

# 糖鎖科学ポータルGlyCosmosの最新情報

木下聖子

第43回日本分子生物学会

# GlyCosmos Overview



## Repositories

- 

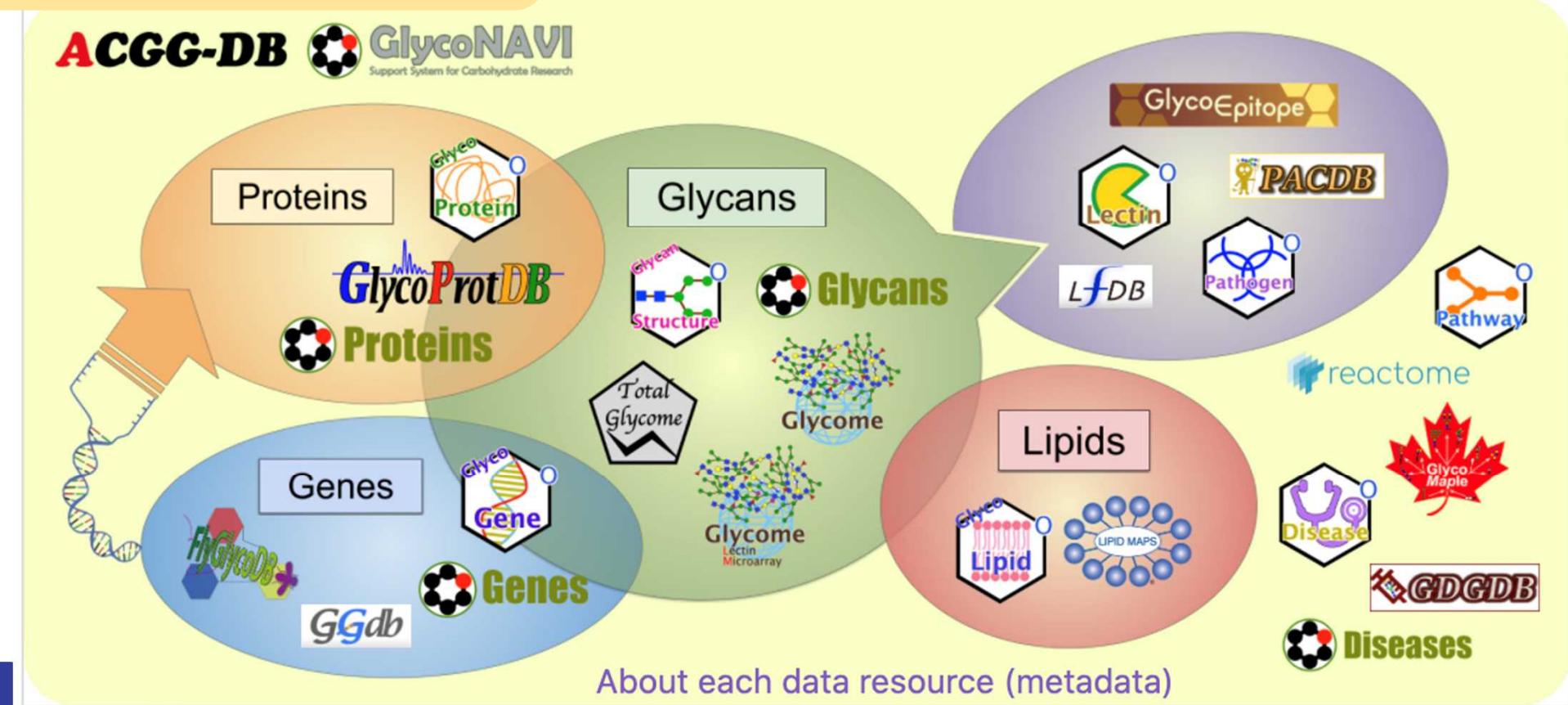
**The glycan structure repository GlyTouCan**  
assigns accession numbers to glycans
- 

**The Glycoconjugate repository GlyComb (TBA)**  
will assign accession numbers to glycoconjugates such as glycoproteins, glycolipids
- 

**The glyco(proteo)mics repository GlycoPOST**  
stores raw mass spectrometry data obtained from glyco-(proteo)mics related experiments.
- 

**The glycomics MS repository UniCarb-DR**  
stores annotated mass spectrometry data obtained from glycomics related experiments.

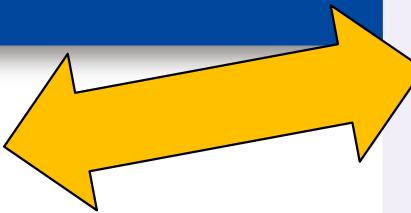
## Data Resources





# GlyCosmos Data Reso

- Genes/Proteins/Lipids
  - Glycogenes
  - Glycoproteins
  - Lectins
  - Glycolipids
- Glycans/Glycoconjugates
  - Glycans
  - Glycans Search
  - Glycoproteins
- Glycomes
- Pathways/Diseases/Organisms
  - Pathways
  - GlycoMaple
  - Organisms



## Genes/Proteins/Lipids

-  Glycogenes
-  Glycoproteins
-  Lectins
-  Glycolipids

## Glycans/Glycoconjugates

-  Glycans
-  Glycans Search
-  Glycoproteins

## Glycomes

-  Pathways
-  GlycoMaple



# Genes/Proteome Database

- Genes
  - GlyCosmos Glycogenes
  - ACGG-DB GGDB
  - Plant GARDEN
  - ACGG-DB GDGDB
  - GlycoNAVI-Genes
  - FlyGlycoDB
  - Lipid Maps Gene/Proteome Database

Submissions

- GlyTouCan
- GlycoPOST
- UniCarb-DR

Resources

Search

- Genes/Proteins/Lipids
  - Glycogenes
  - Glycoproteins
  - Lectins
  - Glycolipids
- Glycans/Glycoconjugates
  - Glycans
  - Glycans Search
  - Glycoproteins
- Glycomes
- Pathways/Diseases/Organisms
  - Pathways
  - GlycoMaple
  - Organisms
- Standards

## Genes

**GlyCosmos Dataset**

**GlyCosmos Glycogenes**

List of glycogenes. The information of each database of GlycoGene DataBase (GGDB), FlyGlycoDB (FGDB), and KEGG BRITE is integrated into one list. You can search for glycogenes of various species. In addition, if applicable GeneID exists, the information of LIPID MAPSGene / Proteome Database is also integrated.

**ACGG-DB**

**GlycoGene Database (GGDB)**

GGDB is a database which includes genes associated with glycan synthesis such as glycosyltransferase, sugar nucleotide synthases, sugar-nucleotide transporters, and sulfotransferases.

— **ACGG-DB**

**Plant GARDEN**

**Plant GARDEN (Genome And Resource Database Entry)**

PlantGARDEN (Genome And Resource Database Entry) is a portal site that curates genome and marker information of various plant species. This is a list of the glycogenes computationally extracted from all plant genomes in PlantGARDEN.

**ACGG-DB**

**Glyco-Disease Genes Database (GDGDB)**

GDGDB is a database of glycan-related diseases and their responsible genes.

— **ACGG-DB**

**GlycoNAVI**

**GlycoNAVI-Genes**

GlycoNAVI-Genes is dataset of gene information. This is the content of GlycoNAVI.

— **GlycoNAVI**

**FlyGlycoDB**

**FlyGlycoDB**

Glycan related *Drosophila* gene database.

**LIPID MAPS Gene/Proteome Database (LMPD)**

**LIPID MAPS Gene/Proteome Database (LMPD)**

Lipid-related genes and proteins from LIPID MAPS Proteome Database (LMPD).



List of glycogenes. The information of each database of GlycoGene DataBase (GGDB), FlyGlycoDB (FGDB), and KEGG BRITE is integrated into one list. You can search for glycogenes of various species. In addition, if applicable GeneID exists, the information of LIPID MAPSGene / Proteome Database is also integrated.

Database Name	Last Update
GlycoGene Database (GGDB)	January 26, 2018
FlyGlycoDB	September 1, 2018
KEGG BRITE	January 30, 2020
Plant GARDEN	May 28, 2020
LIPID MAPSGene/Proteome Database	June 24, 2019

Show 10 entries

To search, enter a keyword in the text box and press Enter (return).

Search across columns

Gene Symbol	Gene ID	GlycoGene Database	FlyGlycoDB	KEGG	LIPID MAPS	Disease Name	Disease Aliases	Species
<a href="#">Search</a>								
FUT1	2523	gg001		hsa:2523	LMP002339		No data	Homo sapiens
FUT2	2524	gg002		hsa:2524	LMP001448		No data	Homo sapiens
FUT3	2525	gg003		hsa:2525			No data	Homo sapiens
FUT4	2526	gg004		hsa:2526	LMP001866		No data	Homo sapiens
FUT5	2527	gg005		hsa:2527			No data	Homo sapiens
FUT6	2528	gg006		hsa:2528			No data	Homo sapiens
FUT7	2529	gg007		hsa:2529	LMP000249		No data	Homo sapiens
FUT9	10690	gg008		hsa:10690	LMP004948		No data	Homo sapiens
FUT8	2530	gg009		hsa:2530			No data	Homo sapiens
FUT10	84750	gg010		hsa:84750			No data	Homo sapiens

Showing 1 to 10 of 20580 entries

[Download the displayed table \(.tsv\)](#)

[Download all \(.tsv\)](#)

Previous

1 2 3 4 5 ... 2058 Next

Line breaks are removed from cells.

# FUT1

Entry of glycogene extract

Summary

## FUT1

Gene ID: 2523

Gene Symbol: FUT1

Organism:

- Scientific Name

Designation: alpha1,2

HGNC: 4012

mRNA: NM\_000148

map: 19q13.3

Protein: NP\_000139

EC:

- 2.4.1.69

CAZy:

- GT11

OMIM: 211100

PubChem: 2523

## GlycoGene Database

GGDB ID

gg001

### General Reaction

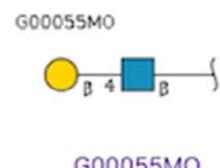
Reference: Three bovine alpha2-fucosyltransferases.

Donor: GDP-Fuc



Reference: Molecular cloning, sequence, and expression analysis of the human gene that codes for the H blood group antigen.

Donor: GDP-Fuc



### Orthologous Gene

Mus musculus

- Protein: NP\_032077
- mRNA: NM\_008051

Caenorhabditis elegans

- Protein: NP\_492814
- mRNA: NM\_060413

Rattus norvegicus

- Protein: NP\_112515
- mRNA: NM\_031236

### Gene Ontology

#### Biological Process

- carbohydrate metabolic process
- protein glycosylation
- fucosylation
- L-fucose catabolic process

#### Cellular Component

- Golgi apparatus
- integral component of plasma membrane
- membrane
- Golgi cisterna membrane

#### Molecular Function

- galactoside 2-alpha-L-fucosyltransferase activity
- fucosyltransferase activity

### KEGG BRITE Database

Orthology K00718

Name FUT1\_2

Definition galactoside 2-L-fucosyltransferase 1/2 [EC:2.4.1.69]

### Glyco-Disease Genes Database (GDGDB)

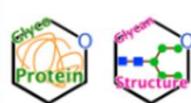
Concept UI Disease name Aliases Disease type

Data not found

### LIPID MAPS® Gene/Proteome Database (LMPD)

LMPD ID LMP002339

Gene Name fucosyltransferase 1 (galactoside 2-alpha-L-fucosyltransferase, H blood group)



A list of glycoproteins extracted from UniProt and annotated with glycosylation. From the entry page, you can check various information related to glycoproteins, such as glycosylation site, sequence information, three-dimensional structure, and pathway.

Database Name	Last Update
UniProt	July 29, 2020
MCAW-DB	July 10, 2019

Show 10 entries

To search, enter a keyword in the text box and press Enter (return).

Search across columns

Protein Name	UniProt ID	Gene Symbol	Organism	No. of Glycosylation Sites	GlyTouCan IDs	Disease Name	Disease Aliases
<input type="text" value="Search"/>	<input type="button" value="Search"/>	<input type="button" value="Search"/>	<input type="button" value="Search"/>			<input type="button" value="Search"/>	<input type="button" value="Search"/>
(R)-mandelonitrile lyase 1	024243	MDL1	Prunus dulcis	13	No data	No data	No data
(R)-mandelonitrile lyase 1	P52706	MDL1	Prunus serotina	3	No data	No data	No data
(R)-mandelonitrile lyase 2	Q945K2	MDL2	Prunus dulcis	4	No data	No data	No data
(R)-mandelonitrile lyase 2	050048	MDL2	Prunus serotina	14	No data	No data	No data
(R)-mandelonitrile lyase 3	P52707	MDL3	Prunus serotina	13	No data	No data	No data
(R)-mandelonitrile lyase 4	082784	MDL4	Prunus serotina	10	No data	No data	No data
1,3-beta-glucan synthase component FKS3	Q04952	FKS3	Saccharomyces cerevisiae (strain ATCC 204508 / S288c)	8	No data	No data	No data
1,3-beta-glucanosyltransferase gas1	Q9P378	gas1	Schizosaccharomyces pombe (strain 972 / ATCC 24843)	9	No data	No data	No data
1,3-beta-glucanosyltransferase GAS1	P22146	GAS1	Saccharomyces cerevisiae (strain ATCC 204508 / S288c)	10	No data	No data	No data
1,3-beta-glucanosyltransferase GAS2	Q06135	GAS2	Saccharomyces cerevisiae (strain ATCC 204508 / S288c)	1	No data	No data	No data

Showing 1 to 10 of 50113 entries

[Download the displayed table \(.tsv\)](#)

[Download all \(.tsv\)](#)

[Previous](#)

1

2

3

4

5

...

5012

[Next](#)

Line breaks are removed from cells.

## External Links

• GlycoProtDB

• GlycansDB

• GlycanDB

## Feature

## Glycan Images

#

GlyTouCan images of glycan extracted from PDB

1

G17013IQ

6x  ?

2

6x  ?

3

??  ?

4

G17013IQ

5

6

7

8

G28589EC

6x  ?

9

6x  ?

10

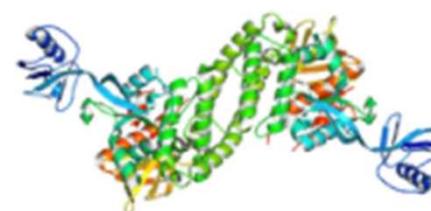
4x ??  ?

11

G28589EC

12

## PDB Images



5XQ0

© PDBj 

Open LiteMol Viewer

G28182LP

4x  ?4x  ???  ?

G28182LP

G42340AQ

6x  ?5x  ?2x ??  ?

G42340AQ

# Anti-H(O) lectin 1

Entry of glycoprotein extracted from [UniProt](#)

## Summary

### Anti-H(O) lectin 1

UniProt ID: P22972

Gene Symbol: N/A

Organism:

- Scientific Name: Ulex europaeus

## Glycosylation Sites

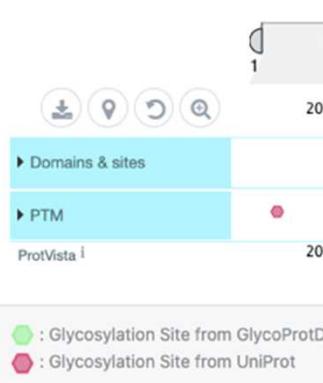
#	Position
1	10
2	116

## Sequence

SDDLSFKFK**N**FSQNGKDKLSFQGDASVIE  
GLFEDTKD**N**DSSYQTVAVEFTDTIGSPVN  
GGTYIGRQATHEVLNWYFTSNLINTNS

**N**: N-glycosylation Site  
—: Potential Sequon

## Feature



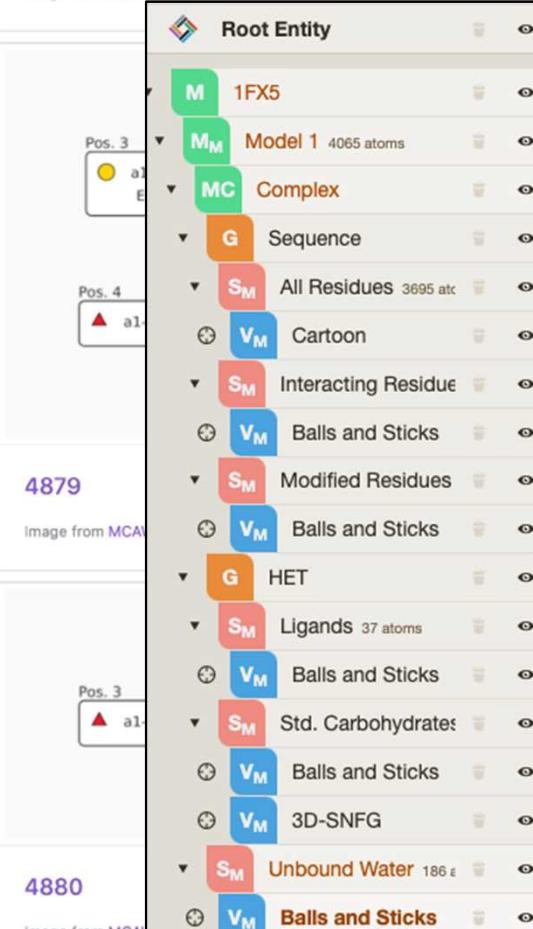
# MCAW-DB (Glycan Recognition Profile) Images

MCAW-DB is a database whereby users can view the multiple alignment analysis of common glycan substructures among a group of glycan structures. The data having higher binding affinity to glycan binding proteins (GBPs) have been analyzed. This database provides published analysis results of glycan array data from the following sources:

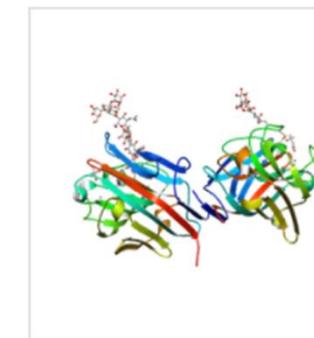


4878

Image from MCAW-DB



## PDB Images



1FX5

© PDBj [CC BY]

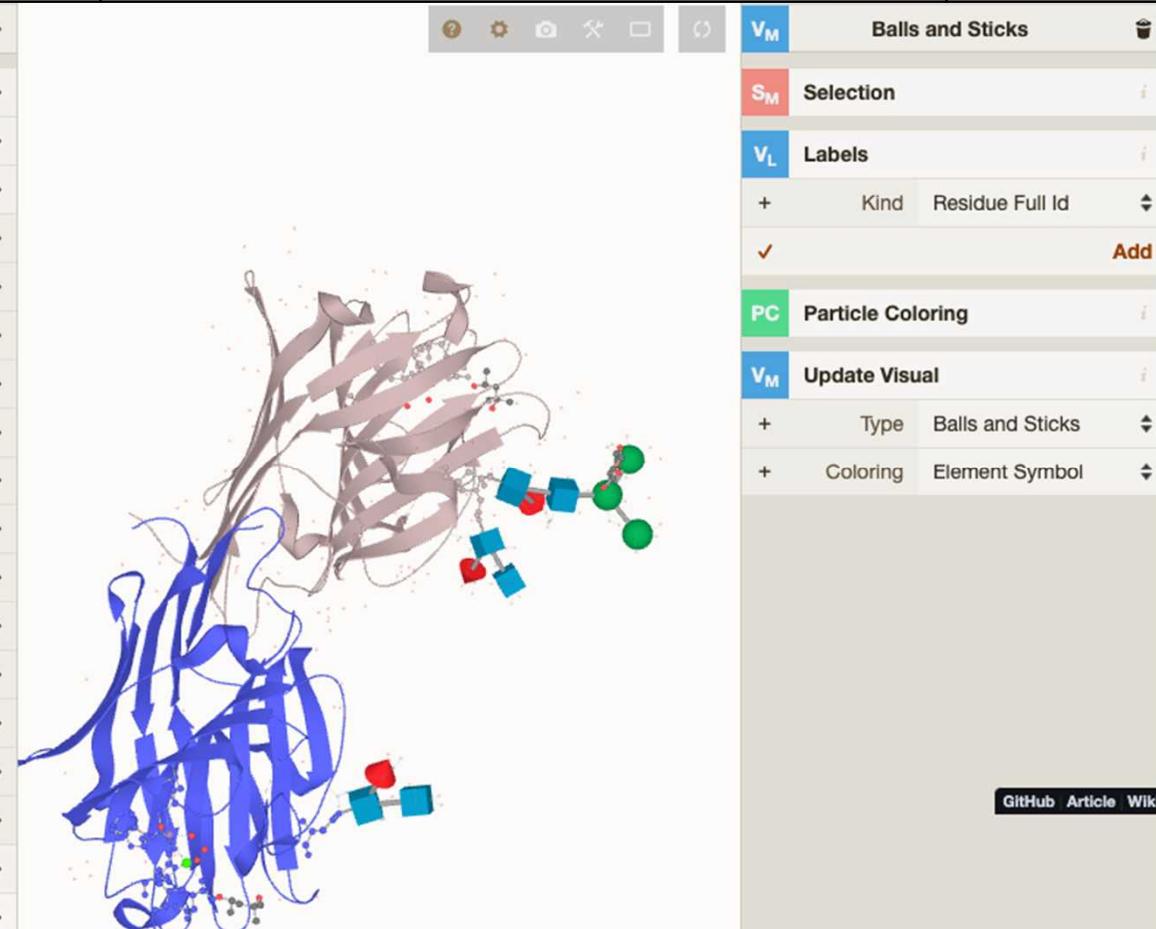
[Open LiteMol Viewer](#)



1JXN

© PDBj [CC BY]

[Open LiteMol Viewer](#)





# Glycans/Glycoconjugates

- Glycans
  - GlyCosmos
  - GlyCosmoDB
  - GlycoNAcDB
- Glycoconjugates
  - GlyCosmoDB
  - ACGG-DB
  - GlycoEpiDB
  - GlycoNAcDB

Submissions

- GlyTouCan
- GlycoPOST
- UniCarb-DR

Resources

Search

- Genes/Proteins/Lipids
  - Glycogenes
  - Glycoproteins
  - Lectins
  - Glycolipids
- Glycans/Glycoconjugates
  - Glycans
  - Glycans Search
  - Glycoproteins
- Glycomes
- Pathways/Diseases/Organisms
  - Pathways
  - GlycoMaple
  - Organisms

## Glycans

### GlyCosmos Dataset

#### GlyCosmos Glycans

The list of validated glycans extracted from [GlyTouCan](#) at the time of the latest GlyCosmos update.

### GlyCosmos Tools

#### GlyCosmos Glycans Search

Various glycan search tools, such as by mass, by composition, or by graphical search.

### GlycoNAVI

#### GlycoNAVI Motif List

GlycoNAVI-Motif is dataset of glycan structure patterns. This is the content of [GlycoNAVI](#).



<https://glyconavi.org/Glycans/motif-tcarp-table.php>

## Glycoconjugates

### GlyCosmos Dataset

#### GlyCosmos Glycoproteins

A list of glycoproteins extracted from UniProt and annotated with glycosylation. From the entry page, you can check various information related to glycoproteins, such as glycosylation site, sequence information, three-dimensional structure, and pathway.

### ACGG-DB

#### GlycoProtDB (GPDB)

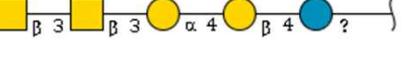
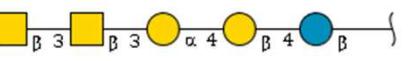
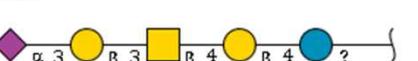
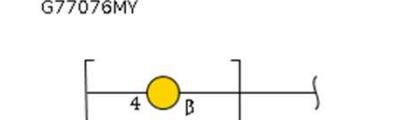
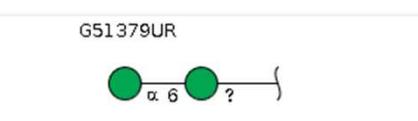
GPDB is a glycoprotein database providing information of Asn (N)-glycosylated proteins and their glycosylated site(s), which were constructed by employing a bottom-up strategy using actual glycopeptide sequences identified by LC/MS-based glycoproteomic technologies.

— ACGG-DB

#### GlycoProtDB

# GlyCosmos Glycans

- List of validated glycans from GlyTouCan

Accession Number	IUPAC Condensed	Minimum < mass < Maximum	motif name(s) ▾	GlycoEpitope
Search	Search	Search	Search	Search
G98848EU	GalNAc(b1-3) G <b>al</b> (b1-4)G			
				
G98848EU				
G51699SI	GalNAc(b1-3) G <b>al</b> (b1-4)G			
				
G51699SI				
G14633CL	Neu5Ac(a2-3) G <b>al</b> (b1-4)G			
				
G14633CL				
G77076MY	No data			
				
G77076MY				
G51379UR	Man(a1-6)Man			
				
G51379UR				

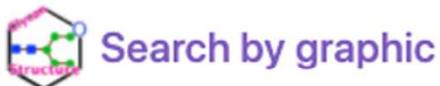
## GlyCosmos Tool



### Search by text

You can search glycan structures registered in GlyTouCan. This allows you to enter structures in any major glycan representation, including GlycoCT, KCF, Linear Code®, etc.

## GlyCosmos Tool



### Search by graphic

Search GlyCosmos Glycans by drawing the query glycan in a drawing tool.

## GlyCosmos Tool



### Search by GNOme Browser

Browse a subset of GlyTouCan Glycans using the GNOme Browser.

## GlyCosmos Tool



### Search by species

List of glycans extracted from GlyTouCan. You can search glycans by taxon.

## GlyCosmos Tool



### Search by mass

Search GlyCosmos Glycans by mass and subsumption hierarchy.

## GlyCosmos Tool



### Search by composition

Search GlyCosmos Glycans by composition.



# Search by graphic

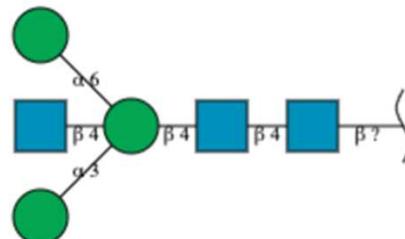
大學

Search GlyCosmos Glycans by drawing the query glycan in a drawing tool.

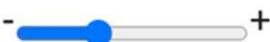
## SugarDrawer

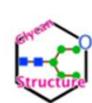
[Load Structure](#)[Add Monosaccharide](#)[Add Substituent](#)[Undo](#)[Redo](#)[Clear](#)[Help](#)**N-glycan**

- Core
- Fucosylated core
- Bisecting core
- Bisecting fucosylated core
- High mannose
- Hybrid
- Complex

**O-glycan****Glycosphingolipids****GAGs****Lewis****Antigen**

ZOOM

[Export String](#)[Import String](#)[Simple mode](#)[Search](#)



# Search by graphic

Search GlyCosmos Glycans by drawing the query glycan in a drawing tool.

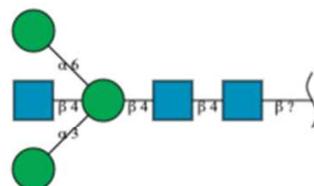
## SugarDrawer

[Load Structure](#)[Add Monosaccharide](#)[Add Substituent](#)[Undo](#)[Redo](#)[Clear](#)[Help](#)**N-glycan**

- Core
- Fucosylated core
- Bisecting core
- Bisecting fucosylated core
- High mannose
- Hybrid
- Complex

**O-glycan****Glycosphingolipids****GAGs****Lewis****Antigen**

Current item:

**ZOOM**[Export String](#)[Import String](#)[Simple mode](#)[Search](#)

ID	Image
G35619UY	



Registration

Search

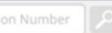
View All

Preferences



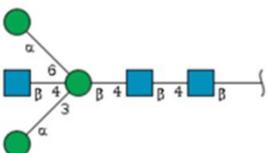
Sign in

Accession Number



## G35619UY

G35619UY



Accession number

G35619UY

Created Date

2020-11-16

[Cite this record](#)

## Literature

Nothing found in this entry.

[Register your Publication!](#)

## External ID

## GlyConnect

- [2695](#)

from GlyConnect

## GlycoChemExplorer

- [JCGG-M0000002997](#)

from  
GlycoChemExplorer,  
JCGGDB AIST

## PubChem CID

- [91857791](#)

from GlycoNAVI

## PubChem SID

- [252291069](#)

from GlycoNAVI

## Carbbank(CCSD)

- [35299](#)
- [44744](#)
- [38594](#)

from GlycomeDB

## GLYCOSCIENCES.de

- [18537](#)
- [2947](#)
- [13933](#)

from GlycomeDB

## KEGG

- [G11051](#)

from GlycomeDB

## PDB

- [2dw0](#)

from GlycomeDB

Image	ID
	G35619UY

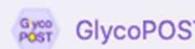
[back](#)



## Submissions



GlyTouCan



GlycoPOST



UniCarb-DR

## Resources

Search



## Genes/Proteins/Lipids



Glycogenes



Glycoproteins



Lectins



Glycolipids

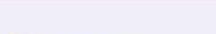
## Glycans/Glycoconjugates



Glycans



Glycans Search



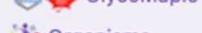
Glycoproteins

## Glycomes

## Pathways/Diseases/Organisms



Pathways



GlycoMaple



Organisms

## Pathways

## GlyCosmos Dataset



## GlyCosmos Pathways

Pathways from Reactome containing glycoproteins as annotated in UniProt. Search by pathway name, species, and protein name.

## GlyCosmos Dataset



## GlycoMaple

GlycoMaple is a visualization tool for pathways. Glycogene expression data can be uploaded or selected from RNA-Seq data from the Human Proteome Atlas. The expression values will be displayed in various glycan-related pathways.

## Diseases

## ACGG-DB



## Glyco-Disease Genes

## Database (GDGDB)

GDGDB is a database of glycan-related diseases and their responsible genes.

— ACGG-DB

## ACGG-DB



## Pathogen Adherence to Carbohydrate Database (PACDB)

PACDB provides the information on pathogens (e.g. bacteria, fungus, toxin and virus) adhering to carbohydrates expressed on the cell surface of host animals or plants.

To view pathways,

## Glycoprotein entry

## Extracted Glycoprotein from GlycoProtDB

**Protein:** Sodium/potassium-transporting ATPase subunit beta  
**GlycoProtDB:** GPD00005232  
**UniProt:** Q545P0  
**Gene Symbol:** Atp1b1  
**Organism:**

- **Scientific Name:** *Mus musculus*

## Glycosylation

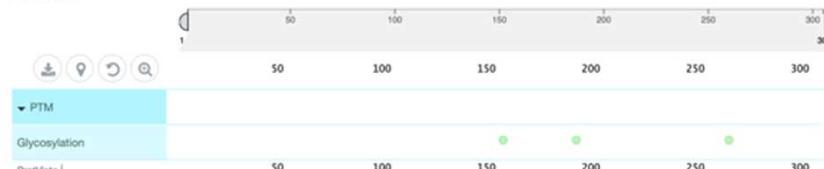
Position	PubMed ID
158	17406563 22823882 23002422
193	17406563 22823882 23002422
266	17406563 22823882 23002422

## Sequence

[  :Potential Sequon , N:Glycosylation Site from GlycoProtDB ]

MARGAKKEEGSWKKFIWNSEKKEFLGRTGOSWPKLKFVYFVGCLAFITRGPTQVMLLTISELKPTYQDRAPPGLTQPIQTKTEISFRPNPDKSYEAYVNLIIRFLEKYKDQSQQDDMIFEDCNGVNPSPERKERDINHERGERVKCRKLDWQHNCGNSLNDGSYRERGKPCPCKPKPKNESLEYTPLMMKYNPNLPVQCTGKRDDEKDVKGNVIEYFGMGGYYGFLQPYPGKLKQLPYQPLQAVPFNTLVDTTERIVEKAGYANGKESYDKEPQGCFIIVKIEKS

## Feature



●:Glycosylation Site from GlycoProtDB · ■:Glycosylation Site from UniProt

## PDB Images

No data

GlyTouCan Images

Extracted GlyToxCap data from GlycoProtDB



## fusions

## Plasma membrane p-Y FGFR1 fusion dimers

**Location : plasma membrane**

UniProtID	ProteinName
O94905	 Erlin-2
O95429	BAG family molecular chaperone regulator
P11362	 Fibroblast growth factor receptor 1

Glycogene Expression Pathway /view/

Data last updated: April 1, 2020

Please input .csv file (Gene ID, TPM value). Do you need sample files?

**GlycoMaple**

Please input .csv file (Gene ID, FPKM value). Do you need sample files?

Complex: Min  Overlap: Ave

If two or more tabs datasets can be compared by clicking the button below.

**LLO biosynthesis**

- N-glycan processing branching
- Complex capping glycans/GSLs
- Biosynthesis of GlcNAc
- Biosynthesis of neutral glycans
- Biosynthesis of O-Glc/Col-Gal/O-Gl
- Biosynthesis of Chondroitin
- Biosynthesis of Heparan sulfate (HS)
- Biosynthesis of Chondroitin sulfate (CS) and dermatan sulfate (DS)
- Biosynthesis of Keratan sulfate (KS)
- Retrovirus glycoprotein

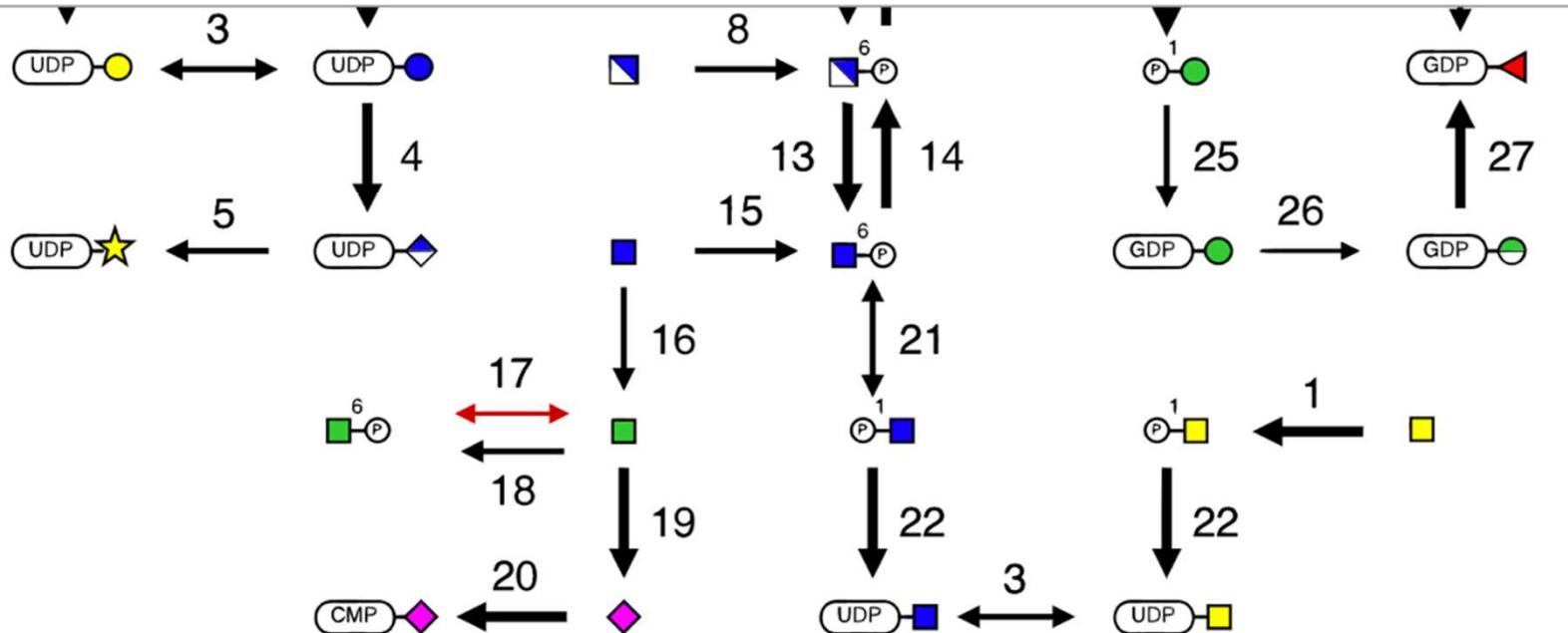


**GlycoMaple**

Please input .csv file (Gene ID, FPKM value). Do you need sample files?

**Heparan sulfate biosynthesis**

Sugar-nucleotide biosynthesis



Twitter [Follow](#) [About](#)  
Powered by RDB [View](#)  
Based on Bio2RDF [View](#)  
  
This work is licensed under a [Creative Commons License](#).

# GlyCosmos Organisms

Show 10 entries

To search, enter a keyword in the text box and press Enter (return).

Search across columns

Organism	Taxon ID					
Gossypium hirsutum	3635	611	6	3	0	0
Salmo salar	8030	566	0	51	0	0
Nicotiana tabacum	4097	515	47	21	0	0
Lingula anatina	7574	446	0	4	0	0
Glycine max	3847	399	38	16	1	0
Juglans regia	51240	340	2	0	0	0
Brassica oleracea var. oleracea	109376	293	0	0	0	0
Scleropages formosus	113540	285	0	19	0	0
Phoenix dactylifera	42345	283	0	0	0	0
Ictalurus punctatus	7998	277	0	30	0	0

Showing 1 to 10 of 21487 entries

Download the displayed table (.tsv)

Download all (.tsv)

Previous

1

2

3

4

5

...

2149

Next

Line breaks are removed from cells.



# GlyCosmos Organisms

List of all species in GlyCosmos Resources.

Show **10** entries

To search, enter a keyword in the text box and press Enter (return).

Search  across columns

Organism ▾	Taxon ID	 Gene	 Structure	 Protein	 Lectin	 Pathway
homo						
Homo sapiens	9606	321	3384	4553	157	2423
Phomopsis amygdali	1214568	0	0	6	0	0
Stenotrophomonas maltophilia	40324	0	7	0	0	0
Trichomonas vaginalis	5722	0	1	4	0	0
Trichomonas vaginalis G3	412133	5	0	0	0	0
Xanthomonas	338	0	10	0	0	0
Xanthomonas campestris	339	0	26	0	0	0
Xanthomonas campestris pv. begoniae	316582	0	2	0	0	0
Xanthomonas campestris pv. vitians	83224	0	1	0	0	0
Xanthomonas cassavae	56450	0	1	0	0	0

Showing 1 to 10 of 10 entries

[Download the displayed table \(.tsv\)](#)

[Download the search results \(.tsv\)](#)

Previous **1** Next

Line breaks are removed from cells.



# Cross Search

Search across GlyCosmos Resources.

Search

e.g. Erythropoietin, FUT2, O00602

Search results for FUT2

## Genes/Proteins/Lipids



GlyCosmos GlycoGenes 4



GlyCosmos GlycoProteins 23



GlyCosmos Lectins 0



GlyCosmos Glycolipids 0



# GlyCosmos Pathways

## Search for pathways

Keywords :

Homo sapiens

FUT2

- Lewis blood group biosynthesis
- ABO blood group biosynthesis
- O-glycosylation of TSR domain-containing proteins

Bos taurus 1

Mus musculus 3

Homo sapiens 3

Sus scrofa 2

Rattus norvegicus 3

Xenopus tropicalis 2

Drosophila melanogaster 1

Canis familiaris 1

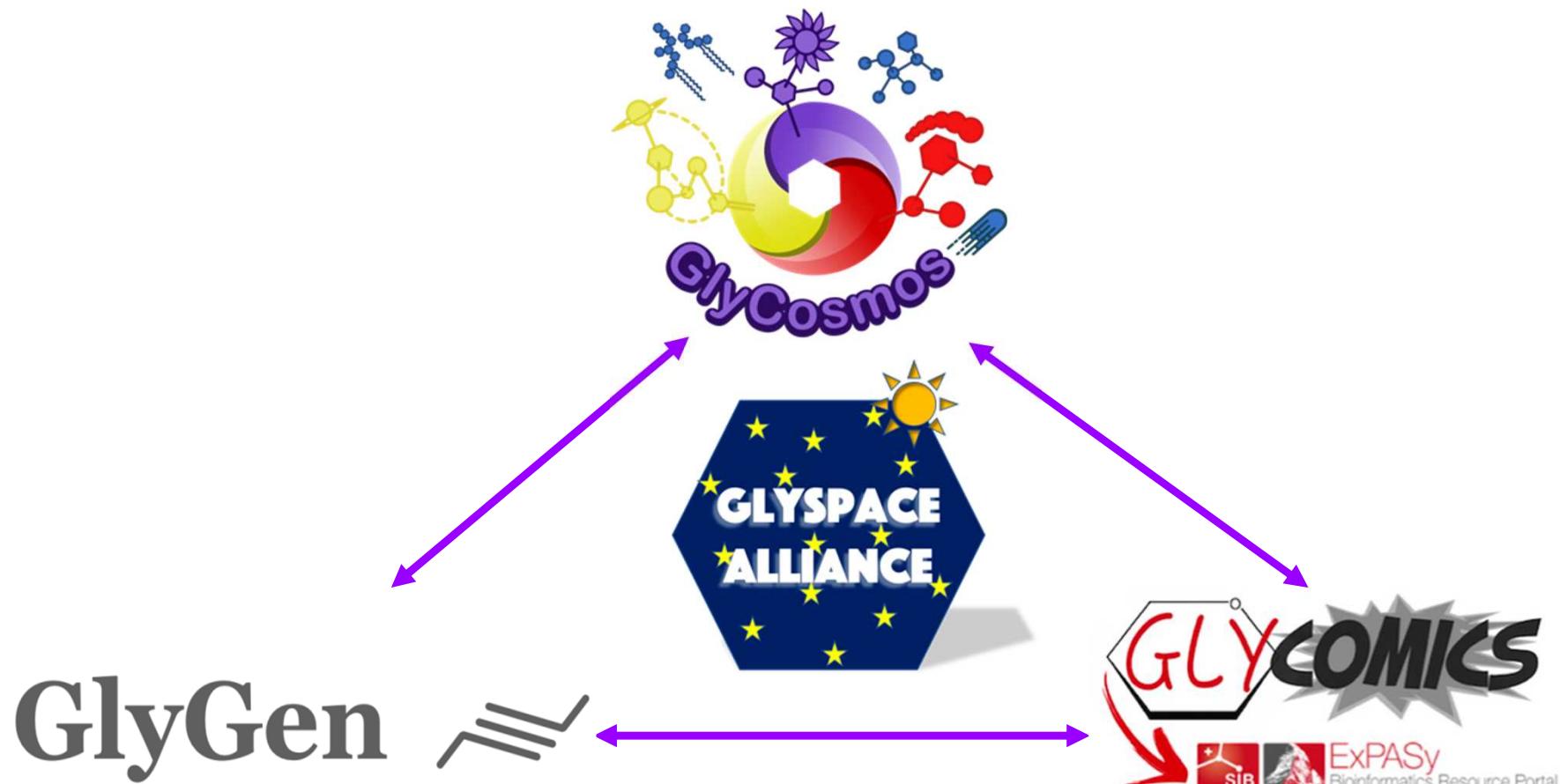
Standards

O Ontologies

N Notations



# GlySpace Alliance



Established August, 2018 @ Warren Workshop

<http://glyspace.org>

# GlySpace Alliance Goals

1. promote the use of standards for representing and exchanging glycobiology information;
2. develop protocols for establishing and representing the provenance of glycobiology data and acknowledgement of the individuals and groups that collect, curate, map and integrate this data;
3. establish metrics regarding the reliability and accuracy of the data based on existing metrics for quality control (e.g., evidence ontology);
4. reach consensus for data filtering and/or annotation when disparities are found among the data;
5. provide globally distributed data storage redundancy to enhance data accessibility and ensure its longevity.

# Summary

- Attempting to integrate life science databases relevant to glycosciences
- As a member of GlySpace Alliance, glycoproteins, pathways, reactions, etc. are all shared via a license requiring only attribution of the data
- More integrations will continue
  - more overlapping data will be available
  - links to data resources will be provided to lead users to the most appropriate website/database
- Constructive feedback is always welcome!

# Acknowledgements

## Soka University

Masaaki Shiota  
Masae Hosoda  
Tamiko Ono  
Akihiro Fujita  
Haruko Kitakaze

## AIST

Noriaki Fujita  
Yoshinori Suzuki  
Kiyohiko Angata  
Hiroyuki Kaji  
Hisashi Narimatsu

Kiyoko F. Aoki-Kinoshita  
[kkiyoko@soka.ac.jp](mailto:kkiyoko@soka.ac.jp)

## Niigata University

Shujiro Okuda  
Yu Watanabe

## The Noguchi Institute

Issaku Yamada  
Shinichiro Tsuchiya  
Masaaki Matsubara

## SPARQLite, LLC

Nobuyuki P. Aoki  
Daisuke Shinmachi

## Funding agencies:

JST Database Coordination  
and Integration Program, JST  
MIRAI Program and NIH

## Advisors

Toshiyuki Kawasaki  
Shoko Nishihara  
Nikki Packer  
Carsten Kettner  
Stuart Haslam  
William S. York



Japan Science and  
Technology Agency