

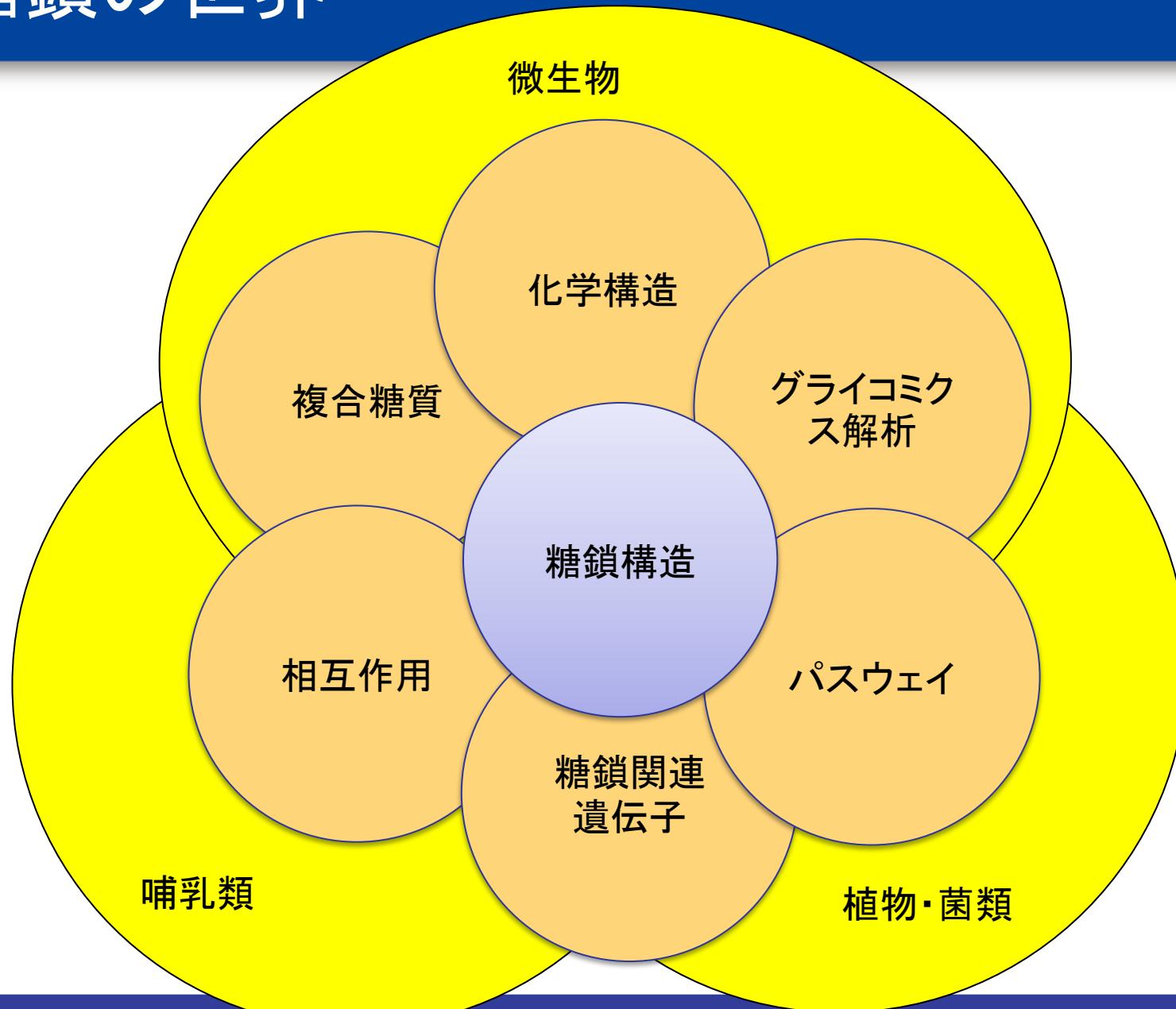
糖鎖関連データベース (GlyCosmosなど)

木下聖子

2020年12月9日

AJACSオンライン4

糖鎖の世界

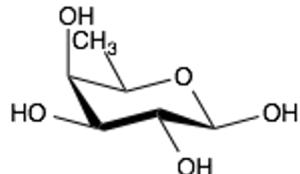


糖鎖情報の標準化の必要性

- 单糖表現の曖昧性

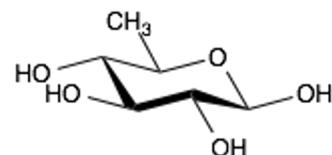
D-Fucose

6-Deoxy-D-galactose



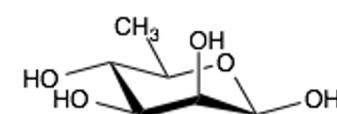
D-Quinovose

6-Deoxy-D-glucose

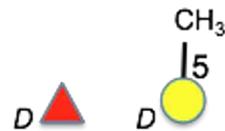


D-Rhamnose

6-Deoxy-D-mannose



β -D-Fucp



β -D-Quip



β -D-Rhap



- 微生物や植物の糖類。。。

SNFG (Symbol Nomenclature for Glycans)

- <https://www.ncbi.nlm.nih.gov/glycans/snfg.html>

SHAPE	White (Generic)	Blue	Green	Yellow	Orange	Pink	Purple	Light Blue	Brown	Red
Filled Circle	○	●	●	●	●	●	●	●	●	●
	Hexose	Glc	Man	Gal	Gul	Alt	All	Tal	Ido	
Filled Square	□	■	■	■	■	■	■	■	■	■
	HexNAc	GlcNAc	ManNAc	GalNAc	GulNAc	AltNAc	AllNAc	TalNAc	IdoNAc	
Crossed Square	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
	Hexosamine	GlcN	ManN	GalN	GulN	AltN	AllN	TalN	IdoN	
Divided Diamond	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇
	Hexuronate	GlcA	ManA	GalA	GulA	AltA	AllA	TalA	IdoA	
Filled Triangle	△	△	△		△	△		△		△
	Deoxyhexose	Qui	Rha		6dGul	6dAlt		6dTal		Fuc
Divided Triangle	▲	▲	▲			▲		▲		▲
	DeoxyhexNAc	QuiNAc	RhaNAc			6dAltNAc		6dTalNAc		FucNAc
Flat Rectangle	◻	■	■		■	■	■	■	■	
	Di-deoxyhexose	Oli	Tyv		Abe	Par	Dig	Col		
Filled Star	★	★	★	★	★	★				
	Pentose	Ara	Lyx	Xyl	Rib					
Filled Diamond	◇	◆					◆	◆	◆	◆
	Deoxynonulosonate	Kdn					Neu5Ac	Neu5Gc	Neu	Sia
Flat Diamond	◇	◆	◆	◆		◆		◆		
	Di-deoxynonulosonate	Pse	Leg			Aci		4eLeg		
Flat Hexagon	○	○	○	○	○	○	○	○	○	○
	Unknown	Bac	LDmanHep	Kdo	Dha	DDmanHep	MurNAc	MurNGc	Mur	
Pentagon	⬟	⬟	⬟	⬟	⬟	⬟	⬟	⬟	⬟	⬟
	Assigned	Api	Fru	Tag	Sor	Psi				

糖鎖構造のテキスト形式

LINUCS

$\text{[]}\text{[b-D-GlcNAc]}\{\text{[(4+1)]}\text{[b-D-GlcNAc]}\{\text{[(3+1)]}\text{[b-D-Manp]}\{\}\text{[(6+1)]}\text{[b-D-Manp]}\{\}\}$

LinearCode

Mb3(Mb6)GNb4GNb

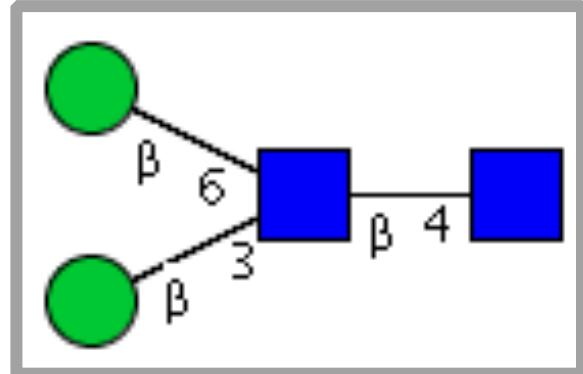
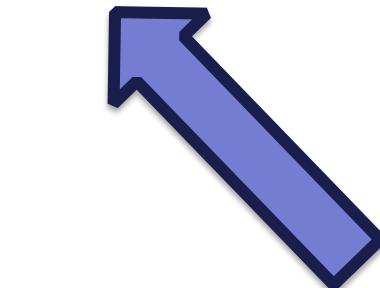
線形文字列

GlycoCT

RES
1b:b-dGlc-HEX-1:5
2s:n-acetyl
3b:b-dGlc-HEX-1:5
4s:n-acetyl
5b:b-dMan-HEX-1:5
6b:b-dMan-HEX-1:5
LIN
1:1d(2+1)2n
2:1o(4+1)3d
3:3d(2+1)4n
4:3o(3+1)5d
5:3o(6+1)6d

KCF format

ENTRY CT-1 Glycan
NODE 4
1 GlcNAc 0 0
2 GlcNAc -8 0
3 Man -16 2
4 Man -16 -2
EDGE 3
1 2:b1 1:4
2 4:b1 2:3
3 3:b1 2:6
///



グラフ形式

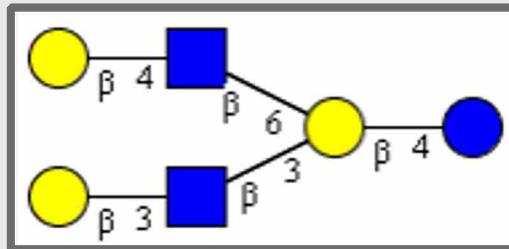
任意なテキスト形式の必要性

ENTRY Structure Glycan
NODE 6

```
1 glcnac -16 2
2 glcnac -16 -2
3 gal -24 2
4 gal -8 0
5 gal -24 -2
6 D-glc 0 0
```

EDGE 5

```
1 4:b1 6:4
2 2:b1 4:3
3 5:b1 2:3
4 1:b1 4:6
5 3:b1 1:4
```



///

ENTRY Structure Glycan
NODE 6

```
1 GlcNAc -16 -2
2 Gal -8 0
3 GlcNAc -16 2
4 Gal -24 -2
5 D-Glc 0 0
6 Gal -24 2
```

EDGE 5

```
1 2:b1 5:4
2 1:b1 2:3
3 4:b1 1:3
4 3:b1 6:6
5 3:b1 2:4
```

///



一連の文字列であらわす糖鎖を任意に記述する形式



Web3 Unique Representation of Carbohydrate Structures*

*Matsubara M, Aoki-Kinoshita KF, Aoki NP, Yamada I, Narimatsu H. WURCS 2.0 update to encapsulate ambiguous carbohydrate structures. *J. Chem. Inf. Model.*, 57(4):632-637, 2017.

糖鎖構造表記法 WURCS

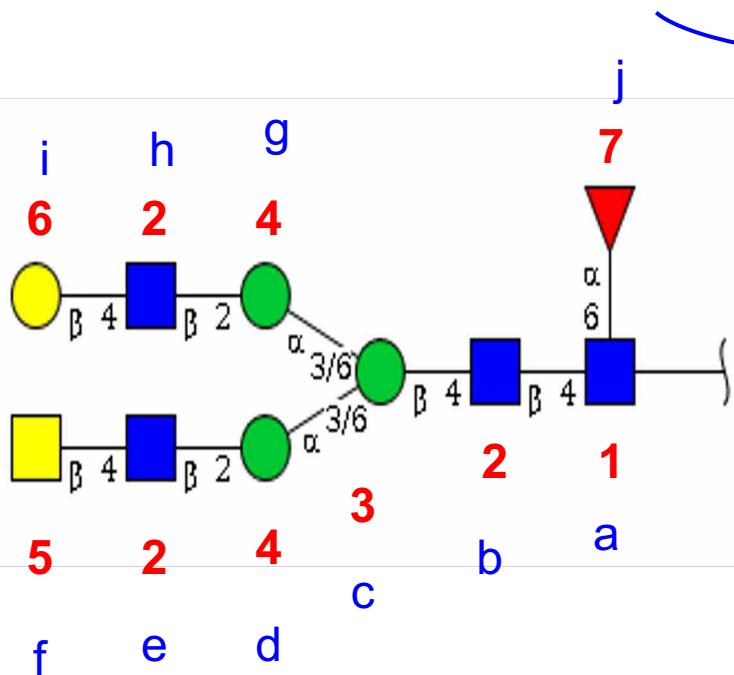
WURCS: Web3 Unique Representation of Carbohydrate Structures

- セマンティックウェブを指向した新しい糖鎖構造表記法
- JST・NBDC統合化推進プログラムで開発
- 国際糖鎖構造リポジトリGlyTouCanの基盤として利用
 - 糖鎖構造の同一性
 - 糖鎖構造検索
 - 分子量計算

WURCS の例

Glytoucan ID:
G00219DO

WURCS=2.0/7,10,9/[c2122h-1x_1-5_2*NCC/3=O][c2122h-1b_1-5_2*NCC/3=O][c1122h-1b_1-5][c1122h-1a_1-5][c2112h-1b_1-5_2*NCC/3=O][c2112h-1b_1-5][c1221m-1a_1-5]/1-2-3-4-2-5-4-2-6-7/a4-b1_a6-j1_b4-c1_d2-e1_e4-f1_g2-h1_h4-i1_d1-c3|c6_g1-c3|c6



J. Chem. Inf. Model., 54(6):1558–1566,
2014, .
J. Chem. Inf. Model, 57(4):632-637, 2017.

1996まで: CarbBank (CCSD)

- Glycosciences.de: (ドイツ) PDBに登録された糖鎖構造を抽出したり、糖鎖の立体構造の描画ツールなどを提供
- BCSDB: (ロシア) 文献から微生物の糖鎖構造を収集・整理されたデータベース
- KEGG GLYCAN: (京大) CarbBank の重複した構造を整理し、糖鎖構造の比較やデータマイニングのツールを開発
- Consortium for Functional Glycomics (CFG): 主に CarbBankや文献の糖鎖構造などを提供

現在の糖鎖関連データベースがたくさん！

- JCGGDB, 現 ACGG-DB(産総研)
 - 糖鎖遺伝子、レクチン、糖タンパク質、糖鎖構造、疾患
- GlycoSuite、現在UniCarbKBやGlyConnectに統合（オーストラリア）
 - 文献に掲載された糖鎖や糖タンパク質
- GlycomeDB、現在GlyTouCanに統合（ドイツ）
 - 7つの主な糖鎖構造データベースを統合したデータベース
- UniCarbKB（オーストラリア）
 - 文献に掲載された糖鎖や糖タンパク質
- GlyConnect（スイス）
 - 文献に掲載された糖鎖や糖タンパク質にエピトープやUniProtなどのタンパク質データベースと連携
- GlyTouCan（創価大）
 - 国際糖鎖構造リポジトリ

A Practical Guide to Using Glycomics Databases

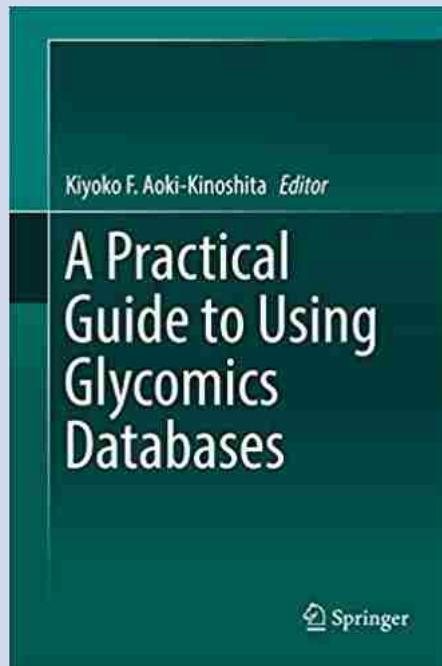


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- Using GlyTouCan Version 1.0: The First International Glycan Structure Repository, Shinmachi, et al.
- Carbohydrate Structure Database (CSDB): Examples of Usage, Egorova, et al.

Glyco-related Genes and Proteins

- The CAZy Database/the Carbohydrate-Active Enzyme (CAZy) Database: Principles and Usage Guidelines, Terrapon, Nicolas (et al.)
- Glyco3D: A Suite of Interlinked Databases of 3D Structures of Complex Carbohydrates, Lectins, Antibodies, and Glycosyltransferases, Pérez, et al.
- GlycoGene Database (GGDB) on the Semantic Web, Narimatsu, et al.
- KEGG GLYCAN, Kanehisa, Minoru

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- Exploring the UniCarbKB Database, Campbell, Matthew P. (et al.)
- GlycoProtDB: A Database of Glycoproteins Mapped with Actual Glycosylation Sites Identified by Mass Spectrometry, Kaji, Hiroyuki (et al.)

Glycan Interactions

- GlycoEpitope, Okuda, Shujiro (et al.)
- SugarBindDB, Mariethoz, Julien (et al.)
- PACOnto: RDF Representation of PACDB Data and Ontology of Infectious Diseases Known to Be Related to Glycan Binding, Solovieva, Elena (et al.)

Glycan Data Analysis

- RINGS: A Web Resource of Tools for Analyzing Glycomics Data, Aoki-Kinoshita
- Glycan Data Retrieval and Analysis Using GLYCOSCIENCES.de Applications, Lütteke, Thomas
- Glycobiology Meets the Semantic Web, Kawano, Shin

糖鎖データベースの統合

- JSTと国立研究開発法人科学技術振興機構 バイオサイエンスデータベースセンター（NBDC）が2006年からライフサイエンスデータベースの統合化を推進
- 糖鎖科学のプロジェクトを支援
 - JCGGDB, ACGG-DB, GlyTouCan
- また、ゲノミクス、プロテオミクスなど多くのオミクスデータベースの統合プロジェクトも実施
- セマンティックウェブ技術を用いて、様々なデータの統合化

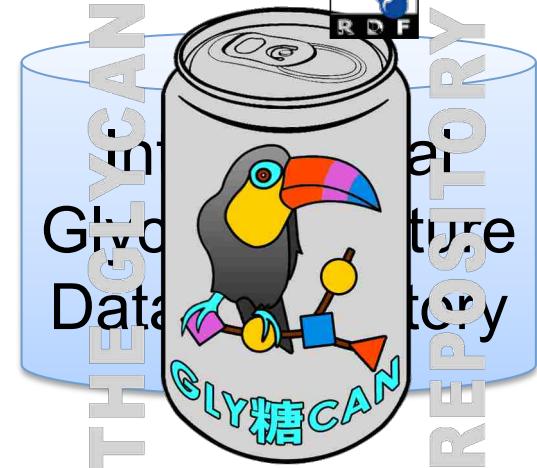
統合化事業の糖鎖プロジェクト

- 国内の糖鎖関連データベースの統合化 (2011年度～2013年度・代表成松久(産総研))
 - JCGGDB
 - GlycoRDF (<http://glycoinfo.org/GlycoRDF>)
- 国際糖鎖構造リポジトリおよび糖鎖科学データベースの統合化 (2014年度～2016年度・代表成松久(産総研))
 - セマンティックウェブ技術の導入(RDF)
 - GlyTouCanの開発
- 糖鎖科学ポータルの構築 (2017年度～2021年度・代表木下聖子(創価大))
 - セマンティックウェブ技術を用いて糖鎖科学と他のオミクスデータの統合したポータルの構築

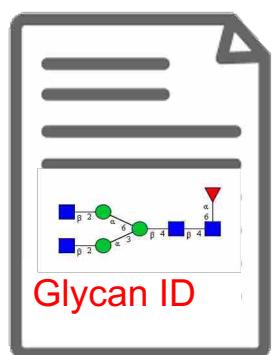
Glycan Databases



Unique
Glycan ID
+
Structure
Data



④ Curation



Research Paper

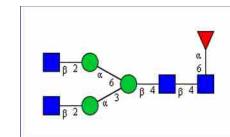
Knowledge-Sharing
of Glycan Knowledge
via Internet



MIRAGE
MIRACE

② Obtain
Unique
Glycan ID

① Structure
Registration



Glycan Research

Glycobiology Glycoforum

Glycobiology, 2017, vol. 27, no. 10, 915–919

doi: 10.1093/glycob/cwx066

Glyco-Forum

Letter to Glycoforum

GlyTouCan: an accessible glycan structure repository

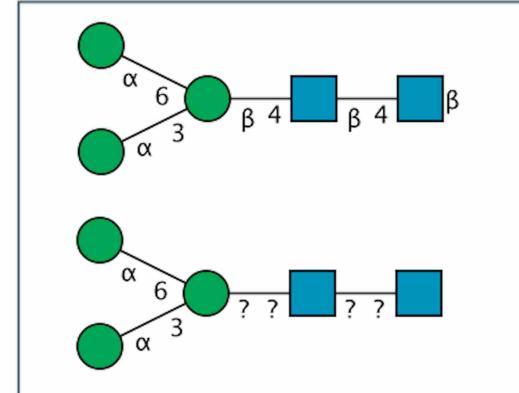
Michael Tiemeyer², Kazuhiro Aoki², James Paulson³,
Richard D Cummings⁴, William S York², Niclas G Karlsson⁵,
Frederique Lisacek⁶, Nicolle H Packer^{7,8}, Matthew P Campbell⁷,
Nobuyuki P Aoki⁹, Akihiro Fujita⁹, Masaaki Matsubara²,
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Michael Pierce², René Ranzinger², Hisashi Narimatsu¹¹,
and Kiyoko F Aoki-Kinoshita^{9,1}

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7. Nathan Edwards, Georgetown University, USA
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31. Todd L. Lowary, Canadian Glycomics Network Scientific Director and University of Alberta, Canada
32. Thomas Luetteke, iTech Progress GmbH, Germany
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43. Tetsuya Okajima, Nagoya University School of Medicine, Japan
44. Shujiro Okuda, Niigata University, Japan
45. Noorjahan Panjwani, Tufts University School of Medicine, USA
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48. Salomé S. Pinho, University of Porto and Institute for Research and Innovation in Health, Portugal
49. Melody Porterfield, University of Georgia, USA
50. Alka Rao, CSIR-Institute of Microbial Technology, Chandigarh, India
51. Celso A. Reis, University of Porto, Portugal
52. Rafael Ricci de Azevedo, University of São Paulo, Brazil
53. Nancy Schwartz, University of Chicago, USA
54. Siro Simizu, Keio University, Japan
55. Avadhesh Surolia, Indian Institute of Science, Bangalore, India
56. Naoyuki Taniguchi, RIKEN, Japan
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59. Christopher M. West, University of Georgia, USA
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62. Yoshiki Yamaguchi, RIKEN, Japan
63. Kazuo Yamamoto, The University of Tokyo, Japan
64. Heng Yin, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China
65. Joseph Zaia, Boston University, USA

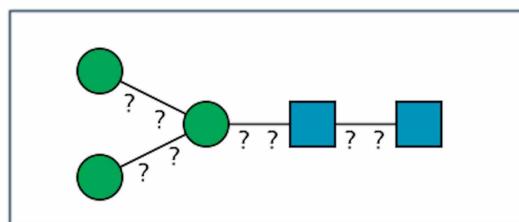
GlyTouCan: the glycan repository

- Glycans can be specified in various levels of granularity (subsumption)
- GlyTouCan accepts glycans at any level, assigning a unique accession number to each
- GlyCosmos (and GNOME) provide frameworks for linking those glycans that “subsume” one another

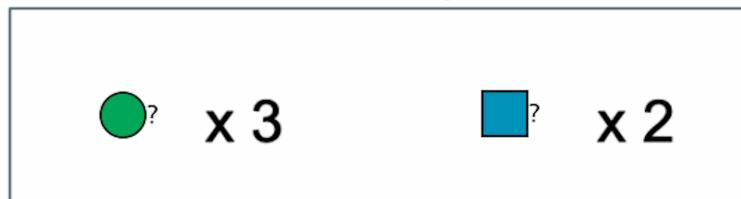
Level1: LinkageDefinedSaccharide



Level2: GlycosidicTopology



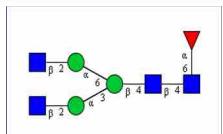
Level3: MonosaccharideComposition



Level4: BaseComposition



New GlyTouCan 3.0 (August, 2019)



Register



Translated



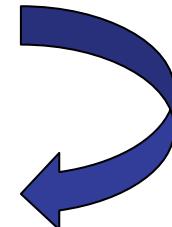
Assign

GlyTouCan ID



Batch Processing Phase:

- Validates inputted data
- Generates images
- Assigns ID



User Profile Page:

- Validation results
- Images
- Assigned ID



Advantages:

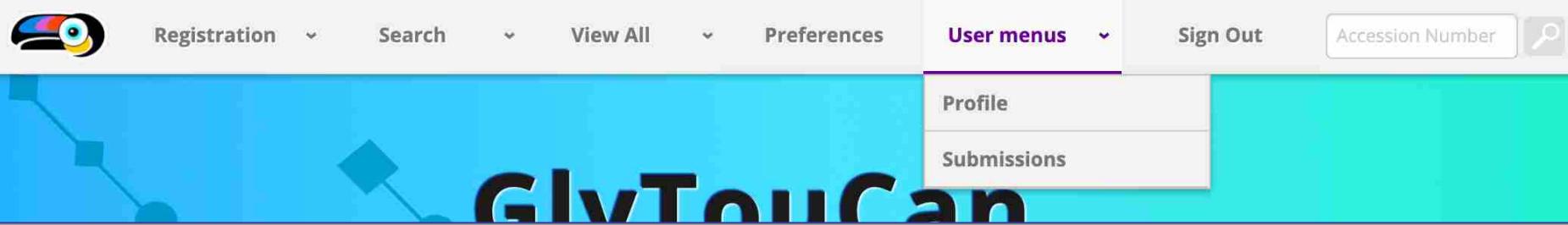
- Input data can be anything translatable to WURCS (GlycanFormatConverter)
- Validation status can be viewed on Profile Page
- Structure duplication can be avoided

GlyTouCan Login

- Before logging in to a Google account:



- After logging in:



User Profile

- To register structures, ensure that you have an API Key generated!

Profile

Username

Email

Contributor ID

Verified Email

[Generate API Key](#)

In order to signout properly, first disconnect the repository access from google accounts, and then click on [Sign Out](#).
To view all submitted structures, please check the [submissions page](#).

User Submissions Page

Submissions

Number of submission 2

Number of accession number 2

Accession number list

From the submitted structures, those list file that have accession number and passed in validation or conversion by batch process.

[Download](#)

Error list

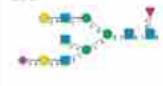
From the submitted structures, those list file that have error in validation or conversion by batch process.

[Download](#)

Show 10 entries

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

[Show hidden columns](#)

Date	Submission Ref	Sequence	Accession Number
Sun, 09 Feb 2020 04:46:23 GMT	4a410a187f...	WURCS=2.0/7,12,11/[a2122h-1b_1-5_2*NCC/3=0] [a1122h-1b_1-5] [a1122h-1a_1-5] [a2112h-1x_1-5] [a2122h-1x_1-5_2*NCC/3=0] [Aad21122h-2x_2-6_5*NCC/3=0] [a1221m-1a_1-5]/1-1-2-3-4-5-6-4-7/a4-b1_a6-l1_b4-c1_c3-d1_c6-g1_d?-e1_e?-f1_g?-h1_g?-k1_h?-i1_i?-j2	 G52268EM
Mon, 03 Feb 2020 06:20:15 GMT	339a8bbee2...	RES 1b:b-dglc-HEX-1:5 2s:n-acetyl 3b:b-dglc-HEX-1:5 4s:n-acetyl 5b:b-dman-HEX-1:5 6b:a-dman-HEX-1:5 7b:b-dalc-HEX-1:5	 G65307KA

Showing 1 to 2 of 2 entries

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

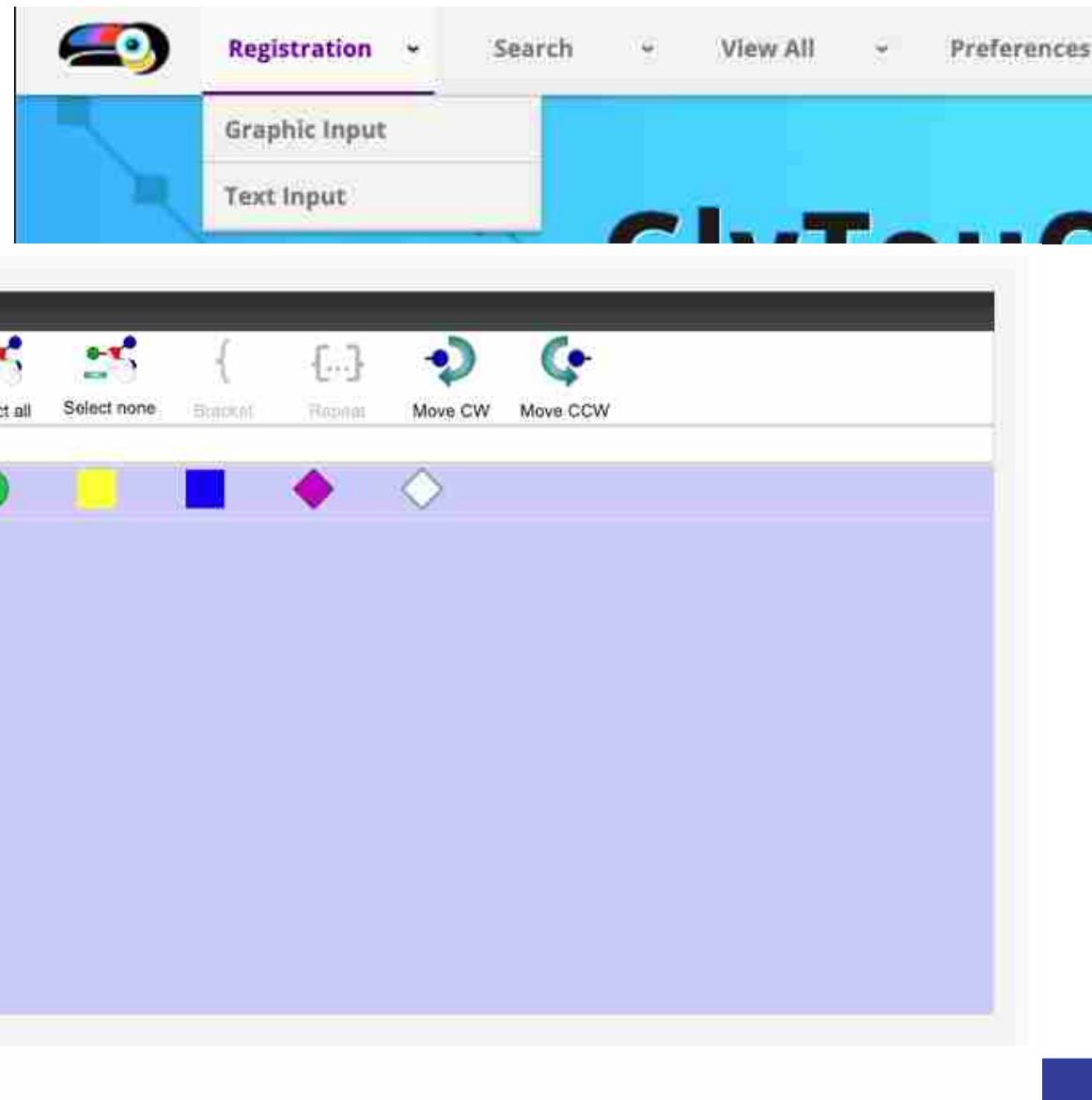
[Download all \(.tsv\)](#)

Previous 1 Next

Line breaks are removed from cells.

Glycan registration

- By graphic tool
- By text



The screenshot shows the user interface of a glycan registration application. At the top, there is a navigation bar with icons for file operations (New, Open, Save, Print, Exit), registration (Registration, Search, View All, Preferences), and a logo for Soka University.

The main window features a toolbar at the top labeled "Structure" which includes icons for "Add structure", "Add residue", "Insert residue", "Change residue", "Add terminal", "Orientation", "Select all", "Select none", "Bracket", "Repeat", "Move CW", and "Move CCW". Below the toolbar is a palette of colored shapes (pentagon, circle, square, diamond, hexagon) used for building glycan structures.

A dropdown menu is open over the "Structure" toolbar, listing the following options:

- Add structure
- Add residue
- Insert residue
- Change residue
- Add terminal

At the bottom left, there is a button labeled "Register".

Glycan registration by text

Glycan Registration - Text Input



Finished sending.

Completed successfully.

Please check the registration status [here](#).

GlycoCT condensed

WURCS

GlycoCT format is encoding schema for carbohydrate sequences based on a connection table approach to describe carbohydrate sequences. The format is adopting IUPAC rules to generate a consistent, machine-readable nomenclature using a block concept to describe carbohydrate sequences like repeating units. It consists of two variants, a condensed format and an XML format. The condensed format allows for unique identification of glycan structures in a compact manner. The monosaccharide naming convention follows the following format: a-bccc-DDD-e:f|g:h, where a is the anomeric configuration (one of a, b, o, x), b is the configurational symbol (one of d, l, x), ccc is the three-letter code for the monosaccharide as listed in Table 1.1, DDD is the base type or superclass indicating the number of consecutive carbon atoms such as HEX, PEN, NON, e and f indicate the carbon numbers involved in closing the ring, g is the position of the modifier, and h is the type of modifier. For a, b, e, f and g, an x can be used to specify an unknown value. bcc and g: h may also be repeated if necessary. It is noted that substituents of monosaccharides are also treated as separate residues

Submissions

Number of submission

3

Number of accession number

3

Accession number list

From the submitted structures, those list file that have accession number and passed in validation or conversion by batch process.

[Download](#)

Error list

From the submitted structures, those list file that have error in validation or conversion by batch process.

[Download](#)

Show entries

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

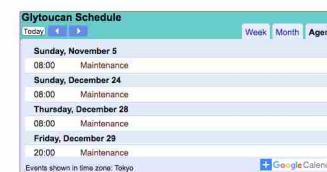
[Show hidden columns](#)

Date	Submission Ref	Sequence	Accession Number
Mon, 02 Nov 2020 07:06:28 GMT	466fe91d72...	RES 1r:r1 REP REP1:8o(4+1)2d=-1--- RES 2b:b-dgal-HEX-1:5 3s:n-acetyl 4b:b-dglc-HEX-1:5 6:a 5b:b-dgal-HEX-1:5 6s:n-acetyl 7b:a-dgal-HEX-1:5 8b:b-dglc-HEX-1:5 LIN 1:2d(2+1)3n 2:2o(3+1)4d 3:4o(4+1)5d 4:5d(2+1)6n 5:5o(4+1)7d 6:7o(3+1)8d	 G60003VQ
Sun, 09 Feb 2020 04:46:23 GMT	4a410a187f...	WURCS=2.0/7,12,11/[a2122h-1b_1-5_2+NCC/3=0] [a1122h-1b_1-5] [a1122h-1a_1-5] [a2112h-1x_1-5] [a2122h-1x_1-5_2+NCC/3=0] [Aad21122h-2x_2-6_5+NCC/3=0] [a1221m-1a_1-5]/1-1-2-3-4-5-3-4-5-6-4-7/a4-b1_a6-l1_b4-c1_c3-d1_c6-g1_d?-e1_e?-f1_g?-h1_g?-k1_h?-i1_i?-j2	 G52268EM
Mon, 03 Feb 2020 06:20:15 GMT	339a8bbbee2...	RES 1b:b-dglc-HEX-1:5 2s:n-acetyl 3b:b-dglc-HEX-1:5 4s:n-acetyl	 G65307KA

現在12万件以上の糖鎖構造が登録済み

- GlyTouCan Partners やBCSDB, GlycoEpitopeなどのデータベースを統合化

BCSDB (5428)
 CFG (6374)
 Carbbank(CCSD) (14840)
 GLYCOSCIENCES.de (15905)
 GlyConnect (3219)
 GlycoChemExplorer (8021)
 GlycoEpitope (169)
 GlycoNAVI (91)
 GlycoStore (23)
 Glycobase (199)
 GlycomeDB (39053)
 JCGGDB (22039)
 JCGGDB AIST (7867)
 JMSDB (911)
 KEGG (10134)
 PDB (894)
 PDBe CC (264)
 PDBj CC (264)
 PubChem CID (21356)
 PubChem SID (21356)
 RCSB PDB CC (264)
 SugarBindDB (173)
 UniCarb-DB (865)
 UniCarbKB (171)



What is GlyTouCan?

GlyTouCan is the international glycan structure repository. This repository is a freely available, curated registry for glycan structures that assigns globally unique accession numbers to any glycan independent of the level of information provided by the experimental method used to identify the structure(s). Any glycan structure, ranging in resolution from monosaccharide composition to fully defined structures can be registered as long as there are no inconsistencies in the structure.

What you can do

Users can search for glycan structures and motifs that have been registered into this repository. Registered users can additionally register new glycan structures to obtain unique IDs for each structure, which can be used in publications and other databases upon approval.

Acknowledgement

The development of this repository is funded by the Integrated Database Project by MEXT (Ministry of Education, Culture, Sports, Science & Technology) and the Program for Coordination Toward Integration of Related Databases by JST (Japan Science and Technology Agency). Development has also been supported by the GlySpace Project.

Tweets by @glytoucan

 @glytoucan
Please note: GlyTouCan will be under maintenance intermittently for very brief periods from 8am to 8pm JST on October 18th.

 Kiyoko Kinoshita
@kiyokof
Thanks to all supporting investigators!
GlyTouCan: an accessible glycan structure repository | Glyobiology | Oxford academic.oup.com/glycob/article...
Oct 3, 2017

 Ethan Goddard-Borger
@ethanborg
Oct 3, 2017

 Gly Retweeted
View on Twitter

糖鎖科学ポータルGlyCosmos Portal

SOKA UNIVERSITY

GlyCosmos Overview

Repositories



[The glycan structure repository GlyTouCan](#)
assigns accession numbers to glycans



[The Glicoconjugate repository GlyComb \(TBA\)](#)
will assign accession numbers to glycoconjugates such as glycoproteins, glycolipids

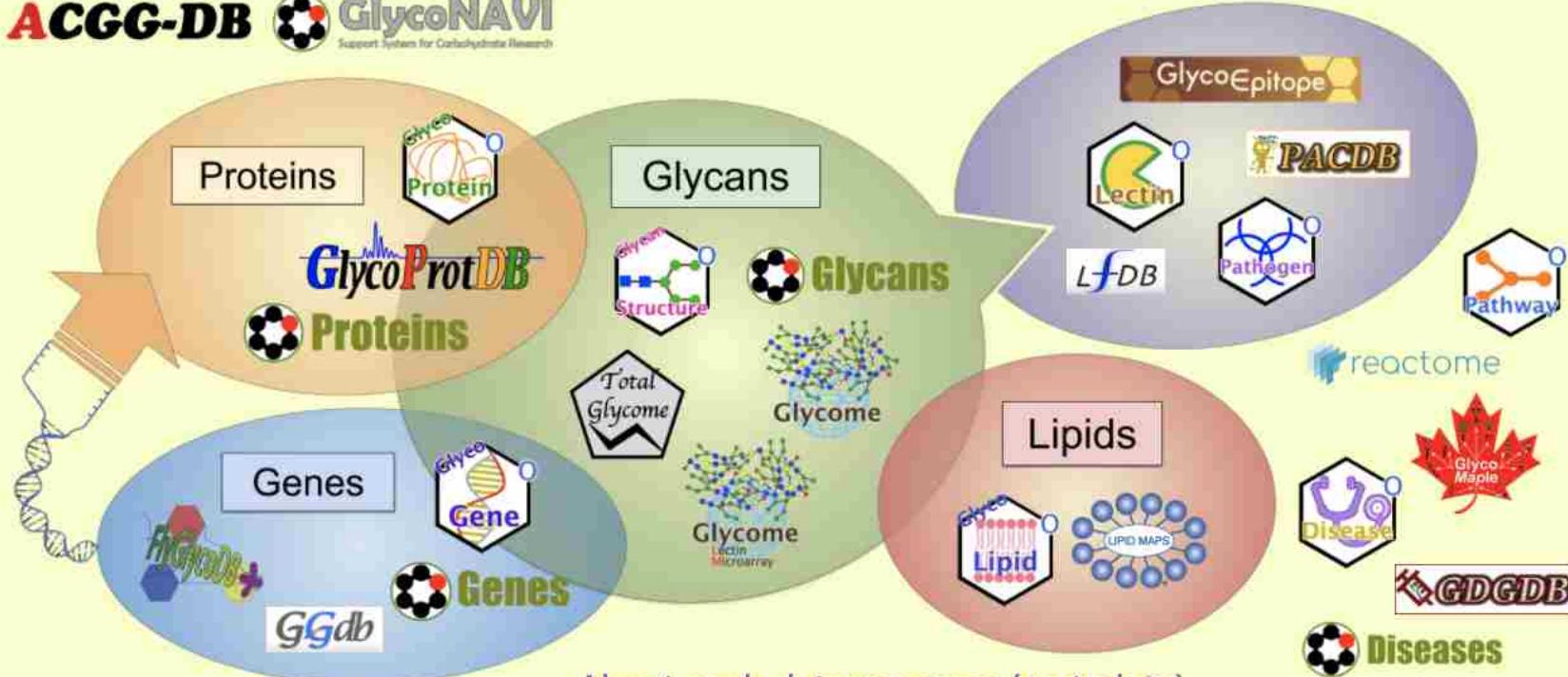


[The glyco\(proteo\)mics repository GlycoPOST](#)
stores raw mass spectrometry data obtained from glyco-(proteo)mics related experiments.



[The glycomics MS repository UniCarb-DR](#)
stores annotated mass spectrometry data obtained from glycomics related experiments.

Data Resources





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

Ontologies

Notations

Back to main page

Welcome to GlyCosmos!!

The GlyCosmos Portal is a Web portal aiming to integrate the glycosciences with the life sciences.

It consists of Standards, Repositories and Data Resources, providing information about genes, proteins, lipids, pathways and diseases.

Learn more

GlyCosmos Data

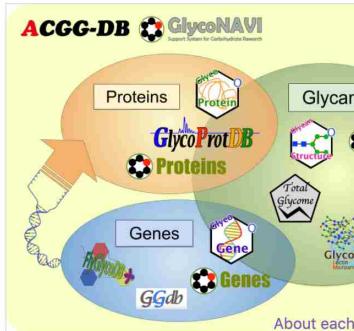
Programmatic access

Download

Release statistics

Data F

Please click each icon will take you t



Subr

Please click each icon to display



Gly

GlyCosmos is a member of the GlySpace



Other Related Resources

PubChem

is an open chemistry database at the National Institutes of Health (NIH).

UniCarb-DB

is a repository of glycomics mass spectrometry data.

UniCarbKB

is a knowledge base for curated glycoconjugate information and their annotations.

UniProt

is a freely available, comprehensive resource of high quality protein sequences and functional annotations.

LIPID MAPS Structure Database (LMSD)

is a relational database encompassing structures and annotations of biologically relevant lipids.

LIPID MAPS Gene/Proteome Database (LMPD)

is comprised of lipid-related genes and proteins.

Reactome

is a freely available, open source relational database of signaling and metabolic molecules and their relations organized into biological pathways and processes.

jPOST

is a proteomic database to integrate proteome datasets generated from multiple projects and institutions.

MIRAGE

"Minimum Information Required for A Glycomics Experiment" guidelines for publishing glycomics-related research articles.

PDBj

is part of the Japanese National Project on Protein Structural and Functional Analyses.

[Twitter](#) [About](#) [Logo](#) [Metadata](#) [License](#) [Policies](#) [Release Notes](#) Contact: support@glycosmos.org

Powered by Ruby on Rails.

Based on [Bootstrap](#) and a css styling from [Bootswatch](#). Icons from [Font Awesome](#). Web fonts from [Google](#).



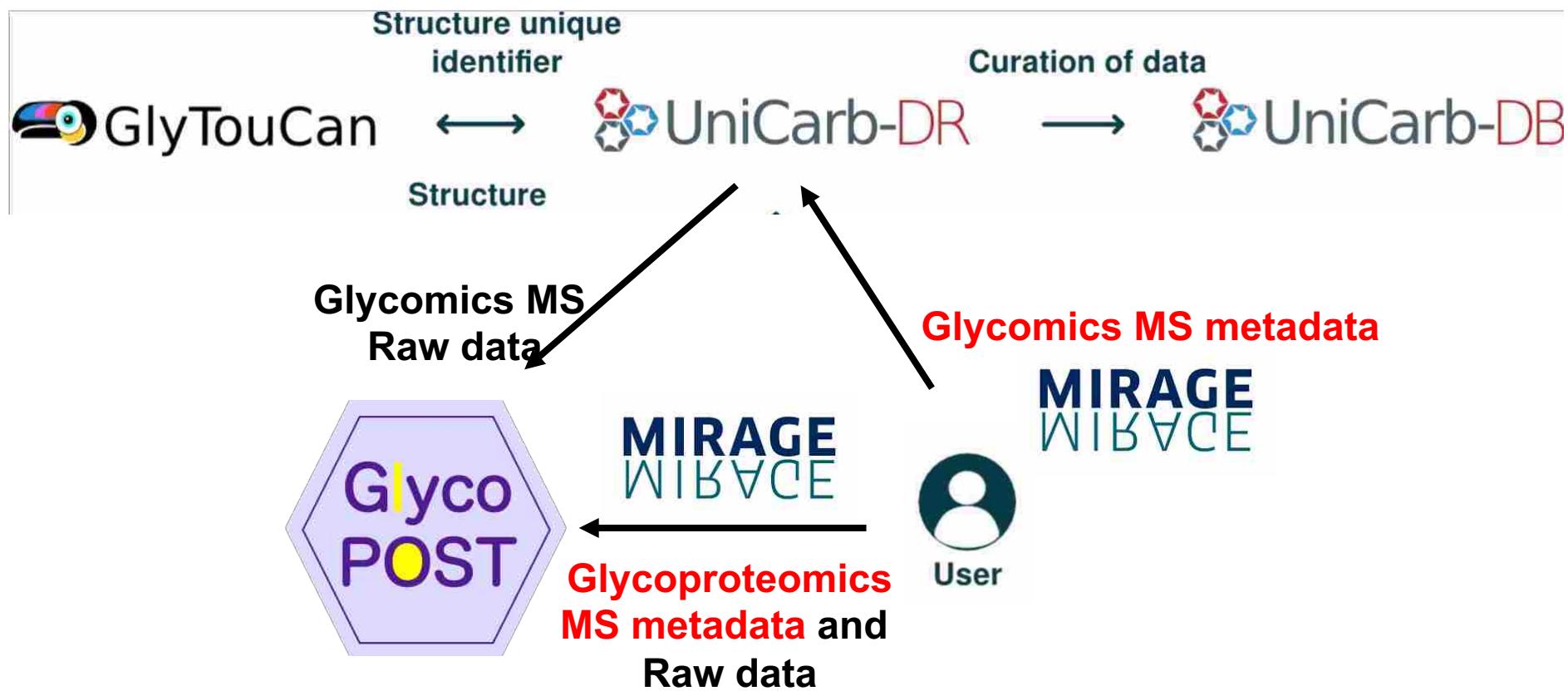
This work is licensed under a [Creative Commons Attribution 4.0 International License](#).



Supported by National Bioscience Database Center (NBDC) of Japan Science and Technology Agency (JST).

Partly supported by NIH Common Fund. Grant # 1U01GM125267-01

GlycoPOST and UniCarb-DR



Minimum Information Required for A Glycomics Experiment

- <http://www.mirage-beilstein.org>
- Definition of reporting guidelines for Glycomics experiments
- Guidelines **do not** define how to perform experiments
- Make results better **understandable** and **reproducible** by reporting required information
- Guidelines can be used by **journals** and **databases**

Repositories (Submissions)

Glycans

GlyTouCan

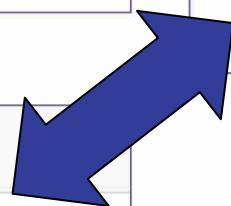
GlyTouCan is the international glycan structure repository.



Glycomic MS Data Repository

UniCarb-DR

UniCarb-DR is a repository of glycans with associated MS information and spectra.



Glycoproteomics Data

GlycoPOST

GlycoPOST is a data repository for assigning accession numbers and embargoing raw data generated from glycomics and glycoproteomics mass spectrometry experiments



User account service

This is a user account service for GlycoPOST and UniCarb-DR. Registration is required for submitting your data to these repositories.

Log in

Don't have an account? [Sign up](#)

Email address

Password

[Forgot your password?](#)

 [Log in](#)

 You are logged in!

 [Go to GlycoPOST](#)

 [Go to UniCarb-DR](#)

 Your profile

Name
Kiyoko Aoki-Kino

Affiliation
Soka University

ORCID
Email
kkiyoko@soka.ac

Password

 [Edit user profile](#)



UniCarb-DR

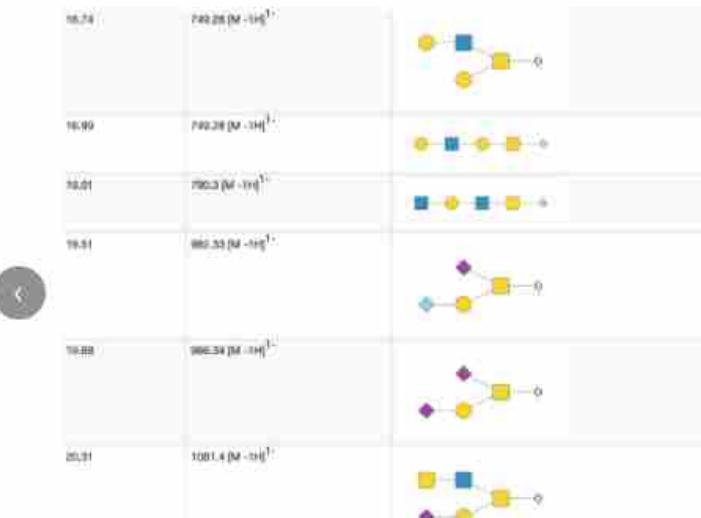
The Glycomics MS Repository

UniCarb-DR was launched in 2019 in order to provide a forum for depositing annotated glycomics MS/MS spectra according to the [MIRAGE](#) reporting guidelines for glycomics experiments. UniCarb-DR is the non-curated sister repository to the curated [UniCarb-DB](#) database. UniCarb-DR allows data to be uploaded as part of scientific publications, fulfilling the requirement for data open access. The current workflow for upload requires that MS settings and sample preparation are recorded organised in a [MIRAGE form](#), as well as having identified oligosaccharide fragments submitted as a GlycoWorkbench file, for which a template is available [here](#).

Glycan nomenclature is available in [Essentials of Glycobiology](#). Please support open data science and submit your valuable glycomics results!

Statistics: click to see the list of registered datasets

 17 Taxonomic
 27 Tissues
 20 Reference
 910 Structure
 1213 Spectra



Tweets by @unicarb-db

 Follow

 UniCarb-DB Retweeted

 GlyCosmos
@GlyCosmos

We're published in Nature Methods!
nature.com/articles/s4159...

 The GlyCosmos Port...
The GlyCosmos Port...
nature.com

  Jun 23, 2020

 UniCarb-DB Retweeted

 BioMS Sweden
@BioMS_Sweden

Pretty cool ayl! Imaging single glycans
[#glycomics">disq.us/t3pn10r #glycomics](http://disq.us/t3pn10r)

Imaging single glycans

Excel file generation.

The forms below mirror the structure of the excel file. The number of tabs is dependent on the options selected in the previous step, and all the data captured in the forms will be transcribed to the excel file. You can also click on the "Generate" button without filling in the forms. This action will generate an empty excel file. It is recommended to use the interface since some of the fields have been validated and the last step will validate the entire excel file before generating it.

The fields marked with an * are required. However, if these data is not relevant for your experiment, you can use the value NA (Not applicable).

Generate

Sample Preparation | LC settings | MS part 1 | MS part 2

MIRAGE Sample Preparation Guidelines
Guidelines for reporting sample preparation descriptors for glycomics experiments

General features — (a) Global descriptors

Data stamp: YYYY/MM/DD

Responsible person: Provide name:

Affiliation:

Stable contact information:

1. Sample origin:
Here "sample" is defined as any parenchymal, secretory, exocrine or excretory tissue or fluid specimen or cell product used to produce the oligosaccharide sample of interest. The source and/or methods used to produce the starting sample material can vary considerably by specimen information that describes its origin is required.

General Information:

1.1 Biologically derived material:
Biologically derived material - Recombinantly produced material:
Cell type:

Growth/master conditions, Other modifications:

Biologically derived material - Biological origin of Material:
Origin biological fluids, tissue, etc.:

Species:

Describe treatments and/or storage conditions:

Glycoprotein (input):

Biologically derived material - Purchased from commercial manufacturer:
Vendor and applicable item information:

1.2 Chemically derived material:
Synthesis steps or specify where the equivalent reaction protocol is available:

Description of starting material:

2. Sample Processing:
2.1 Sample Processing - Isolation

Enzymatic treatments:
Enzymes used: Vendor or enzyme producer: Reaction conditions:

Chemical treatments:
Chemical methods: Reaction conditions:

2.2 Sample Processing - Modification

Enzymatic modifications:
Enzymes used: Reaction conditions: Origin of used enzyme:

Chemical modifications:
Chemical methods: Type of modification: Reaction conditions:

2.3 Sample Processing - Purification

Purification steps:

3. Defined sample

Sample name:

Manuscript □**PubMed ID****Fetch details from PubMed****Mirage File (.xlsx)****Choose File** No file chosen**GlycoWorkbench Files (.gwp)****Choose Files** No file chosen**Next****UnICarb-DB** Generate

Excel file generation.

The forms below mirror the structure of the excel file. The number of tabs is dependent on the options selected in the previous step, and all the data captured in the forms will be transcribed to the excel file. You can also click on the "Generate" button without filling in the forms. This action will generate an empty excel file. It is recommended to use the interface since some of the fields have been validated and the last step uses a defined language, which prevents validation errors later during the submission process.

The fields marked with an * are required. However, if these data is not relevant for your experiment, you can use the value NA (Not applicable).

Generate

Sample Preparation | LC settings | MS part 1 | MS part 2

4. Spectrum and peak list generation and annotation

For this section, if software other than that listed in the Control and analysis software is used to perform a task, it must be supplied in each case.

Software name Version:

Spectrum and peak list generation and annotation — (a) Spectrum description

Location of source (raw) files:

Software	Name	Format	Link to the target area	URL
----------	------	--------	-------------------------	-----

Peak list generation and annotation — (b) Peak list generation

Since several different applications may be used for the data acquisition, data post processing and spectrum annotation each used software should be recorded separately together with the information what modification has been done to the data.

Software Name	Version	Customizations	Software settings
---------------	---------	----------------	-------------------

Data file(s)

Software	Name	Format	URL
----------	------	--------	-----

Acquisition number for all acquisitions:

Generation of peak-lists from raw data:

Raw data scoring:

Smoothing: whether applied, parameters:

Background threshold, or algorithm used:

Signal-to-noise estimation and method:

Percentage peak height for centroiding:

Retention times for all acquisitions:

m/z and intensity values:

Peak list generation and annotation — (c) Annotation and scoring

Since several different applications may be used for the data acquisition, data post processing and spectrum annotation each used software should be recorded separately together with the information what modification has been done to the data.

Software name	Version	Software type	Customizations	Software settings
---------------	---------	---------------	----------------	-------------------

Data file(s) generated by the software

Software	Name	Format	URL
----------	------	--------	-----

Database settings and matching

Database queried:

Taxonomical restrictions:

Other restrictions:

Allowed cleavages:

Parent error:

Fragment error:

Scoring method:

Scoring value format:

Scoring algorithm:

Scoring result:

Validation status:

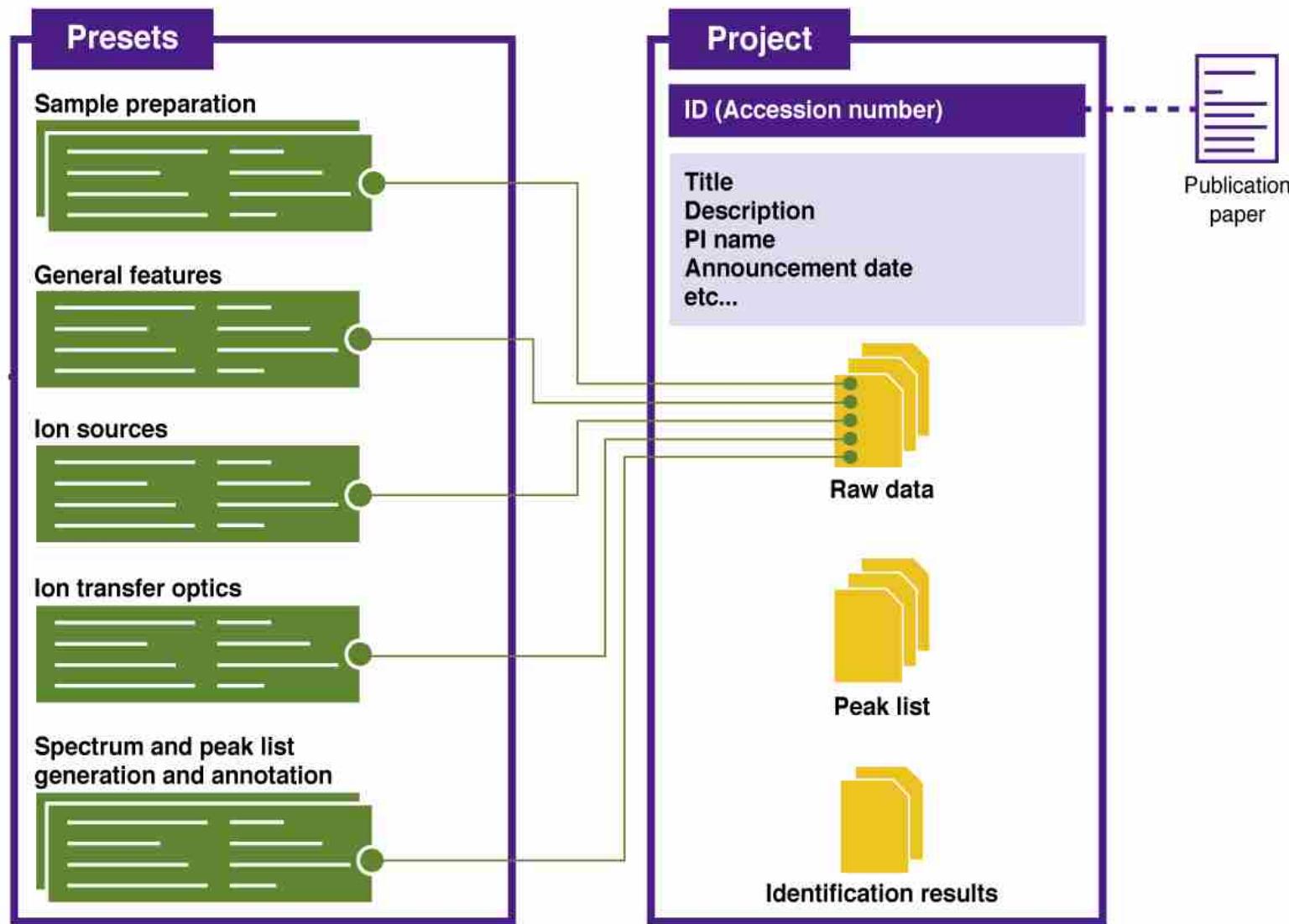
Validation value format:

Validation result:

GlycoPOST Registration

MIRAGE
WIBACE

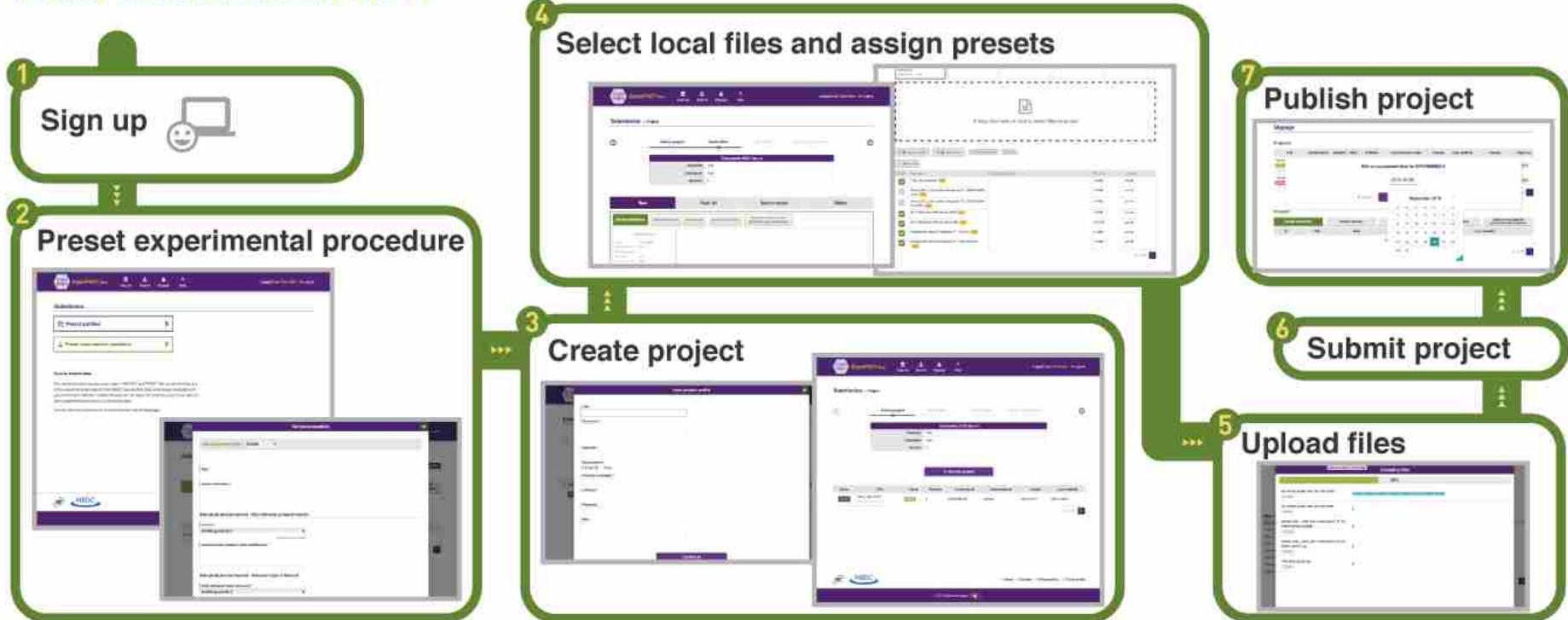
Metadata expression
guideline



GlycoPOST data submission workflow

- Manual: <https://glycopost.glycosmos.org/help>

Data submission flow



GlycoPOST Preset

GlycoPOST Data list Submit Mypage Help Logged in as Kiyoko Aoki-Kinoshita Logout

Submission > Preset Import MIRAGE Excel file

Sample preparation General features Ion sources Ion transfer optics Spectrum and peak list generation and annotation

Sample preparation

The sample preparation section is designed to include all aspects of sample generation, purification and modifications of the biological and/or synthetic material analyzed. Users input biologically derived material and/or chemically derived material as sample origin, and enzymatic and/or chemical treatments as sample processing for isolation. In addition, enzymatic and/or chemical modifications, and purification steps are needed to be registered.

+ Add new preset

ID	Title	Files	Created	Last modified
(No preset registered.)				

Mypage

Projects

Title	Announced ID	Revision	Files	PubMed	Announcement date	Created	Last modified	Preview	Export as
Editing Edit		0	0		Unfixed	2019/02/01	2019/02/01		MIRAGE

1 - 1 / 1

1

Presets

Sample preparation		General features		Ion sources		Ion transfer optics		Spectrum and peak list generation and annotation	
ID	Title	Files		Created		Created		Last modified	
(No preset registered.)									

0 - 0 / 0

1

Your account

Name
Kiyoko Aoki-Kinoshita

Email
kkiyoko@soka.ac.jp

Password

Affiliation
Soka University

Verification status
 Verified

Project list

- All projects, with revision information, are listed under Projects
- Those that are not fixed can be edited by clicking on the “edit” button
- Clicking on a Project ID will jump to the file list

Projects

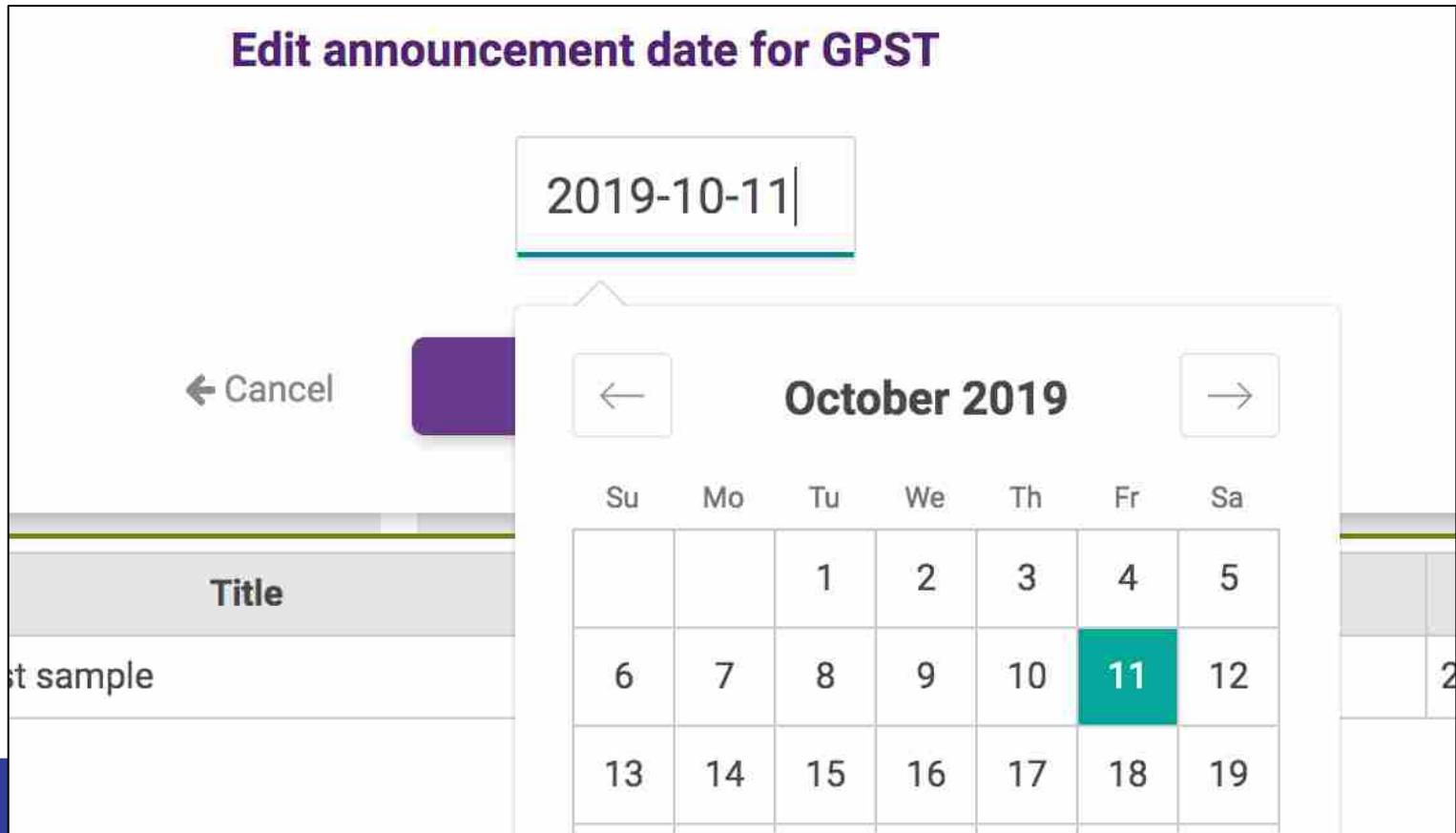
Title	Status	Announced ID	Revision	Files	PubMed	Announcement date	Created	Last modified	Preview	Export as
Test project 1102	Announced	GPST	0	0		2018/11/02	2018/11/02	2018/11/02		<button>MIRAGE</button>
Test project 1023 fixed	Editing		0	0		Unfixed	2018/10/23	2018/10/23		<button>MIRAGE</button>
Test project 1011	Submitted	GPST	0	0		2019/10/11 <small>Change announcement date</small>	2018/10/11	2018/10/11	<button>Request preview URL</button>	<button>MIRAGE</button>

Preview code

- To allow reviewers and editors to access your project before being announced, click the “Request preview code” button in the project list
- This will generate a temporary URL and four-digit code to access your project
- This cannot be done while the project is in Edit mode

Set Announcement date and PubMed ID

- By setting the announcement date, the project data and files can be kept confidential until the given date



Announced projects

ID	Project title	Description	Publication	Principal investigator	Announcement date	Detail
GPST000040	Protein O-linked glycosylation in the plant pathogen <i>Ralstonia solanacearum</i>	W. Elhenawy, N. E. Scott, M.L. Tondo, E.G. Orellano, L.J. Foster, M.F. Feldman. Protein O-linked glycosylation in the plant pathogen <i>Ralstonia solanacearum</i> . <i>Glycobiology</i> . (2015) 26(3):301-11.	26531228	Nichollas Scott	2020/10/15	Detail page
GPST000041	Diversity within the O-linked protein glycosylation systems of <i>Acinetobacter</i> species	N.E Scott*, R.L Kinsella*, A.V Edwards, M.R Larsen, S Dutta, J Saba, L.J Foster, M.F Feldman. Diversity within the O-linked protein glycosylation systems of <i>Acinetobacter</i> species. <i>Mol Cell Proteomics</i>	24917611	Nichollas Scott	2020/10/15	Detail page
GPST000119	UVPD of fondaparinux	Tandem mass spectral structural characterization of fondaparinux with CID, HCD, and UVPD using a Fusion Lumos	Pre-publication	Adam Hawkrige	2020/10/10	Detail page
GPST000100	Core-2 O-glycans are required for galectin-3 interaction with the synovial glycoprotein lubricin - MRM of released O-glycans from synovial lubricin	MRM of released O-glycans from synovial OA and control lubricin	Pre-publication	Dr. Niclas Karlsson	2020/10/08	Detail page

GlyCosmos Data Reso

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

Search



Genes/Proteins/Lipids

Glycogenes

Glycoproteins

Lectins

Glycolipids

Glycans/Glycoconjugates

Glycans

Glycans Search

Glycoproteins

Glycomes

Pathways/Diseases/Organisms

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 GenelD exists, the information of LIPID MAPSGene / Proteome Database is also integrated.

ACGG-DB

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

GDGDB

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

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
Search								
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 extra

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 D

GGDB ID

gg001

General Reaction

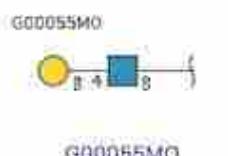
Reference: Three bovine alpha2-fucosyltransferases substrates.

Donor: GDP-Fuc



Reference: Molecular cloning, sequence, and expression of the 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_12515
- 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
						Search	Search
(R)-mandelonitrile lyase 1	Q24243	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	O50048	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	O82784	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.

- Scientific Name: *Mus musculus*



External Links

- GlycoProtDB
- Glycopol
- GlycanDB

Feature

Glycan Images

GlyTouCan images of glycan extracted from:

G17013IQ

6x ?

6x ?

?? ?

G17013IQ

G28589EC

6x ?

6x ?

4x ?? ?

G28589EC

PDB Images



5XQ0

© PDB |

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**FSQNGKDLDFQQGASVIE
GLFEDTKDN**D**SYYQTVAVEFDTIGSPVN
GGTYIGRQATHEVLNWYFTSNLINTNS

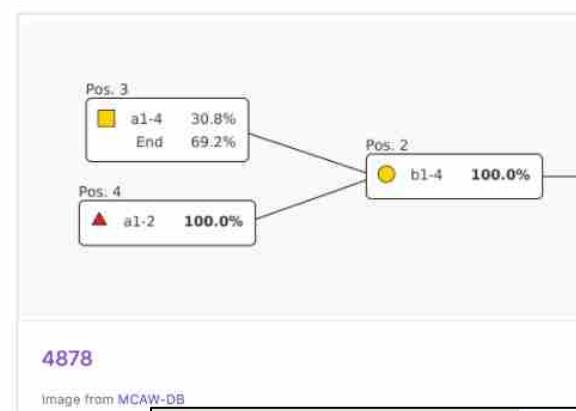
N: N-glycosylation Site
—: Potential Sequon

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 Co



PDB Images



1FX5

© PDB | CC BY

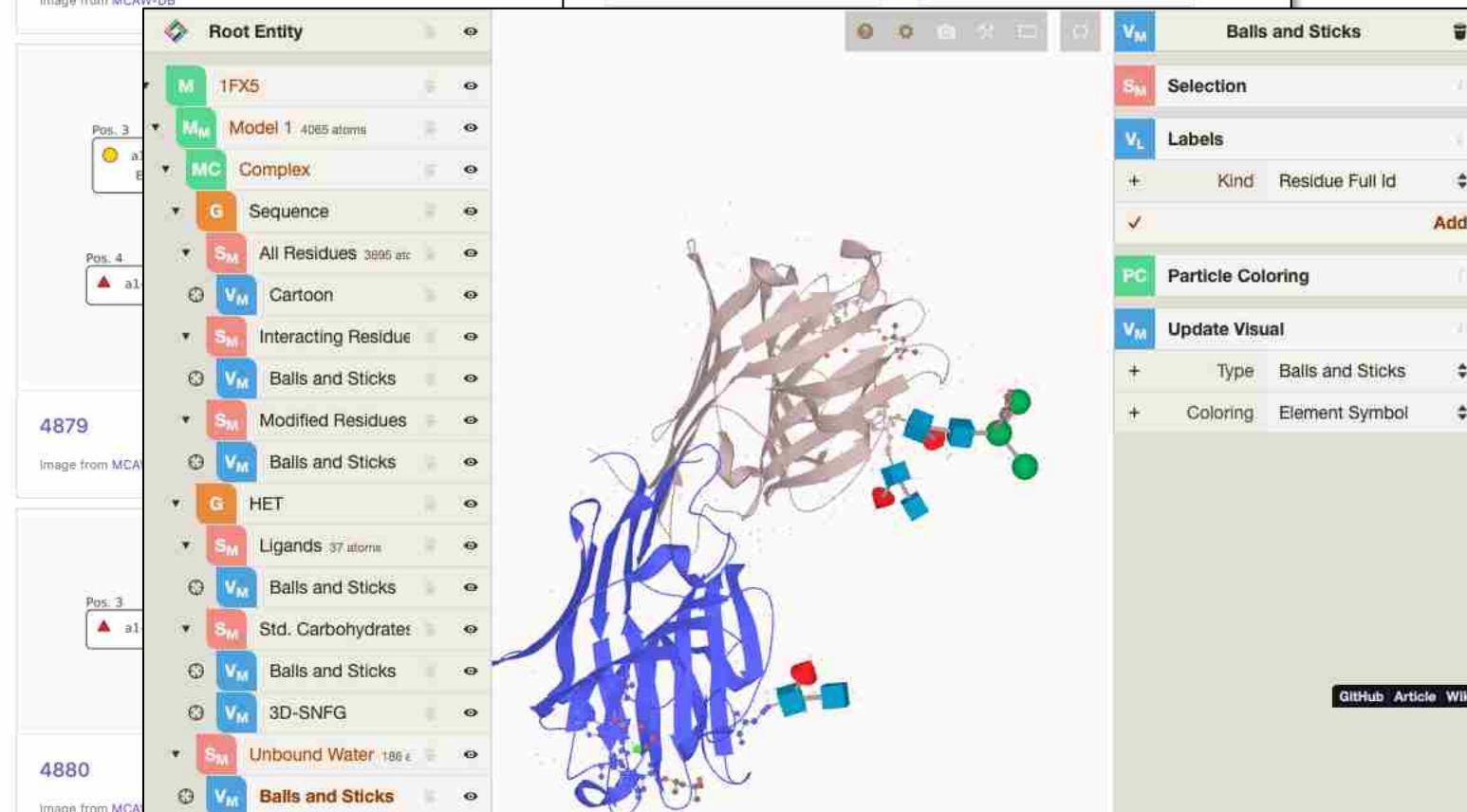
Open LiteMol Viewer



1JXN

© PDB | CC BY

Open LiteMol Viewer



Glycans/Glycoconjugates

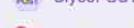
- Glycans
 - GlyCosr
 - GlyCosr
 - GlycoNAF
- Glycoconjugates
 - GlyCosr
 - ACGG-[
 - GlycoEp
 - GlycoNAF



Submissions



GlyTouCan



GlycoPOST



UniCarb-DR

Resources

Search



Genes/Proteins/Lipids



Glycogenes



Glycoproteins



Lectins



Glycolipids

Glycans/Glycoconjugates



Glycans



Glycans Search



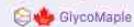
Glycoproteins

Glycomes

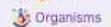
Pathways/Diseases/Organisms



Pathways



GlycoMaple



Organisms



GlyCosmos Dataset



The list of validated glycans extracted from GlyTouCan at the time of the latest GlyCosmos update.

GlyCosmos Tools



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

GlycoNAVI



GlycoNAVI-Motif is dataset of glycan structure patterns. This is the content of GlycoNAVI.



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



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)

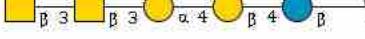
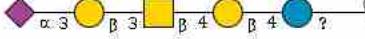
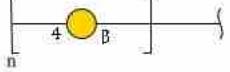
GPDB is a glycoprotein database providing information of Asn (N)-glycosylated proteins and their glycosylated site(s), which were constructed by employing a bottom-up strategy using actual glycopeptide sequences identified by LC/MS-based glycoproteomic technologies.

— ACGG-DB



GlyCosmos Glycans

- List of validated glycans from GlyTouCan

Accession Number	IUPAC Condensed	Minimum < mass < Maximum	motif name(s)	GlycoEpitope
G98848EU	 GalNAc(b1-3)GalNAc(b1-3)Gal(a1-4)Gal(b1-4)Glc(?1-	910.32778	para-Forssman glycolipid	No data
G98848EU				
G51699SI	 GalNAc(b1-3)GalNAc(b1-3)Gal(a1-4)Gal(b1-4)Glc(b1-	910.32778	para-Forssman glycolipid	No data
G51699SI				
G14633CL	 Neu5Ac(a2-3)Gal(b1-3)GalNAc(b1-4)Gal(b1-4)Glc(?1-	998.34382398	cisGM1	No data
G14633CL				
G77076MY		No data	No data	beta 1-4 Galactan
G77076MY				EP0506
G51379UR	Man(a1-6)Man(?1-	342.11621153	alpha-oligomannoside	No data
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.

Glycomes

- Total Glycome Database
- GlycomeAtlas
- LM-GlycomeAtlas

Glycomes

Glycome Database

**Total Glycome Database**

N-glycan, O-glycan, sphingolipids, glycosaminoglycans and free glycans as quantified from various types of cells.

Glycome Database

**GlycomeAtlas**

Visualization of glycome profiling data on human, mouse and zebrafish tissue samples.

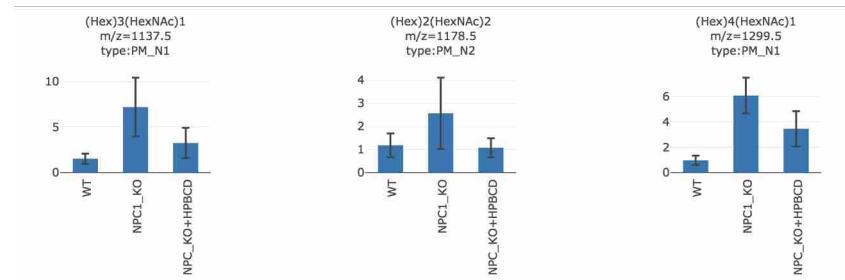
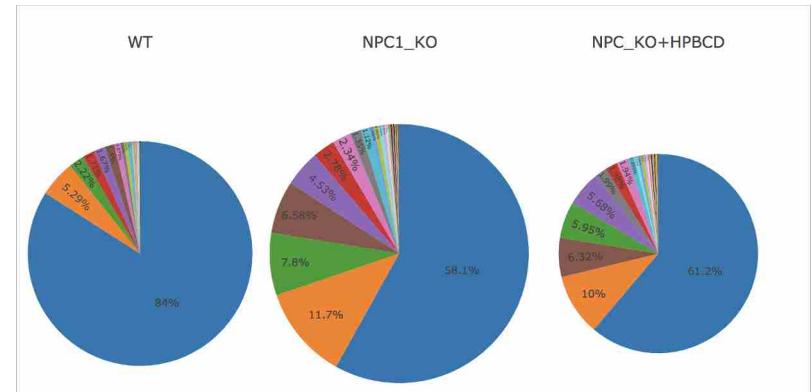
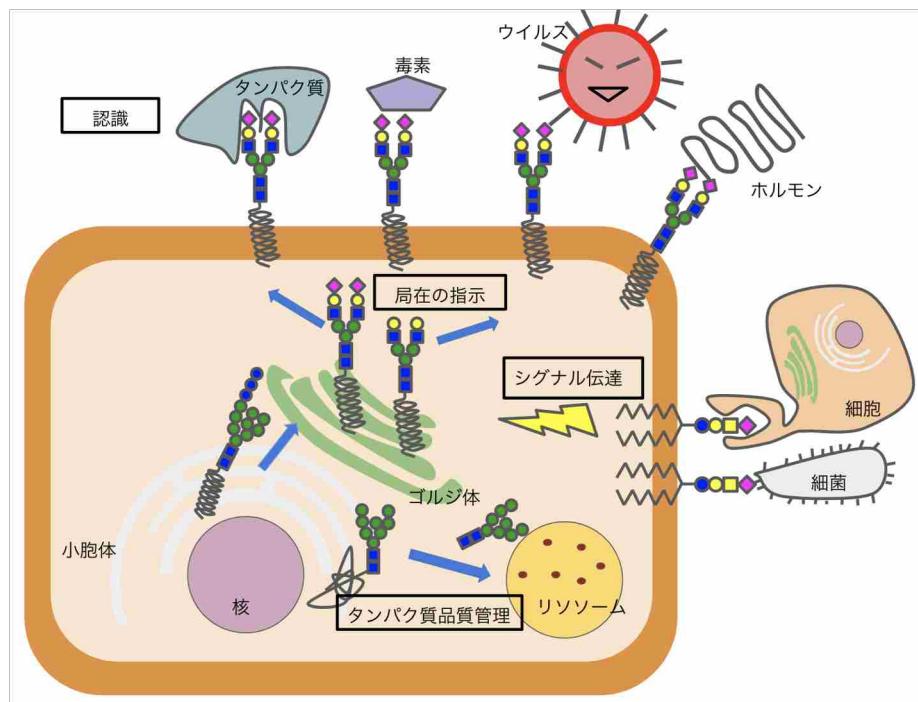
Glycome Database

**LM-GlycomeAtlas**

LM-GlycomeAtlas is a web tool visualizing the data from Lectin Array analyses by the Kuno Laboratory at AIST.

Total Glycome Database

Total Glycome data including N-glycans, O-glycans, sphingolipids, GAGs, free glycans, as reported in Furukawa, JI, et al. *Kagaku to Seibutsu* 53(9): 586-592 (2015)



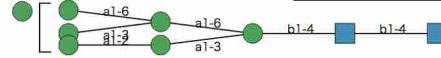
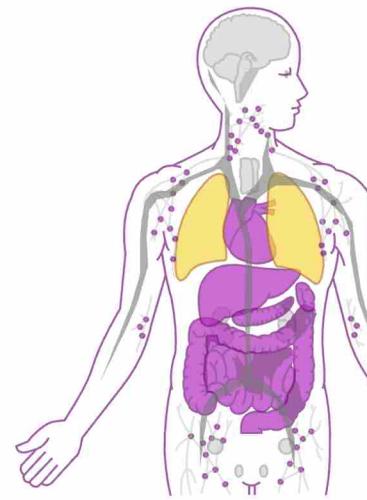
GlycomeAtlas

GlycomeAtlasV5

[Human](#) [Mouse](#) [Zebrafish](#)

Human

[New Home](#)
[Old Home](#)
[Help](#)
[Feedback](#)
[Data source](#)
Glycan search(β)
[Profile input\(β\)](#)



All Clear

GlycomeAtlasV5

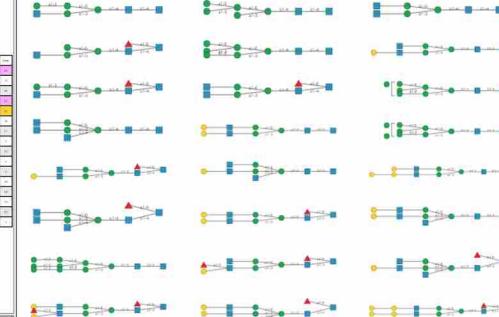
[Human](#) [Mouse](#) [Zebrafish](#)

Mouse

[New Home](#)
[Old Home](#)
[Help](#)
[Feedback](#)
[Data source](#)
Glycan search(β)
[Profile input\(β\)](#)



Mouse-Large Bowel



GlycomeAtlasV5

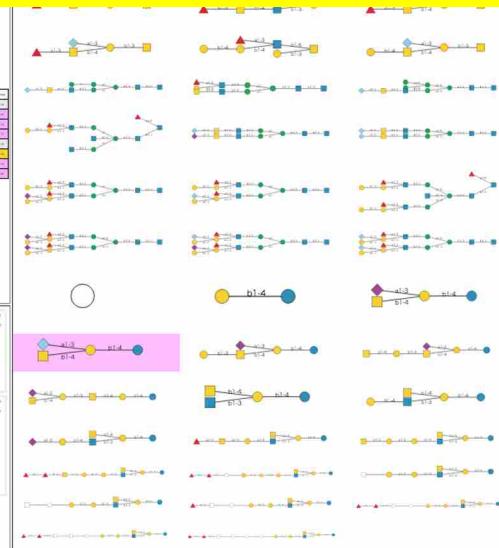
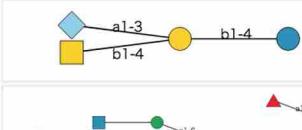
[Human](#) [Mouse](#) [Zebrafish](#)

Zebrafish

[New Home](#)
[Old Home](#)
[Help](#)
[Feedback](#)
[Data source](#)
Glycan search(β)
[Profile input\(β\)](#)



Yamakawa N, Guerardel, Y. et al.
Nature communications. 9(1):4647, 2018.



All Clear

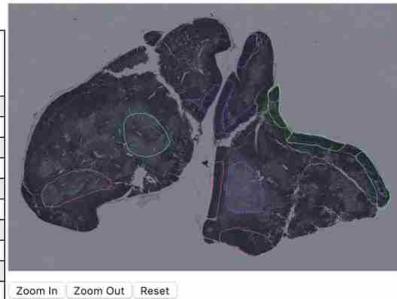
LM-GlycomeAtlas

- Web tool to visualize laser microdissection-assisted lectin microarray analyses data using 45 lectins
 - high-throughput and in-depth glycomic profiling of formalin-fixed paraffin-embedded mouse tissue sections
 - Collaboration with Dr. Kuno at AIST

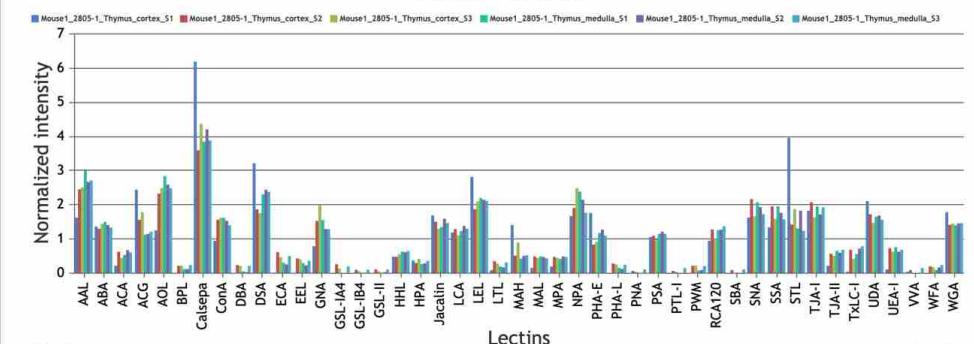
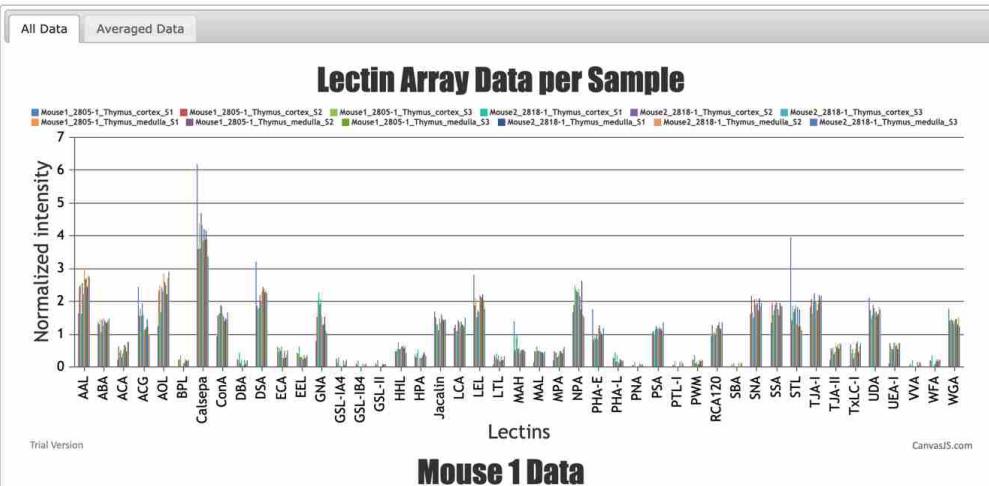


LM-GlycomeAtlas v.1.0 is a web tool visualizing the data from Lectin Microarray analyses using [45 lectins](#) by the Kuno Laboratory at AIST.

TissueID	TissueName	No. Sections (click to Download)
1	Brain	0
2	Cornea	0
3	Heart	42
4	Kidney	0
5	Colon	24
6	Liver	0
7	Lung	18
8	Lymph Nod	0
9	Ovaries	0
10	Pancreas	30
11	Skin	18
12	Small Bowel	60
13	Spleen	0
14	Testes	0
15	Thymus	12
16	Serum	0
17	Stomach	24
18	Gallbladder	6



Zoom In | Zoom Out | Reset



Molecules 2019, 24(16), 2962; <https://doi.org/10.3390/molecules24162962>

Article

LM-GlycomeAtlas Ver. 1.0: A Novel Visualization Based Glycomic Profiles of Mouse Tissue Sectio

by Chiaki Nagai-Okatani ^{1,*} , Kiyoko F Aoki-Kinoshita ² , Shuichi Kak Katsue Kiyohara ¹, Noriaki Fujita ¹, Yoshinori Suzuki ¹, Takashi Sato ¹, Kiy

¹ Glycoscience and Glycotechnology Research Group, Biotechnology Resea of Advanced Industrial Science and Technology (AIST), Tsukuba, Ibaraki 30

² Glycan & Life Science Integration Center (GaLSIC), Faculty of Science and 192-8577, Japan

* Authors to whom correspondence should be addressed.

Received: 27 June 2019 / Accepted: 12 August 2019 / Published: 15 August 2



Submissions



GlyTouCan



GlycoPOST



UniCarb-DR

Resources

Search



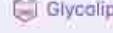
Genes/Proteins/Lipids



Glycogenes



Glycoproteins



Lectins



Glycolipids

Glycans/Glycoconjugates



Glycans



Glycans Search



Glycoproteins

Glycomes

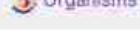
Pathways/Diseases/Organisms



Pathways



GlycoMaple



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,
Select a species

Select a species

By selecting a spe

all

Enter the keyword

Enter the first few

Then please select

Glycoprotein entry

Extracted Glycoprotein from GlycoProtDB

Protein: Sodium/potassium-transporting ATPase subunit beta
 GlycoProtDB: GPD80005232
 UniProt: Q545P0
 Gene Symbol: Atg1b1
 Organism:
 ◦ Scientific Name: Mus musculus

Glycosylation

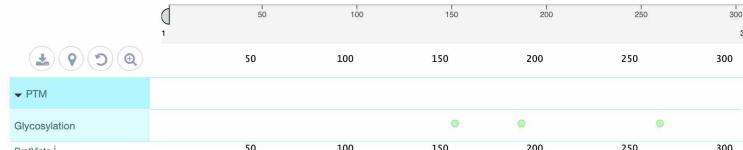
Position	PubMed ID
158	17406563 22823882 23002422
193	17406563 22823882 23002422
266	17406563 22823882 23002422

Sequence

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

MARGAKKEEGSWKFVNSEKKEFLGRRTGGSWFKILLFYVIFYGLAGIFIGTQVMLLTISELKPTYQDRVAPPGLTQIPQIQKTEISFRPNDPKSYEAVVLNIRFLEKYKDSAQKDDMIFED
 YCPNPSEPKERDINHERGERKVCVRFLKDWLGNCSGLNDSYGYYREGKPCIIKKLNRLVLFKPCKPKPIESLEYPLMMKYNPNVLPVQCTGKRDEDKDVGNIEYFGMGGYYGFLQY
 PYYYGKLLQPKYLQPPLAVQFTLTVDTIRVECKAYGENIGYSEKDRFQGRFDVKIEIKS

Feature



[●:Glycosylation Site from GlycoProtDB , ●:Glycosylation Site from UniProt]

PDB Images



GlyTouCan Images

Extracted GlyTouCan data from GlycoProtDB



fusions

Plasma membrane p-Y FGFR1 fusion dimers

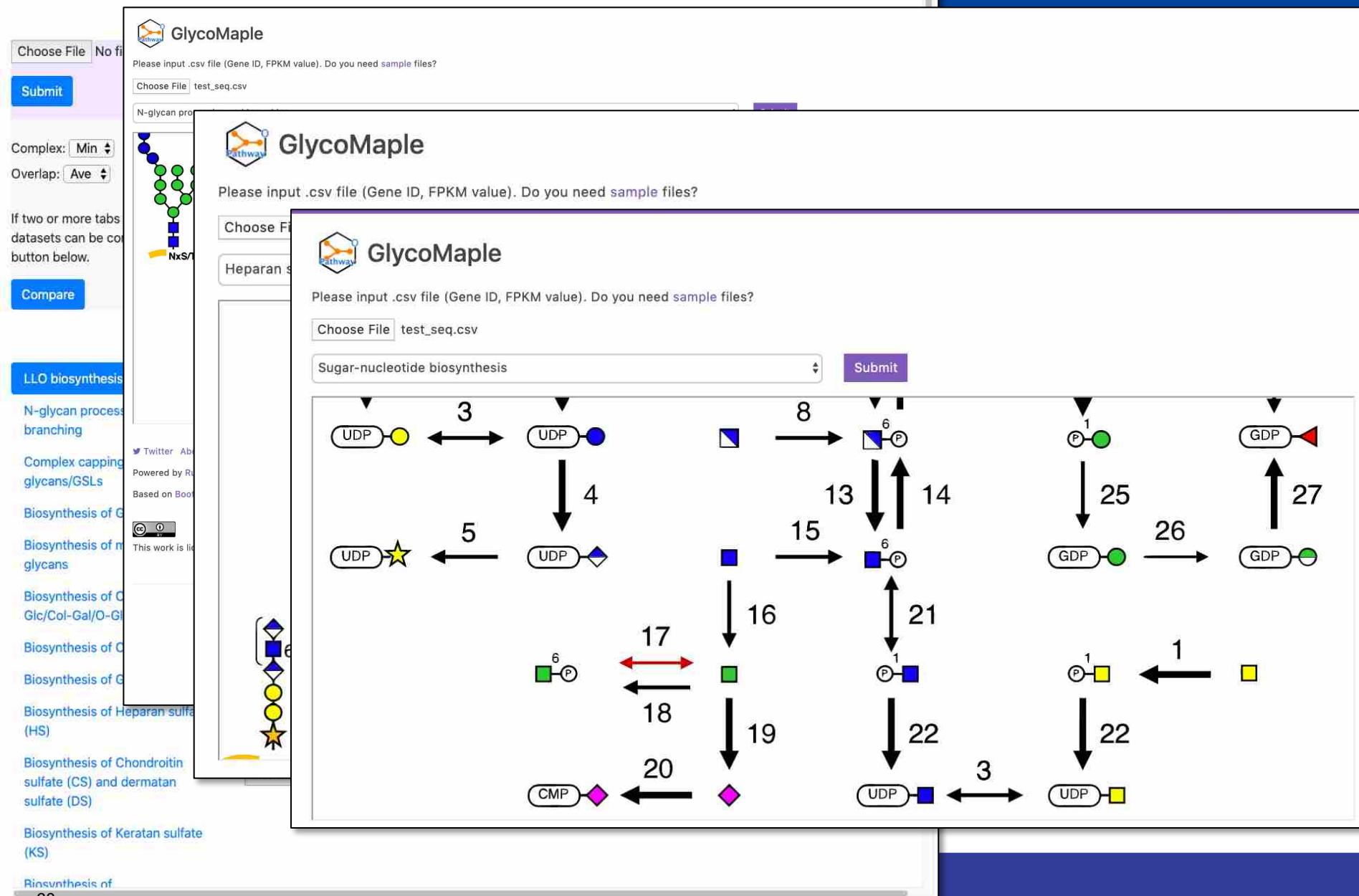
Location : plasma membrane

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

Glycogene Expression Pathway viewer

Data last updated: April 1, 2020

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





GlycoMaple i
expression d
from the Hu
displayed in:

Overlap: M

If two or mo
diagram, tw
compared t
below.

Compare

LLO bios
and OST

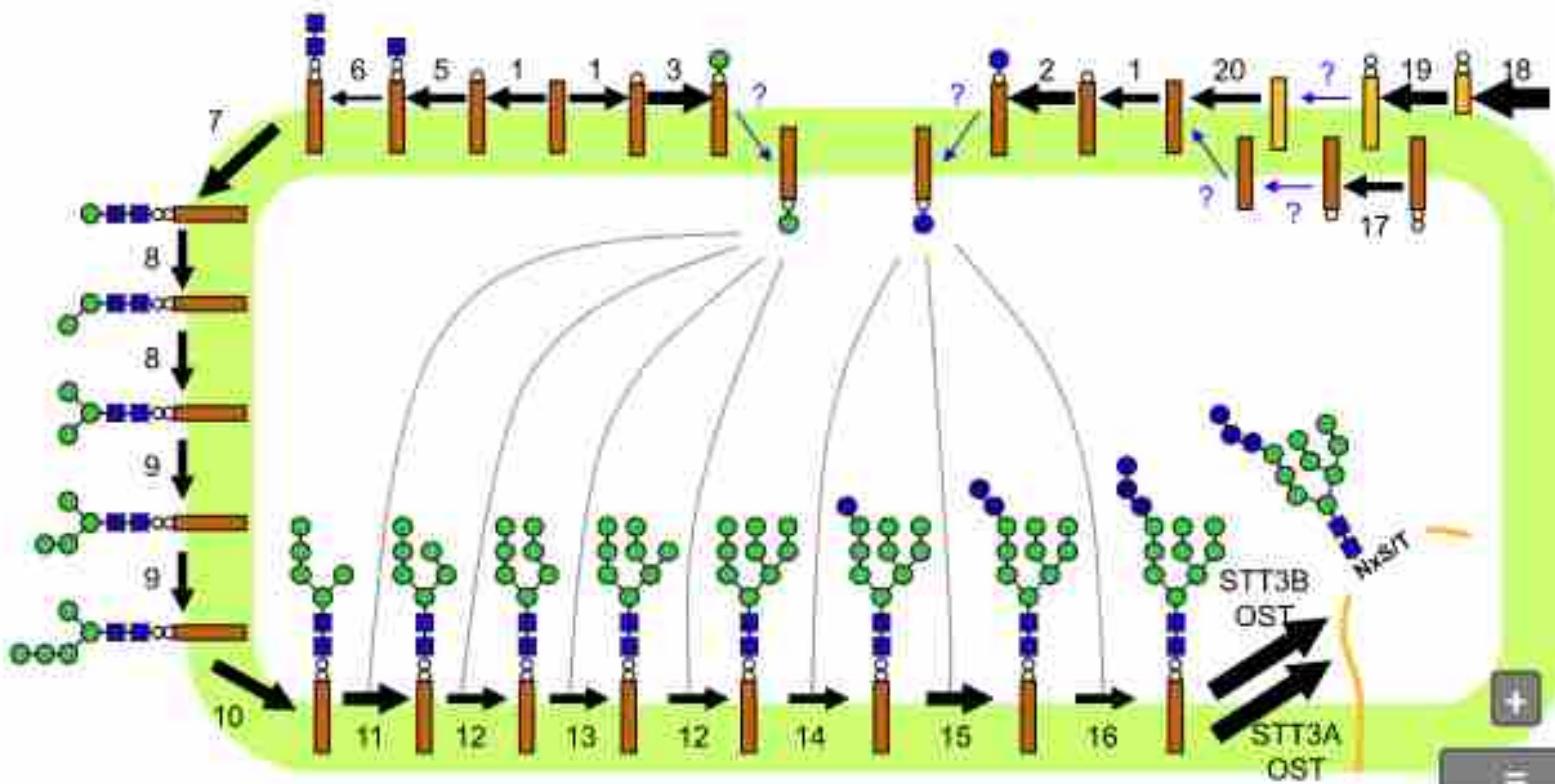
N-glycan
processin
branching

Complex
glycans/C
glycans/C

Biosynth
APs

Biosynth
mucin-typ
glycans

Biosynth
Fuc/O-GI
Gal/O-GI
Man



GlyCosmos Organisms

Show 10 entries

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

Search across columns

Organism	Taxon ID					
<input type="text" value="Search"/>						
<i>Gossypium hirsutum</i>	3635	611	6	3	0	0
<i>Salmo salar</i>	8030	566	0	51	0	0
<i>Nicotiana tabacum</i>	4097	515	47	21	0	0
<i>Lingula anatina</i>	7574	446	0	4	0	0
<i>Glycine max</i>	3847	399	38	16	1	0
<i>Juglans regia</i>	51240	340	2	0	0	0
<i>Brassica oleracea</i> var. <i>oleracea</i>	109376	293	0	0	0	0
<i>Scleropages formosus</i>	113540	285	0	19	0	0
<i>Phoenix dactylifera</i>	42345	283	0	0	0	0
<i>Ictalurus punctatus</i>	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					
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 \(.tsv\)](#)

Line breaks are removed from cells.

Previous **1** Next



Species : Homo sapiens

Pathway Name : ABO blood group biosynthesis

Search across

Search

e.g. Erythrop

Search res

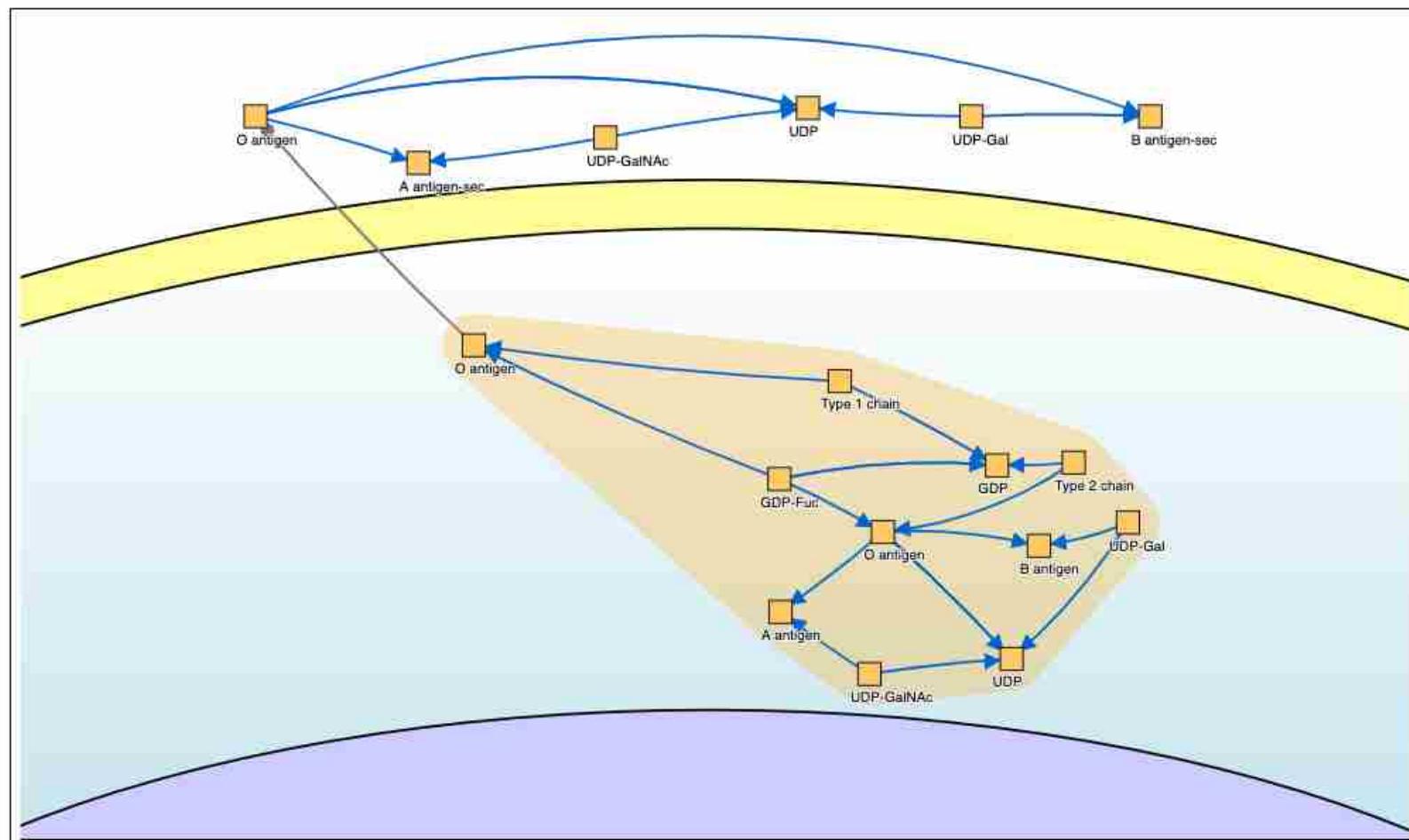
Genes



Annotations

Ontologies

Notations

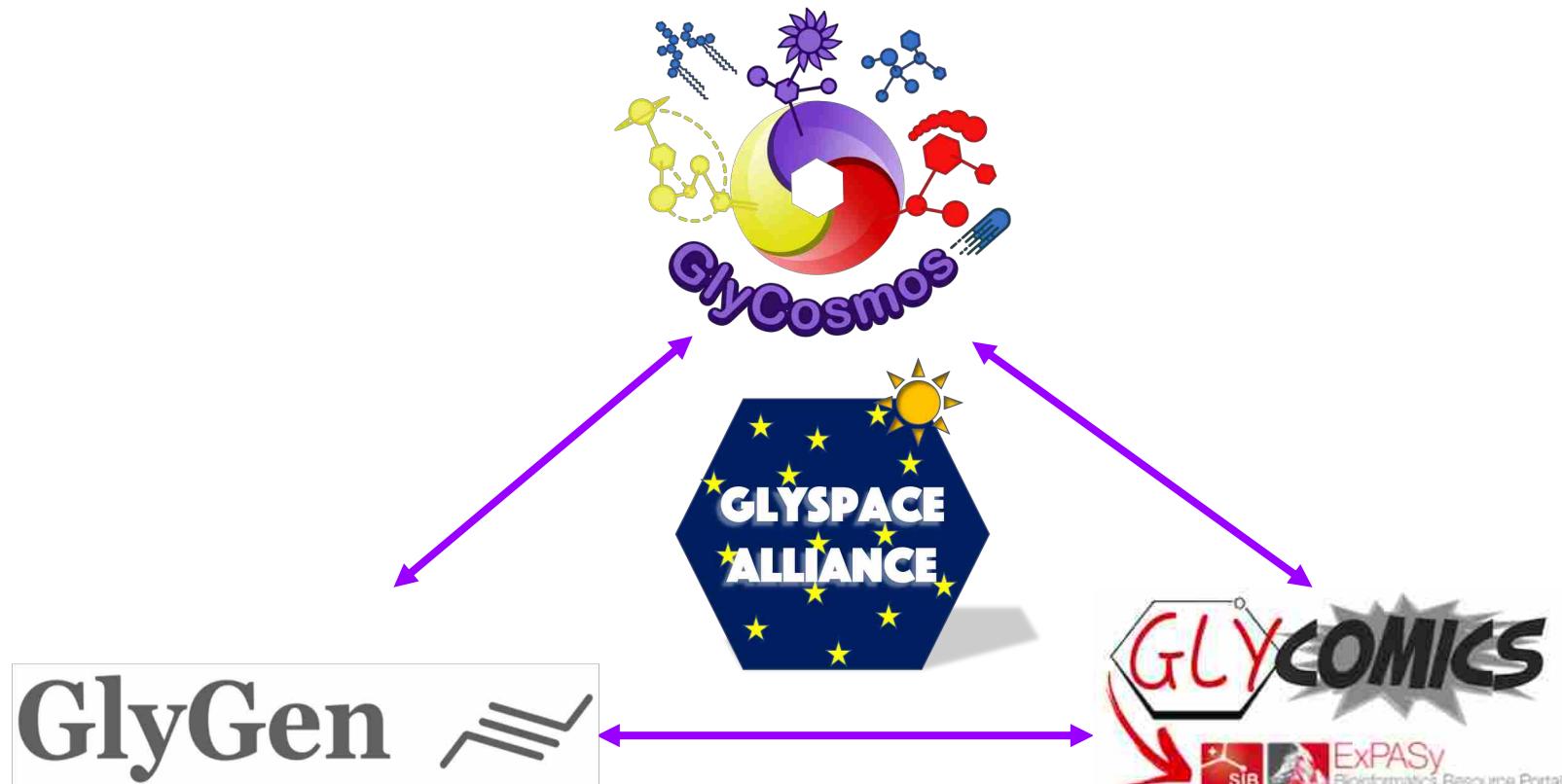


- | | |
|----------------------|------------------------|
| ● Protein | ● Lysosome |
| ○ Protein family | ■ Membrane |
| ● DNA | — Up-regulates |
| ● RNA | — Down-regulates |
| ● Complex | — Physical interaction |
| ■ Chemical/Molecule | — Unknown |
| ■ Phenotype/Stimulus | — Direct |
| ■ Nucleus | — Indirect |
| ■ Mitochondria | Binding |
| ■ Endosome | |
| ■ Golgi apparatus | |

GlyCosmosで期待する効果

- ・ 糖鎖科学研究から生成される情報を格納する基盤を構築し、研究を促進
- ・ 糖鎖研究の初心者でも糖鎖について容易に調べられるポータルを作成し、幅広い分野の研究者が利用
- ・ 技術的には、興味・ターゲットのデータを調べるための使いやすいユーザーインターフェースを構築
- ・ データは全て RDFで連携することで、海外のEndpointとの同時検索が可能となる。また海外のGlyGenやGlyConnectともGlyCosmosのデータを相互に共有可能

GlySpace Alliance



Established August, 2018 @ Warren Workshop

<http://glyspace.org>

- 米国NIHによる国際プロジェクト
- ヒトとマウスの糖鎖構造、糖タンパク質を整理し、生物学者が探したい情報を得やすいユーザーインターフェースを開発

We will log your actions to improve the user experience. You can always change this setting in [My GlyGen](#).

GlyGen

[HOME](#)
[EXPLORE](#)
[QUICK SEARCH](#)
[TRY ME](#)
[ABOUT](#)
[MORE](#)

[MY GLYGEN](#)

GlyGen
Computational and Informatics Resources for Glycoscience Research

GlyGen is a data integration and dissemination project for carbohydrate and glycoconjugate related data. GlyGen retrieves information from multiple international data sources and integrates and harmonizes this data. This webportal allows exploring this data and to perform unique searches that cannot be executed in any of the integrated databases alone.

Glycan
Search of glycan structures based on their chemical and structural properties.

[EXPLORE](#)

Protein
Search for proteins structures based on their sequence and their annotations.

[EXPLORE](#)

Glycoprotein
Search for glycoconjugates based on the proteins or glycan structures involved.

[EXPLORE](#)

Quick Search

What are the enzymes involved in the biosynthesis of [glycan X](#) in human?

Which proteins have been shown to bear [glycan X](#) and which site is this glycan attached to?

What are the orthologues of [protein X](#) and how does a glycosylation site and glycan structure change in different species?

Which glycans might have been synthesized in mouse using [enzyme X](#)?

What are the glycosyltransferases in [species X](#)?

Which glycosyltransferases are known to be involved in [disease X](#)?

[SEE ALL](#)

Try Me

What are the enzymes involved in the biosynthesis of [Man5](#) in human?

Which proteins have been shown to bear a [bi-antennary fully sialated N-Glycan](#) and which site is this glycan attached to?

Which glycans might have been synthesized in mouse using [Mgat1](#)?

Your Opinion Matters

Please provide feedback and suggestion to help us improve the GlyGen portal and make it more useful for the community.

[LEAVE FEEDBACK](#)

GlyGen Statistics

GlyGen's Database Statistics.

	Human	Mouse
Proteins	21538	25490
Glycoproteins	4679	3816
Glycans	5239	2406

Explore Other Resources

GlyGen is pleased to provide user with variety of resources in glycobiology.

[EXPLORE](#)

News

Tweets by [@gly_gen](#)

GlyGen
@gly_gen

Protein
Search for proteins structures based on their sequence and their annotations.

Feb 27, 2018

GlyGen
@gly_gen

Proteiform
Search for glycoconjugates based on the proteins or glycan structures involved.

Feb 27, 2018

67

GlyGen



Glycans

Summary of your Glycan Search

Performed on: 8/23/2018, 4:47:34 PM (PT)

Mass 150-6750 Da

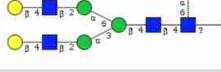
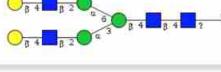
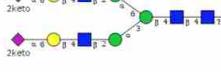
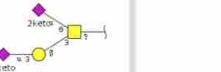
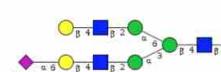
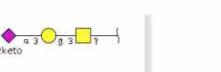
No.of Sugar 1-37

[Modify Search](#)

[Update Results](#)

** By clicking "Update Results", you will perform the search again by using the current version of database.

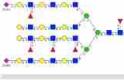
Page [Prev](#) [1](#) [Next](#) Records per page [10](#) Sort By [No of Protein](#) [DESC](#) You Found 5776 results of glycan

GlyTouCan Accession	Glycan Image	Native Mass (Da)	No of Monosaccharides	On How Many Glycoproteins
+ G00998NI		1786.65	10	18
+ G66741YQ		1640.59	9	16
+ G73866ZM		2222.78	11	14
+ G65191ST		965.33	4	12
+ G01670UQ		1931.69	10	11
+ G56299XO		674.24	3	11

GlyTouCan Ac

- [Species](#)
- [Motif](#)
- [Found Glycoconjugates](#)
- [Cross Reference](#)
- [Biosynthetic-Enzyme](#)
- [Digital Sequence](#)

G08866CW



• GlyTouCan Accession: G08866CW

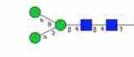
• Monoisotopic mass: 0.160439 Da

• Classification: N-Glycan complex

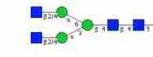
Species

+ Homo sapiens (NCBI taxonomy ID: 9606)

Motif



G00026MO-N-Glycan core basic



G00330MO-N-Glycan complex



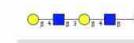
G00051MO-Lewis X



G00054MO-Sialyl Lewis X



G00055MO-Lactosamine motif



G00058MO-Polyfucosamine



Found Glycoconjugates

No data available

Cross Reference

- GlycomeDB: 32463
- PubChem Compound: CID91862746
- PubChem Substance: SID952297019

Biosynthetic-Enzyme

No data available



Glycan

Protein

Species

Disease

SEARCH BY GLYCAN

What are the enzymes involved in the biosynthesis of glycan X in human? 

Glycan X:

G00279YF

Submit

Example: G00279YF

Which proteins have been shown to bear glycan X and which site is this glycan attached to? 

What are the gene locations of the enzymes involved in the biosynthesis of glycan X in human? 

SEARCH BY PROTEIN

What are the orthologues of protein X in different species? 

What are the functions of protein X? 

Which glycans might have been synthesized in mouse using enzyme X? 



Page

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1

[Next](#)

Records per page

25

Sort By

UniProt Name

ASC

You Found 9 results of protein

UniProt Accession	Gene Name	UniProt Name	Native Mass (Da)	Organism	RefSeq Name	RefSeq Accession
Q9H553-1	ALG2	16-mannosyltransferase ALG2	47092	Homo sapiens	alpha-1,3/1,6-mannosyltransferase ALG2	NP_149078.1
P26572-1	MGAT1	Alpha-13-mannosyl-glycoprotein 2-beta-N-acetylglucosaminyltransferase	50878	Homo sapiens	alpha-1,3-mannosyl-glycoprotein 2-beta-N-acetylglucosaminyltransferase isoform X1	XP_016864976.1
Q9UM21-1	MGAT4A	Alpha-13-mannosyl-glycoprotein 4-beta-N-acetylglucosaminyltransferase A	61544	Homo sapiens	alpha-1,3-mannosyl-glycoprotein 4-beta-N-acetylglucosaminyltransferase A isoform 1	NP_036346.1
Q9UQ53-1	MGAT4B	Alpha-13-mannosyl-glycoprotein 4-beta-N-acetylglucosaminyltransferase B	63198	Homo sapiens	alpha-1,3-mannosyl-glycoprotein 4-beta-N-acetylglucosaminyltransferase B isoform 2	NP_463459.1
Q9UBM8-1	MGAT4C	Alpha-13-mannosyl-glycoprotein 4-beta-N-acetylglucosaminyltransferase C	56061	Homo sapiens	alpha-1,3-mannosyl-glycoprotein 4-beta-N-acetylglucosaminyltransferase C isoform X4	XP_016874639.1
Q10469-1	MGAT2	Alpha-16-mannosyl-glycoprotein 2-beta-N-acetylglucosaminyltransferase	51550	Homo sapiens	alpha-1,6-mannosyl-glycoprotein 2-beta-N-acetylglucosaminyltransferase	NP_002399.1
Q9NP73-1	ALG13	Putative bifunctional UDP-N-acetylglucosamine transferase and deubiquitinase ALG13	126056	Homo sapiens	putative bifunctional UDP-N-acetylglucosamine transferase and deubiquitinase ALG13 isoform 2	NP_060936.1
Q6GMV1-1	ALG1L	Putative glycosyltransferase ALG1-like	21132	Homo sapiens	putative glycosyltransferase ALG1-like isoform 1	NP_001182152.1
Q96F25-1	ALG14	UDP-N-acetylglucosamine transferase subunit ALG14 homolog	24151	Homo sapiens	UDP-N-acetylglucosamine transferase subunit ALG14 homolog isoform 1	NP_659425.1

Page

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Records per page

25

Sort By

UniProt Name

ASC

You Found 9 results of protein

Glycomics



- スイスのノウハウ
- 多くのデータ

Expsy

Swiss Bioinformatics Resource Portal



e.g. BLAST, UniProt, MSH6, Albumin...

SIB Resources ⓘ

Other Resources of SIB Groups

-  **Genes & Genomes**
 - Genomics
 - Metagenomics
 - Transcriptomics
-  **Proteins & Proteomes**
-  **Evolution & Phylogeny**
 - Evolution biology
 - Population genetics
-  **Structural Biology**
 - Drug design
 - Medicinal chemistry
 - Structural analysis
-  **Systems Biology**
 - Glycomics
 - Lipidomics
 - Metabolomics
-  **Text mining & Machine learning**



Glydin'

Network representation of known glycan determinants



Glynsight

Visualise and compare glycan expression profiles



GlycoDigest

In silico digestion of glycans by exoglycosidases



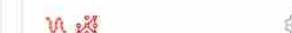
GlycoMod

Possible oligosaccharide structures on proteins from masses



UniCarb-DB

Glycan structures and associated mass spectrometry data



GlycoSiteAlign

Multiple alignment of sequences around glycosylation sites



GlyS3

Match a glycan substructure to a database of full structures



SugarSketcher

Fast, intuitive, SNFG-compliant glycan structure drawing



SugarBind

Pathogen Sugar-Binding Database



EpitopeXtractor

Compare glycan structures to Glydin' network's collection



UniLectin

Structural and functional classification of lectins



Swiss Mass Abacus

Intuitive calculator of peptide and glycopeptide masses



GlyConnect

Integrated data platform to study glycosylation

Platform integrating sources of information to help characterise the molecular components of protein glycosylation

Data browser and search

TAXONOMY (246)

PROTEIN (2650)

TISSUE (254)

STRUCTURE (3737)

COMPOSITION (1043)

DISEASE (91)

REFERENCE (917)

SITE (5589)

PEPTIDE (5355)

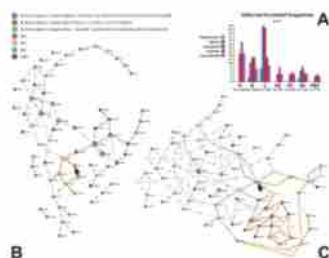
Programmatic Data Access

REST API

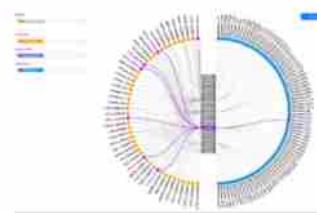
RDF

Data Visualization Tools

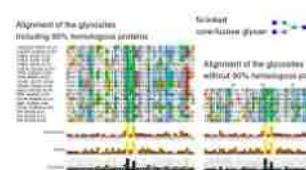
Compozitor



Octopus



GlycositeAlign



GlySpace Alliance



目的: データの共有や連携についての合意を得ること

基本的な合意:

- データもソフトウェアも無料でオープンソースのライセンスで提供する
- 共通の標準を利用する(オントロジー、アクセッション番号など)
- 年1回の対面会議
 - 他のデータベースやソフトウェアのプロジェクトとの連携の議論など

現在の参加メンバー

- 糖鎖関連のマルチオミックス統合プロジェクト
- Glycomics@ExPASy, GlyCosmos, GlyGen

Established August, 2018 @ Warren
Workshop

Glycoinformatics Consortium

[View on GitHub](#)

- 目的:
 - 糖鎖科学関連ソフトウェアの中心的なリポジトリを提供・維持
 - <http://glic.glycoinfo.org>
 - 糖鎖科学者が糖鎖インフォマティクス専門家に連絡できる場を提供
 - メンバーおよび開発された**ソフトウェアやデータベース**の一覧
 - 要望リスト“Wish list”を登録できるシステムを提供
- メールも受け付けます : kkiyoko@soka.ac.jp

文科省ロードマップ2020

学術研究の大型プロジェクトの推進に関する基本構想 ロードマップの策定

- 「ヒューマングライコードプロジェクト」
 - 糖鎖の構造やその機能を解明し、ヒトの全糖鎖情報（グライコード）を取得することで、疾患の成り立ちを理解する。また、糖鎖解析技術の先導により、革新的な新医療・予防・先制医療を牽引する。
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Technology Agency