Use of proteomics-related bioinformatics resources

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The goal of this exploration is to become more familiar on protein databases by conduction an exploration on MMP1. **Matrix metalloprotease 1 (MMP1)** is a human protein involved in a number of different diseases, especially cancer. It degrades collagen and other highly insoluble substrates and is therefore crucial for the integrity and flexibility of tissues.

1. What is the gene symbol and the uniprot id for human MMP1? MMP1 is also found in other organisms. When we select for 'human' in UniProt, we see the ID is *P03956*. The gene symbol is MMP1 and CLG is a synonym. The secondary Accession is *P08156*

Figure 1: MMP1 Uniprot

Source: https://www.uniprot.org/uniprotkb/P03956/entry

2. What is the pdb code for its structure? Copy and paste an image of its structure here8

The PDB code for its structure is 1FBL

3. Is MMP1 phosphorylated? If yes, where (at what position) and at what amino acids?

According to phosphosite.org-a database for post translational modifications- there are 10 phosphorylated sites found by high throughput papers and only one was found by both high throughput and low throghput. See below for the exact sites that are phosphorylated. There is interestingly, one ubiquitylation listed in residue 450.

	MMP1 (human)	LTP	HTP	
S57-p	QVEKRRNsGPVVEKL	0	1	KL
Y121-p	LTYRIENytPDLPRA	0	1	
T122-p	TYRIENytPDLPRAD	0	1	KL
S142-p	EKAFQLWsNVTPLTF	0	1	KL
S153-p	PLTFTKVsEGQADIM	0	1	KL
T274-p	VQPIGPQtPKACDsK	0	1	KL
S280-p	QtPKACDsKLTFDAI	0	1	KL
T288-p	KLTFDAIttIRGEVM	0	1	KL
T289-p	LTFDAIttIRGEVMF	0	1	KL
Y360-p	GQNVLRGyPKDIYSS	1	2	
K450-ub	RQYKFDPkTKRILTL	0	1	

4. Are there any other posttranslational modifications in MMP1. Use at least two different databases to compare and contrast your answer based on each. As mentioned in item 3 above, phosphosite.org lists one ubiquitylation in residue 450. HPRD lists some of the same modifications but also shows an acetylation at K276 and a site for proteolytc cleavage at site L102.

PTMs

Residue	Type	Site	Upstream Enzymes
L	Proteolytic Cleavage	102	Chymase 1
K	Acetylation	276	
S	Phosphorylation	280	
T	Phosphorylation	288	
T	Phosphorylation	289	
Y	Phosphorylation	360	

Figure 2: MMP1 ptm

5. Is MMP1 involved in any pathways? To investigate pathways, I am querying Reactome and KEGG. MMP1 is listed in the pathway called 'Autocatalytic activation of MMP1' which describes how MMP1 is turned into its active form by pro-MMP1 initial activators (See zoomed-in and zoomed-out pathways below.). MMP1 is tightly linked with Extra-Cellular Matrix Proteoglycans and after a series of interconnected downstream steps, is involved in the degradation of collagen.

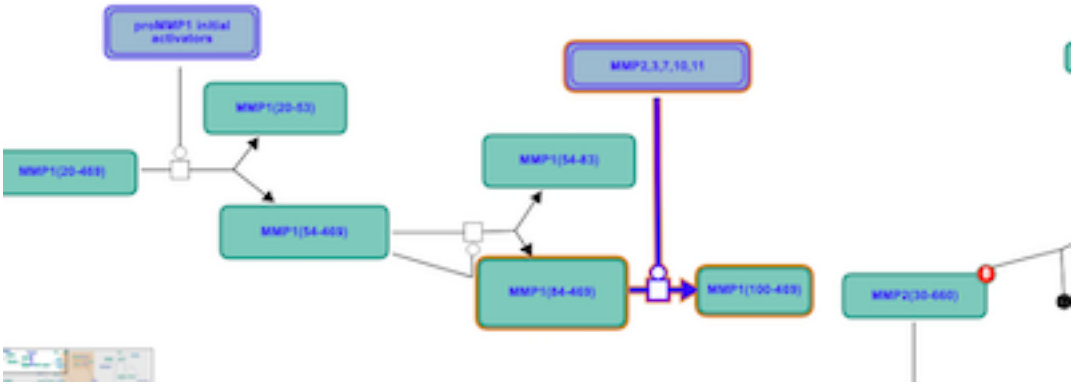

Figure 3: MMP1 activation

6. Was MMP1 found in any 2d gel, if yes, provide the image of the gel (or if there are two or more different conditions compared in one study, discuss similarities and differences for different gems with respect to MMPP1.

7. What is MMP1's mass? Have peptides derived from MMPP1 been found in any samples? Show the corresponding mass spectra

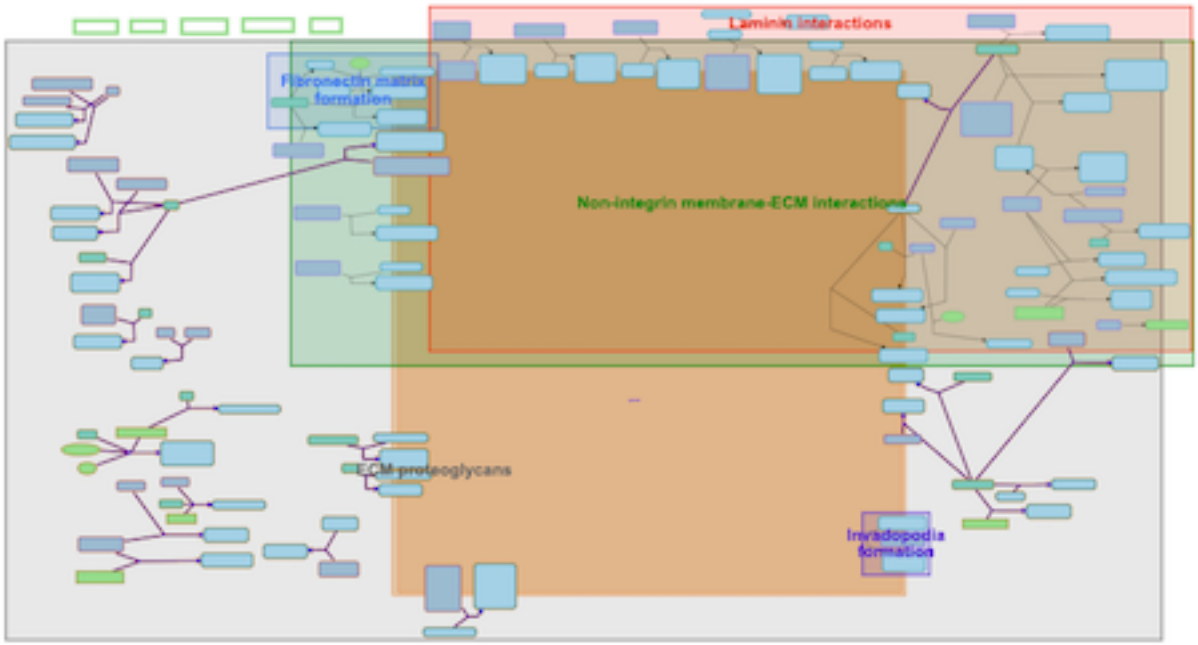

Figure 4: MMP1 pathways