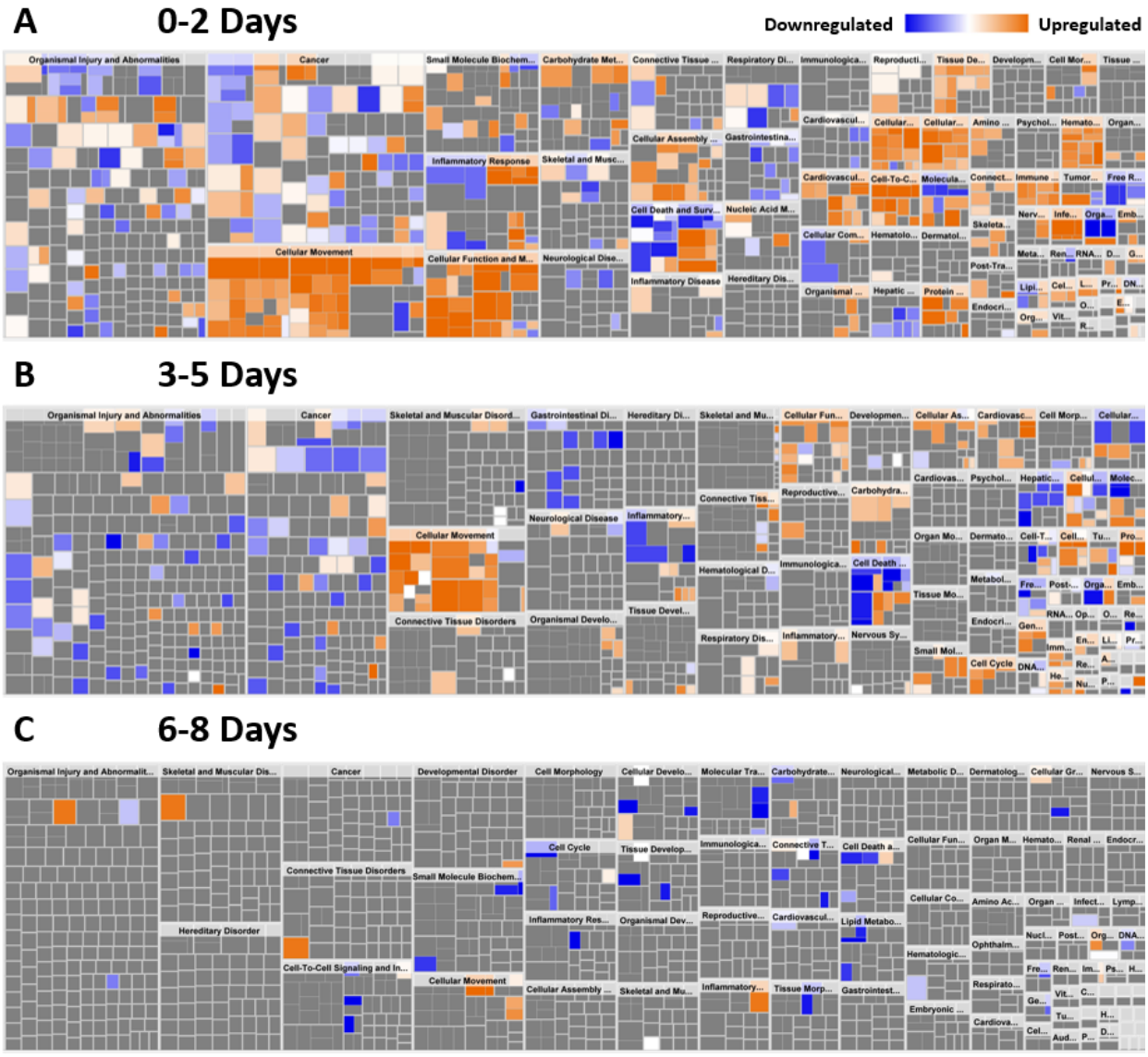

Figure S9. Heat maps identifying canonical pathway groupings associated with diseases and biological functions altered for (A) 0-2 days, (B) 3-5 days and (C) 6-8 days within culture media following TNF-α/IL-1β treatment of *ex-vivo* equine cartilage explants. Squares are coloured according to their Z score, with blue downregulated following treatment and orange upregulated. The intensity of the colour indicates strength of the prediction.

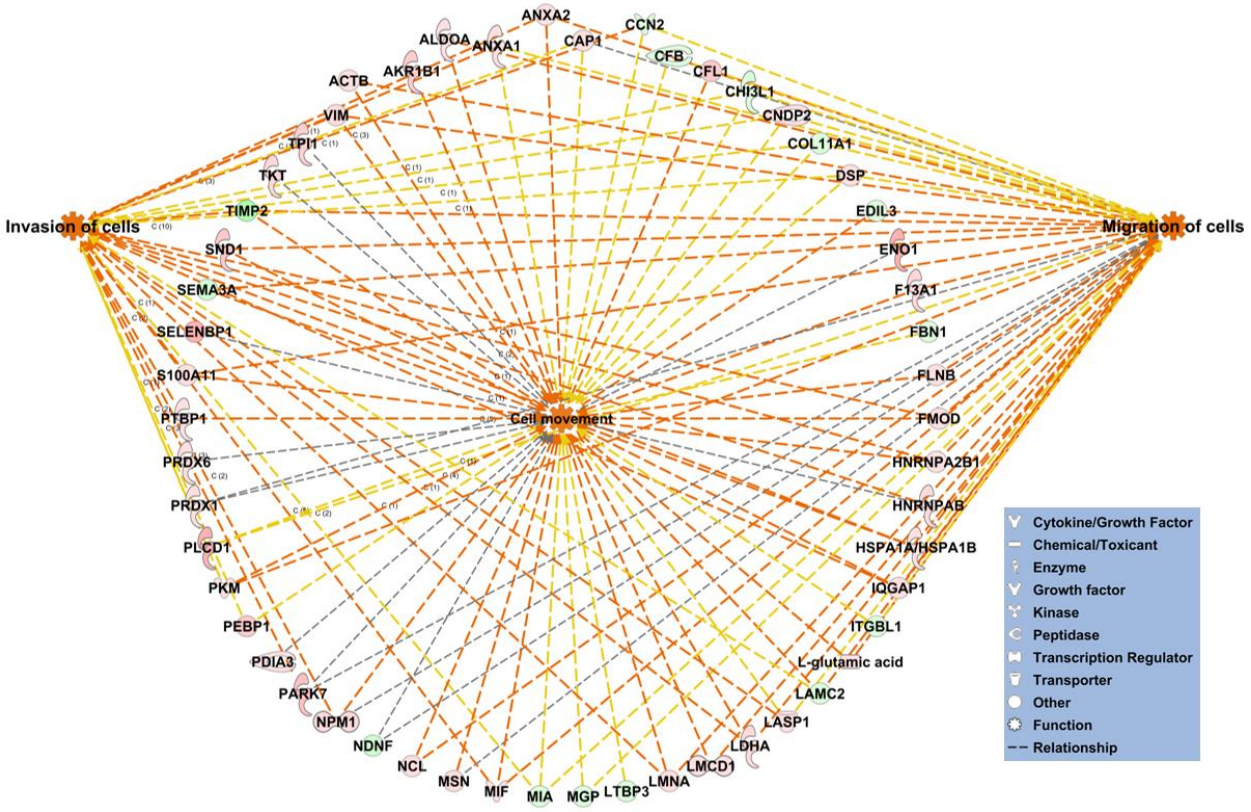

Figure S10. Networks involved in cell movement, migration of cells and invasion of cells in culture media at 0-2 days following TNF-α/IL-1β treatment of *ex-vivo* equine cartilage explants. Green nodes represent lower protein/metabolite abundance following treatment and red nodes represent greater protein/metabolite abundance following treatment. Blue arrows represent predicted inhibition, orange arrows represent predicted activation, yellow arrows indicate findings which are inconsistent with the state of downstream molecules and grey arrows indicate an effect which was not predicted.

Table S1. All proteins identified within culture media, including control and TNF-α/IL-1β treated *ex-vivo* equine cartilage sample wells.

Associated Accession Numbers	Family/Subfamily	Unique peptides
F6T0A6	10 KDa Heat Shock Protein, Mitochondrial	3
H9H007	10-Formyltetrahydrofolate Dehydrogenase	3
F6SP02	14-3-3 Protein Theta	3
F6PLF6	2-Phosphoxylose Phosphatase 1	3
F6Z421	60S Ribosomal Protein L12	2
F7D917	6-Phosphogluconate Dehydrogenase, Decarboxylating	3
F6YG82	78 KDa Glucose-Regulated Protein	7
F6X782	Actin Related Protein 2/3 Complex Subunit 1B	2
P60708, F7AAK7	Actin, Cytoplasmic 1	12
F6WM79	Actin-Related Protein 2	5
F6WE31, F7B381	Actin-Related Protein 2/3 Complex Subunit 3	2
F6PH57	Actin-Related Protein 2/3 Complex Subunit 4	3
F6W354	Actin-Related Protein 3	4
F6RHD5	Adenine Phosphoribosyltransferase	3
F6UFV3	Adenosine Kinase	3
F6TL52	Adenylate Kinase Isoenzyme 1	3
F6X5J6	Adenylosuccinate Lyase	1
F6SRP7	Adenylyl Cyclase-Associated Protein 1	4
F7C2Y5	Adipocyte Enhancer-Binding Protein 1	3
F6UJD4	Adseverin	12
F7C3C6	Aggrecan Core Protein	20
F7AJD4	AHNAK Nucleoprotein	19
F7CBN0	Alcohol Dehydrogenase (NADP+)-Like Protein	6
P19854	Alcohol Dehydrogenase Class-3	2
F7CZV6	Aldehyde Dehydrogenase 7 Family Member A1	3
F7C0U4	Aldo_Ket_Red Domain-Containing Protein	2
F7DMQ3	Aldose Reductase	8
F7C450	Alpha-2-Hs-Glycoprotein	5
F6V7C1	Alpha-Enolase	32
P49066, F6U4X2	Alpha-Fetoprotein	3
Q5VI84	Angiogenin	2
F7DQI1	Angiopoietin Like 7	3
F7A971	Angiopoietin-Related Protein 4	4
Q8HZM6	Annexin A1	16
F6ZI51	Annexin A2-Related	14
F7E419	Annexin A8	9
F6ZB53	Apurinic or Apyrimidinic site Lyase	5
F7D8L9	Argininosuccinate Synthase 1	2
F6ZXT0	Atpase Inhibitor, Mitochondrial	2

F6QDP0	ATP-Citrate Synthase	2
F7C0I7	Basement Membrane-Specific Heparan Sulphate Proteoglycan Core Protein	13
F6VYL8	Betaine--Homocysteine S-Methyltransferase	17
F7C555	Bifunctional Purine Biosynthesis Protein Purh	11
O46403	Biglycan	14
F7D5K3	Bone Morphogenetic Protein 3	2
F6YIU8	C-1-Tetrahydrofolate Synthase, Cytoplasmic	7
F7CPZ3, F7CQ80	Calsyntenin 1	4
F6YQD9	Carboxypeptidase E	4
F7C2J3	Cartilage Intermediate Layer Protein 1	44
F7CCP9	Cartilage Intermediate Layer Protein 2	3
F6U3D3	Cartilage Oligomeric Matrix Protein	63
F7D854	Catalase	3
F6YUR2	Cathepsin F	2
F7A8R5	Cathepsin K	2
F6RLX6	C-C Motif Chemokine	2
F7BND2	Cell Migration Inducing Hyaluronidase 1	1
F6TJG2	Cellular Communication Network Factor 3	2
F6YF95	Cellular Nucleic Acid-Binding Protein	2
F6PQ46	Ceruloplasmin	5
F7BGW7	Chitinase Domain Containing 1	2
F7AJP3	Chitotriosidase-1	13
F6QHY8	Chloride Intracellular Channel Protein	2
F6WD70	Chondroadherin	18
F6T4U9	Chondroadherin-Like Protein	2
F6VF11	Chordin-Like Protein 2	3
Q29482	Clusterin	22
F6UZI2	Coagulation Factor XIII A Chain	26
F7CR22	Coatomer Subunit Delta	6
F7DXG8	Cofilin-1	3
F7DE18	Coiled-Coil Domain-Containing Protein 80	11
F6RVX8, F6SSG3, F6VUP8, F7A3F7, F7D939, F7D9C7	Collagen Type I Alpha 1 Chain	5
F6RTH9, F6RTI8, F6RTJ6, F6RTL6, F6RTN7, F6RTP3, F6RUA6	Collagen Type I Alpha 2 Chain	10
F6XIM5, F6Y2J1, F6Y8T1, Q28396	Collagen Type II Alpha 1 Chain	38

F6R4Y3, F6R528	Collagen Type III Alpha 1 Chain	8
F6ZXE8	Collagen Type IX Alpha 2 Chain	3
F6VP03	Collagen Type IX Alpha 3 Chain	8
F6UW03	Collagen Type VI Alpha 1 Chain	6
F7CGV8	Collagen Type VI Alpha 2 Chain	16
F6QAT0, F6R735	Collagen Type VI Alpha 3 chain	44
F6WCC9	Collagen Type X Alpha 1 Chain	35
F6VAW6, F6VBF7	Collagen Type XI Alpha 1 Chain	6
F7BRR9	Collagen Type XI Alpha 2 Chain	11
F6TIN6	Complement C1Q Subcomponent Subunit A	4
F7BUV8	Complement C1Q Subcomponent Subunit B	5
F7DBT2	Complement C1Q Subcomponent Subunit C	3
F7BQD6	Complement C1S Subcomponent	2
F7BTW7, F7CJG3, F7E454	Complement C3	9
F6XSF7	Complement C4-A-Related	6
F6RMD0	Complement Factor B-Related	16
F6ZR63	Complement Factor H	4
F6X0K3	Connective Tissue Growth Factor	2
F7CAX0	C-Type Lectin Domain Family 3 Member A	8
F7AW05	C-Type Lectin Domain Family 3 Member B	2
F6S9Z1	C-X-C Motif Chemokine 5	4
F7D1J3	Cystathionine Gamma-Lyase	2
F6XJR7	Cysteine and Glycine-Rich Protein 1	4
F6WCB7	Cytokine-Like Protein 1	3
F7B5P1	Cytosolic Non-Specific Dipeptidase	3
O46542	Decorin	20
F6ZV64	Desmoplakin	2
F6UMA1	DExD-Box Helicase 39B	2
F7B320	Dihydropyrimidinase-Related Protein 2	6
F6PIC7	Ectopic P-Granules Autophagy Protein 5 Homolog	2
F6VKK6	EGF Like Repeats and Discoidin Domains 3	2
A2Q127	Elongation Factor 1-Gamma	2
F6UUS3	Elongation Factor 2	12
F6XTN1, F6YYS2	Eukaryotic Initiation Factor 4A-I	1
F6QYS3	Extracellular Matrix Protein 1	9
F7BPT4	Ezrin	4
F6ZYU6	Far Upstream Element-Binding Protein 1	5
F7A984	Far Upstream Element-Binding Protein 2	4
F7BTD8, F7CKI7	Fibrillin 1	2
F6W2Y1	Fibrinogen Gamma Chain	2
Q8WMP4	Fibroblast Growth Factor	2

A2Q126	Fibromodulin	11
F7CN11	Fibronectin	114
F7ABC9	Fibulin-1	6
F6XT77	Filamin B	3
F7D2D9	Flavin Reductase	2
F6RKC6	Four and A Half Lim Domains Protein 1	3
F6SX98	Fructose-Bisphosphate Aldolase A	10
F6ZP69	Fructose-Bisphosphate Aldolase C	7
Q28372	Gelsolin	18
F6QIB2	Glia-Derived Nexin	14
F7DMG5	Glucose-6-Phosphate 1-Dehydrogenase	2
F7CL92	Glutamine--Fructose-6-Phosphate Aminotransferase [Isomerizing] 1	3
F7BKK5	Glutathione S-Transferase	1
F7DZD2	Glutathione S-Transferase Theta-1	3
F6YV40	Glyceraldehyde-3-Phosphate Dehydrogenase	6
F6ZD04	Glycogen Phosphorylase, Brain Form	9
F6RV94	Glycogen Phosphorylase, Liver Form	5
F7AB03, F7AS83	Granulin Precursor	2
F6VSL0	GTP-Binding Nuclear Protein Ran	2
F7DW69	Heat Shock 70 KDa Protein 1A-Related	15
A2Q0Z1, F7AUW2	Heat Shock Cognate 71 Kda Protein	6
F7E3Y7	Heat Shock Protein Beta-1	6
Q9GKX7	Heat Shock Protein HSP 90-Alpha	3
F6TF34	Heme Oxygenase 1	6
F6YZ44	Heterogeneous Nuclear Ribonucleoprotein A1-Related	4
F6RTD6	Heterogeneous Nuclear Ribonucleoprotein L	4
F7BA08	Heterogeneous Nuclear Ribonucleoprotein R	4
F6VYB1	Heterogeneous Nuclear Ribonucleoproteins A2/B1	3
F7BB45	High Density Lipoprotein Binding Protein	2
F6S2F8	Histone H1.2	2
F6SK17, F6UGW9, F7AHT9, F7AZR5, F7DIN7	Histone H2B Type 1-B	2
F6PWV1, F6TWM4, F6VUX0, F6VYH8, F7ASE9, F7CJ51, F7DLL0, F7E1X9	Histone H2B Type 2-F	2
F6VCB4, F6Y7V5, F6YXV8, F7B238, F7C964	Histone H3	7

F6VFV9	Histone H4	5
Q28381	Hyaluronan and Proteoglycan Link Protein 1	3
P55102, F7BCH1	Inhibin Beta A Chain	4
F7DEB1	Insulin-Like Growth Factor-Binding Protein 6	2
Q95LJ1	Insulin-Like Growth Factor-Binding Protein 7	2
F6SSR0	Integrin Beta-Like Protein 1	2
F6QBB1	Inter-Alpha-Trypsin Inhibitor Heavy Chain H5	4
F6QJC7	Interleukin Enhancer Binding Factor 3	2
F6QJ27	Isochorismatase Domain-Containing Protein 1	2
F6R7J2	Isocitrate Dehydrogenase [Nadp] Cytoplasmic	9
F6S8W6	Keratin 75	2
F6TNR4, F6TVT0	Keratin, Type I Cuticular Ha1	3
F6PJX6	Keratin, Type I Cytoskeletal 13	4
F7ATL5	Keratin, Type I Cytoskeletal 14	2
F6ZEQ3	Keratin, Type I Cytoskeletal 16	2
F7B7X0	Keratin, Type II Cytoskeletal 1	6
F6W7V0	Keratin, Type II Cytoskeletal 5	4
F7D281	Keratin, Type II Cytoskeletal 6B-Related	7
F7C7Y1	Keratin, Type II Cytoskeletal 73	4
F6YZV8	Keratin-87 Protein-Related	7
F7B0S3	Lactadherin	13
F7B232	Lambda-Crystallin Homolog	6
Q8HZI9, F6WZ08	Laminin Subunit Gamma-2	6
F6ZDB7	Latent-Transforming Growth Factor Beta-Binding Protein 2	7
F6Z0F8	Latent-Transforming Growth Factor Beta-Binding Protein 3	4
F6VQL3	Leukocyte Cell-Derived Chemotaxin-2	2
F7DQB9	Lim and Cysteine-Rich Domains Protein 1	8
F6PSB8	Lim and Sh3 Domain Protein 1	5
F6W3T1	L-Lactate Dehydrogenase A Chain	9
C6L1J5	L-Lactate Dehydrogenase B Chain	4
F6SKT2	Lumican	3
F6ZYC2	Lysine--tRNA Ligase	3
F7CU94	Lysozyme C	9
F6UXM7	Lysyl Oxidase Homolog 3	9
F6S243	Macrophage Migration Inhibitory Factor	3
F7D144	Macrophage-Capping Protein	9
F6ZN44	Mannose-6-Phosphate Isomerase	3
F6XSR3	Matrilin-3	5
F6SAI2	Matrilin-4	3
F6R013	Matrix Gla Protein	8
Q9XSZ5, F6WTM6	Matrix Metalloproteinase 1	17

Q28397, F6T9W9	Matrix metalloproteinase 3	25
F6VJF5	Melanoma-Derived Growth Regulatory Protein	6
F6U999	Mesencephalic Astrocyte-Derived Neurotrophic Factor	2
O02722	Metalloproteinase Inhibitor 1	6
F7BEE7	Metalloproteinase Inhibitor 2	4
Q9TUL9	Metalloproteinase Inhibitor 3	4
P02801, F7DM22	Metallothionein-1B	2
F6PVJ6	Mimecan	2
F6PUX2	Moesin	3
F7D7Z9	Multifunctional Protein Ade2	7
F6QKR7	Myocilin	6
F7AX54	Myosin Light Chain 1	2
F6YM24	N-Acetylneuraminate Synthase	2
F7AEL9	Neuron Derived Neurotrophic Factor	5
F6PXV9, F6PYQ6	Nitric Oxide Synthase	2
F6X3K0	Nucleolin	3
F6X9D3	Nucleophosmin 1	2
F6YY66	Nucleoside Diphosphate Kinase B	3
F6QLR9	Olfactomedin Like 1	2
F6ZCC8, F7BQX4, F7BR00	Peptidyl-Glycine Alpha-Amidating Monooxygenase	6
A5YBL8	Peptidyl-Prolyl Cis-Trans Isomerase B	6
F6X6A6	Peptidyl-Prolyl Cis-Trans Isomerase-Related	5
F6S6J4	Peroxiredoxin-1	7
F7AXI9	Peroxiredoxin-6	7
F6QXW2	Phosphatidylethanolamine-Binding Protein 1	8
F6X8Q2	Phosphoglucomutase-1	9
F7DQS6	Phosphoglycerate Mutase 1	2
F6XW20	Phosphoinositide Phospholipase C	2
F6VTS1	Phospholipase A1 Member A	5
F7CR03	Phospholipid Transfer Protein	4
F7BKE1	Pigment Epithelium-Derived Factor	2
F6R5Y2	Plasma Serine Protease Inhibitor	2
F7AGA5	Plastin-3	4
F7D3K4	Platelet-Activating Factor Acetylhydrolase IB Subunit Alpha	1
F6WPZ3, F6WQ73, F6WQF0, F6WQW5, F6WRA4, F6WXR4	Plectin	5
F6QUR2	Poly(rC) Binding Protein 3	2
F6TQ92	Polyadenylate-Binding Protein 1	6

F6UGL6	Polypyrimidine Tract-Binding Protein 1	2
F6ZY40	Prelamin-A/C	31
F6WZ69	Procollagen C-Endopeptidase Enhancer 1	11
F6UP14	Procollagen C-Endopeptidase Enhancer 2	11
F6V2X7	Procollagen-Lysine,2-Oxoglutarate 5-Dioxygenase 1	7
F6UJ33	Profilin-1	4
F6RZ46	Prolargin	9
F6VSN9	Protein Disulfide-Isomerase A3	9
F6VS95	Protein Disulfide-Isomerase A6	3
F6WPB4	Protein Dj-1	3
F7BND9	Protein S100-A11	2
O77691	Protein S100-A6	2
F7CB04	Protein Transport Protein Sec23A	2
F7C108	Protein-Lysine 6-Oxidase	4
F6VTD3	Proteoglycan 4	3
F6W3M5	Pyruvate Kinase	26
F6WB51	Quinone Oxidoreductase	4
F6Z4J4	Rab Gdp Dissociation Inhibitor Beta	3
F6YRC5	Ras Gtpase-Activating-Like Protein Iqgap1	10
F6PYW4	Ras Homolog Family Member C	2
F7C5F1	Retinoic Acid Receptor Responder Protein 2	5
F7ATC2	Ribonuclease 4	4
F6WNV3	Secreted Frizzled-Related Protein 3	6
F7ASU6, F7CI32, F7DKR3	Selenium Binding Protein 1	7
F6R988, F6RIR4	Semaphorin 3A	3
F6T8U8	Semaphorin-3C	11
F6SHH7	Septin 2	2
F7B812	Serine Protease Htra1	2
F7BAY6	Serum Albumin	8
F6PJF6	Serum Amyloid A Protein	8
F6XS05	S-Formylglutathione Hydrolase	2
F6W215	Sorcin	3
F6RWA0	Sorting Nexin	2
F6XVP2	Sparc-Related Modular Calcium-Binding Protein 1	4
F7C177	Splicing Factor Proline and Glutamine Rich	3
F6YPR7	Stanniocalcin 2	2
F6PZ47	Staphylococcal Nuclease Domain-Containing Protein 1	8
F7E1X2	Stress-Induced-Phosphoprotein 1	4
F6QR51	SUB1 Regulator of Transcription	2
F6WQ44, F6WR95	Sulfhydryl Oxidase	6
F6VXD1	Sulfotransferase	2
F7DMJ7	Sushi Repeat-Containing Protein Srpx2	6
F6XC16	Synaptic Vesicle Membrane Protein Vat-1 Homolog	3

F6PN89, F6QIZ4, F6RZP8	Talin 1	7
F7DSE1	Tata-Box Binding Protein Associated Factor 15	1
F6PN81	Tenascin	5
F7CCQ6	Tenascin-X	58
F6S5E7	Threonyl-tRNA Synthetase	3
F6YR34	Thrombospondin-1	48
F7E0P3	Thrombospondin-4	27
F6W9B1	TPR_REGION Domain-Containing Protein	2
F7BA40	Transaldolase	2
F6U5V3	Transcobalamin-2	5
F6VB94	Transforming Growth Factor-Beta-Induced Protein Ig-H3	10
F6QXN5	Transgelin-2	1
F7D9J2	Transketolase	15
F6TZS9	Triosephosphate Isomerase	8
F7ALH5	Tryptophanyl-tRNA Synthetase	2
F7ANC9	Tubulin Alpha-1B Chain	5
F7E0H3	Tubulin Beta Chain	5
F7DMU4	Tumour Necrosis Factor Receptor Superfamily Member 11B	18
F7C6F2	Ubiquitin Like Modifier Activating Enzyme 1	6
F7D253	UDP-Glucose 6-Dehydrogenase	7
F6WHI8, F6WI21	UDP-N-Acetylglucosamine Pyrophosphorylase 1	6
F7APU2, F7AU56	Uncharacterised Protein	4
F7DL64	Uncharacterised Protein	2
F6U974	Uncharacterised Protein	2
F6SJK9, F6SQQ0, F6SS14, F6WDW3	Uncharacterised Protein	9
F6RUZ6	Uncharacterised Protein	2
F6Y4I1	UTP--Glucose-1-Phosphate Uridylyltransferase	6
Q9GKR0, F6XLT6	Vascular Endothelial Growth Factor A	2
F7B5C4	Vimentin	24
F6ZSZ5, F6ZT22, F6ZT60	Vinculin	2
F6QP96	Vitrin	4
F6Z8W0	Wd Repeat Domain 1	2
F7D8I6	Xanthine Dehydrogenase/Oxidase	12
F6VSD4	X-Prolyl Aminopeptidase 1	2
F7AZP8	Xylosyltransferase 1	4