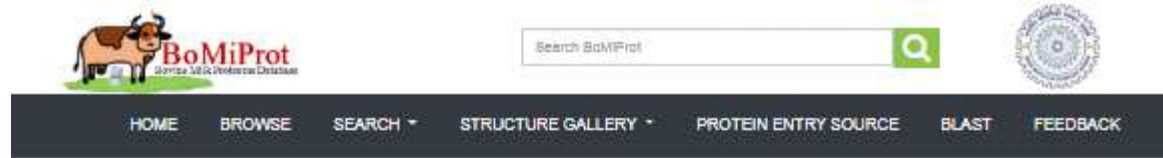


# **BoMiProt Tutorial**

# BoMiProt Home Page

Information can be retrieved by clicking on any of the desired links appearing as pull-down menus under four headings – Browse, Search, Structure Gallery, and Protein Entry Source



## STATISTICS

- Total number of proteins: 3183
- BoMiProt defined proteins: 350
- Proteins exclusively found in exosomes: 1445
- Proteins exclusively found in MFGM: 750
- Proteins exclusively found in whey: 230
- Proteins with PTMs: 177
- Proteins with significance in milk: 158
- BoMiProt defined proteins with crystal structures: 87
- BoMiProt defined proteins with homology models: 161




## Welcome to BoMiProt

BoMiProt is a manually curated, comprehensive repository of published information of bovine milk proteins. It provides a bird's eye view of the on-going research on bovine milk and possible information gaps that needs attention for maximizing health promoting effects of milk and different dairy products. It is a focused effort to consolidate the existing information of different milk proteins with focus on functions, biochemical properties, post translational modifications and significance of the protein in milk.

One can submit a new bovine milk protein

**Contact**




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**Quick Links**

- Contact
- Team
- Submit
- Help
- Disclaimer
- Acknowledgement
- Citing BoMiProt – Pubmed, .....

**Integrated Resources**



on such as  
databases.  
information  
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ntries were  
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so allows a  
information  
of crystal  
ns used to  
of proteins

Overall STATISTICS OF BOMIPROT:

# Browse Proteins in BoMiProt

## Browse BoMiProt

Browse protein entries in BoMiProt

Browse all protein entries

Browse endogenous/bioactive peptides

Browse protein entries by PTMs

Browse protein entries by milk fractions

All

Phosphorylation

MFGM

Exosomes

Glycosylation

Others

Whey

Download and Print Options are present in each page

Browse Endogenous peptides

Browse Protein entries based on PTMs or Milk fractions

The Browse page will list down the protein entries based on the selected categories

## Browse BoMiProt

Database of bovine milk proteins

BoMiProt ID	Uniprot ID	Protein	Gene Name	Gene ID	Milk Fraction	PTMs
Bom1	F1MMP5	Inter-alpha-trypsin inhibitor heavy chain H1	ITIH1		Whey	Glycosylated. Two potential N-glycosylation sites at H1 are effectively fully occupied by complex-type N-glycans. Approximately 40% of the heavy chain H1 heavy chain carries one or two complex-type N-glycan attached to Asn64. N-glycan chains by itself, but not those attached to Asn64, carry sialic acid. Sialic acid chains are present on H1 consist of a type II core structure with one or two N-acetyl moieties.
Bom2		Clustern	CLU		Whey	

Search by BoMiProt ID - Bomi1

### Primary Information

Displays BoMiProt ID, Uniprot ID, ref seq ID, gene name, gene ID, milk fraction, FASTA seq, length and molecular weight of the protein and protein existence status.

BoMiProt ID	Bom1
Protein Name	Inter-alpha-trypsin inhibitor heavy chain H1
Organism	Bos taurus
Uniprot Id	F1MMP5
Milk Fraction	Whey
Ref Sequence Id	XP_005222812.1
Amino Acid Lenth	906
Molecular Weight	101238
Fasta Sequence	<a href="https://www.uniprot.org/uniprot/F1MMP5.fasta">https://www.uniprot.org/uniprot/F1MMP5.fasta</a>
Gene Name	ITIH1
Protein Existence Status	Unreviewed: Experimental evidence at protein level

### Secondary Information

Displays protein function, biochemical properties, significance in milk, PTMs and its role, additional comments (if any) and bibliography

Presence in other biological fluids/tissue/cells	Iol family proteins are mainly secreted by the liver and present in the blood;
Protein Function	plasma serine-proteinase inhibitor; ITIH4 is a liver-derived member of the ITI family with diverse functions as an anti-apoptotic and matrix-stabilizing molecule that is important throughout development; ITIH4 is a significant biomarker to assess particulate matter in patients with chronic obstructive pulmonary disease
Biochemical Properties	The 3 isoforms are all expressed in the liver and coupled with bikunin before they are released into blood circulation - difference being their selective combination with bikunin; The heavy chain(HC)1-3 prepropeptides (~900 amino acid residues) comprise a signal

# Search Proteins in BoMiProt

Place the cursor on Search and select from the pull-down menu appearing thereafter

The screenshot displays the BoMiProt website interface. At the top, a navigation bar includes links for HOME, BROWSE, SEARCH, STRUCTURE GALLERY, LINKS, BLAST, and FEEDBACK. Below this, a 'STATISTICS' section shows 'Total number of proteins: 3183' and 'BoMiProt defined proteins: 390'. A search bar is present with the text 'Search: BoMiProt Defined Proteins'. A pull-down menu is open, showing options: 'All Entries', 'BoMiProt Defined Proteins', and 'BoMiProt Undefined Proteins'. Below the search bar, there are two search forms. The first form has a 'Select Search Criteria' dropdown and radio buttons for 'BoMiProt ID', 'Uniprot ID', 'Ref Seq ID', 'Protein name', 'Gene Name', and 'Gene ID'. It also has a 'Select Display Criteria' section with radio buttons for 'Primary information' and 'Secondary information'. The second form is similar but only has the 'Primary information' radio button selected. Both forms have 'Clear' and 'Submit' buttons.

BoMiProt Defined proteins appear with both primary and secondary information. However, BoMiProt Undefined Proteins have only primary information

All entries contains all proteins curated in BoMiProt

BoMiProt defined proteins with homology models: 161

# Protein Display Page



A print option enables to either download/print the display page

Search by BoMiProt ID - Bomi1

## Primary Information

Displays BoMiProt ID, Uniprot ID, refseq ID, gene name, gene ID, milk fraction, FASTA seq, length and molecular weight of the protein and protein existence status.

BoMiProt ID	Bomi1
Protein Name	Inter-alpha-trypsin inhibitor heavy chain M1
Organism	Bos taurus
Uniprot Id	P118815
Milk Fraction	Whey
Ref Sequence Id	XI_00522812.1
Amino Acid Length	308
Molecular Weight	101238
fasta Sequence	<a href="https://www.uniprot.org/uniprot/P118815.fasta">https://www.uniprot.org/uniprot/P118815.fasta</a>
Gene Name	IIIH1
Protein Existence Status	Unreviewed: experimental evidence at protein level

Displays primary information with cross links with other databases.

## Secondary Information

Displays protein function, biochemical properties, significance in milk, I<sup>1</sup>IMs and its role, additional comments (if any) and bibliography

Presence in other biological fluids/tissues/cells	IaI family proteins are mainly secreted by the liver and present in the blood;
Protein Function	plasma serine-proteinase inhibitor; IIIH4 is a liver-derived member of the III family with diverse functions as an anti-apoptotic and matrix-stabilizing molecule that is important throughout development; IIIH4 is a significant biomarker to wheeze particulate matter in patients with chronic obstructive pulmonary disease
Biochemical Properties	The 3 isoforms are all expressed in the liver and coupled with bikunin before they are released into blood circulation - difference being their selective combination with bikunin; The heavy chain(HC)1-3 prepropeptide (~300 amino acid residues) comprise a signal peptide, a short propeptide, a mature form of HC, and a C-terminal polypeptide; hyaluronan is the most recognized HC interacting molecule; HCs are observed to be covalently linked to hyaluronan via a transesterification reaction, where they are often referred to as SHAI <sup>1</sup> (serum-derived hyaluronan-associated proteins); The effects of SHAI <sup>1</sup> s on hyaluronan include protection against free radicals, enhancement of macromolecular aggregation, and an increase in the binding avidity to other matrix components;
Significance in milk	acute phase protein in cattle- was isolated from heifers with experimentally induced 'summer mastitis'
I <sup>1</sup> IMs	Glycosylated: two potential N-glycosylation sites of H1 are effectively fully occupied by complex-type N-glycans- predominantly of biantennary type; H2 heavy chain carries only one complex-type N-glycan attached to Asn84; O-glycan carried by Thr87, two or three additional O-linked carbohydrate chains are present on H2-consist of a type-1 core structure with one or two NeuAc moieties;
Significance of I <sup>1</sup> IMs	O-glycans influence the metabolism of IaI- preferentially cleave the H2 heavy chain in its C-terminal part which is enhanced by charge-mediated interactions between the glycoaminoglycan chain of IaI and wheyase-mediated by O-glycan chains located in the C-terminal part of H2
Other Forms	Bom2337
Bibliography	1. Flaheut, C., Capon, C., Belduyck, M., Hcart, G., Sauters, P., & Moon, J. (1998). Glycosylation pattern of human inter-alpha-inhibitor heavy chains. The Biochemical Journal, 333 ( Pt 3), 749-758. <a href="https://doi.org/10.1042/bj3330749">https://doi.org/10.1042/bj3330749</a> . 2. Soler, L., Dąbrowski, H., Garcia, N., Alava, M. A., Lampreave, F., Pınero, M., ... Bochner, M. (2019). Acute-phase inter-alpha-trypsin inhibitor heavy chain 4 (IIIH4) levels in serum and

Displays secondary information curated from literature with bibliography.

Proteins with same secondary information but different primary information are linked to each other

# Search in Structural Gallery – Crystals or Homology Models

STATISTICS

Total number of proteins: 3183

Crystal Structure  
Homology Models

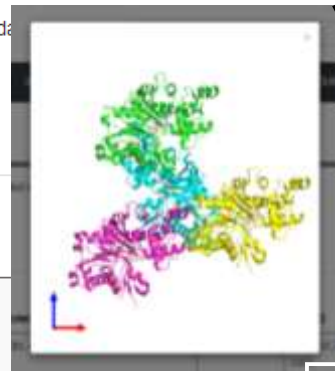
All crystal structures are displayed upon click

All homology models are displayed upon click

## Crystal Structure

Link to crystal structures represented in RCSB PDB database

S.No.	BoMiProt ID	Protein Name	PDB ID	Crystal Structure(PDB)
1	Bomi18	Actin, cytoplasmic 1	1hlu, 2btf, 2oan, 3u4, 3ub5,	
2	Bomi227	Actin-related protein	A7MB62	
3	Bomi207	Acyl-CoA-binding protein	P07107	



Click to enlarge the model

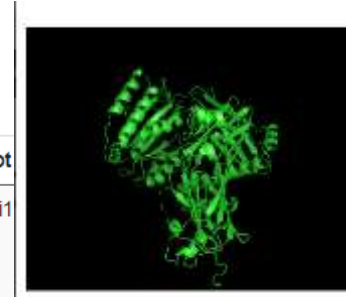
PDB Links

Protein will open in BoMiProt with a single click

## Homology Model

List of homology models built using Phyre2 web server

S.No.	BoMiProt	Uniprot ID	Homology Model
1	Bomi1	F1MMP5	Download
2	Bomi10	P17697	Download
3	Bomi100	P01035	Download



Click to enlarge the model

Download PDB file

Protein will open in Uniprot with a single click

Enter BoMiProt ID, Uniprot ID, protein name or PDB ID

# Protein Entry Source

## Protein Entry Source

Display of publications used as source for protein entries



Provides list of all publications used to curate protein IDs

10 records per page Search:

S.No. <sup>▲</sup>	Milk Fraction <sup>◆</sup>	Authors <sup>◆</sup>	Year <sup>◆</sup>	Total number of proteins identified <sup>◆</sup>	Techniques used <sup>◆</sup>	Protein Repository ID <sup>◆</sup>	Links <sup>◆</sup>
1	MFGM	Reinhardt et al	2006	120	Micro-capillary high performance LC nano MS/MS		<a href="#">Link</a>
2	MFGM	Affolter et al	2010	387	Stable isotope dilution (SID)-MS combined with MRM		<a href="#">Link</a>
3	Exosome	Reinhardt et al	2011	2107	Offline RP-fractionated on a nanoLC connected to tandem MS		<a href="#">Link</a>
4	whey	Alonso-Fauste et al	2012	62	2D MALDI TOF		<a href="#">Link</a>
5	whey, MFGM, Exosome	Reinhardt et al	2013	2971	iTRAQ-coupled LC-MS/MS		<a href="#">Link</a>
6	MFGM	Yang et al	2015	445	iTRAQ-coupled LC-MS/MS		<a href="#">Link</a>
7	Whole Milk	Vincent et al	2015	629	LC-MS/MS	PXD002529	<a href="#">Link</a>

# Use Blast Tool

## Blast

Allows user to run BLAST against protein sequences in BoMiProt Database

Input Protein Sequence(s) in (FASTA format) For Example file [Click here](#)

Paste a protein sequence in  
fasta format

Select expect value  
in the pull-down  
menu. 1 is set by  
default.

Choice for BLAST

Expect Value

Weight Matrix

BLAST Against

Select weight matrix. BLOSUM62  
is set by default.

Clear All

RUN BLAST

BLAST will be performed  
against default BoMiProt DB

Download

Download complete Bovine  
Milk Proteome in FASTA  
format

Blast result page

### Blast Result

Your job ID is 75434

BLASTP 2.3.0+

Reference:  
Stephan F. Altschul, Thomas L. Madden, Alejandro A. Schäffer,  
Jinghui Zhang, Zheng Zhang, Webb Miller, and David J. Lipman (1997),  
"Gapped BLAST and PSI-BLAST: a new generation of protein database  
search programs", *Nucleic Acids Res.* 25:3389-3402.

Reference for  
composition-based statistics:  
Alejandro A. Schäffer, I. Aravind, Thomas L. Madden, Sergey  
Shastri, John L. Spang, Yuri I. Wolf, Eugene V. Koonin, and  
Stephan F. Altschul (2001), "Improving the accuracy of PSI-BLAST  
protein database searches with composition-based statistics and  
other refinements", *Nucleic Acids Res.* 29:2594-3005.

Database: /Users/apple/Downloads/YYY/1\_A011\_cir-2015/FASTA.Fasta  
3,181 sequences; 2,544,865 total letters

Query: sp|P01888|B2PG\_BOVIN Beta-2-microglobulin OS=Bos taurus GN=9913  
QI=02M PE=1 SV=2

Length=118	Score	E
	(bits)	Value
sp P01888 B2PG_BOVIN Beta-2-microglobulin OS=Bos taurus GN=9913...	246	3e-85
tr A9801 A9801_BOVIN BOLA DQAI protein OS=Bos taurus GN=0913...	72.0	7e-17
tr Q5209 Q5209_BOVIN BOLA class II histocompatibility antigen, ...	62.9	7e-14
sp Q51V8 H2L1_BOVIN beta class II histocompatibility antigen, ...	58.5	3e-11
tr F0H06 F0H06_BOVIN Ig-like domain-containing protein OS=Bos...	40.7	2e-08
tr F0P16 F0P16_BOVIN Ig-like domain-containing protein OS=Bos...	40.1	3e-08
sp P13752 P45A_BOVIN BOLA class I histocompatibility antigen, a...	40.1	5e-08
tr F0P48 F0P48_BOVIN Ig-like domain-containing protein OS=Bos...	40.1	5e-08
tr F0H05 F0H05_BOVIN Ig-like domain-containing protein OS=Bos...	47.8	5e-08
tr E1B03 E1B03_BOVIN Ig-like domain-containing protein OS=Bos...	45.2	2e-07
tr A7994 A7994_BOVIN BOLA protein OS=Bos taurus GN=0913 QI=0...	45.8	3e-07
tr F0P25 F0P25_BOVIN Ig-like domain-containing protein OS=Bos...	44.3	9e-07
tr F0P03 F0P03_BOVIN Ig-like domain-containing protein OS=Bos...	43.0	2e-06
sp P13753 P05A_BOVIN BOLA class I histocompatibility antigen, a...	43.1	2e-06
tr F0P05 F0P05_BOVIN Uncharacterized protein OS=Bos taurus GN...	41.2	9e-06
tr Q8878 Q8878_BOVIN Major histocompatibility complex, class ...	41.2	1e-05
sp Q3204 ZAG5_BOVIN Zinc-alpha-2-glycoprotein OS=Bos taurus GN...	40.8	1e-05
tr F0P06 F0P06_BOVIN Uncharacterized protein OS=Bos taurus GN...	33.1	0.008
sp Q4851 Q4851_BOVIN tyrosine-protein phosphatase non-receptor...	30.8	0.032
tr G9809 G9809_BOVIN Uncharacterized protein OS=Bos taurus GN...	29.5	0.072
tr Q4849 Q4849_BOVIN CD88 antigen (Fragment) OS=Bos taurus GN...	27.3	0.145
tr Q4851 Q4851_BOVIN Uncharacterized protein OS=Bos taurus GN...	27.3	0.145
tr Q4851 Q4851_BOVIN Uncharacterized protein OS=Bos taurus GN...	26.8	0.190

> sp|P01888|B2PG\_BOVIN Beta-2-microglobulin OS=Bos taurus GN=9913  
QI=02M PE=1 SV=2  
Length=118



# Feedback

[HOME](#)[BROWSE](#)[SEARCH ▾](#)[STRUCTURE GALLERY ▾](#)[PROTEIN ENTRY SOURCE](#)[BLAST](#)[FEEDBACK](#)

## Get In Touch

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We would be glad to receive feedback from you on your experience of using BoMIProt. We welcome your suggestions on how we can improve it in the future.

**Submit feedback by providing contact details and the message on which the database could be improved**