

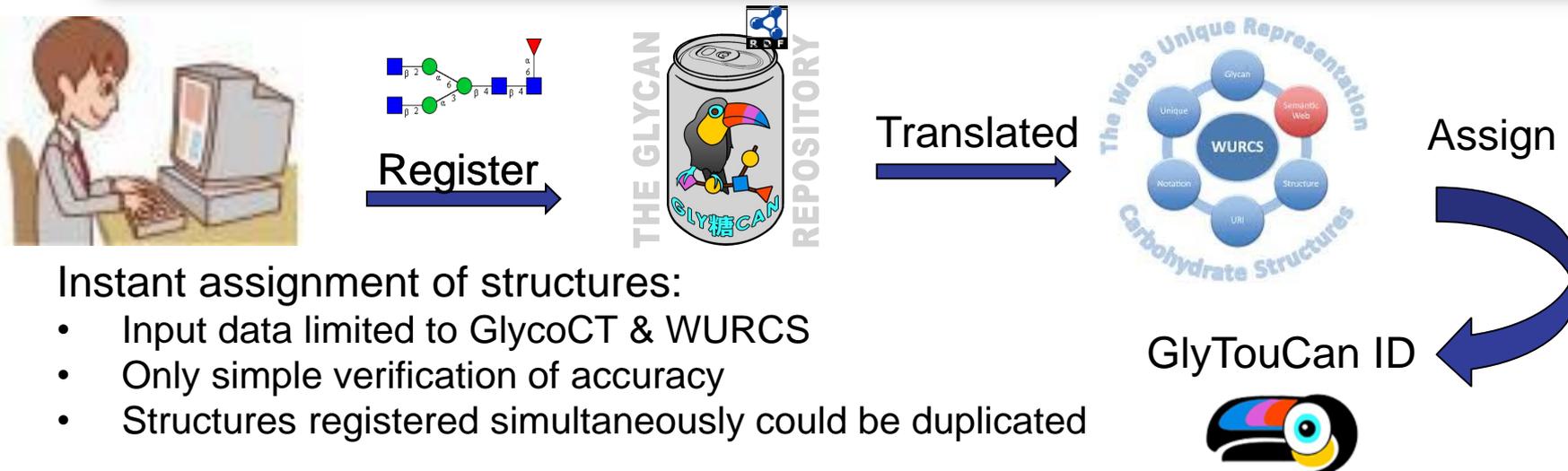
GlyTouCanの更新および GlyCosmos Portalの公開

木下聖子

2019年12月3日

第42回日本分子生物学会年会

New GlyTouCan 3.0 (August, 2019)



Instant assignment of structures:

- Input data limited to GlycoCT & WURCS
- Only simple verification of accuracy
- Structures registered simultaneously could be duplicated

Batch Processing Phase:

- Validates inputted data
- Generates images
- Assigns ID

Advantages:

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

User Profile Page:

- Validation results
- Images
- Assigned ID

GlyCosmos Overview



Repositories



The glycan structure repository GlyTouCan
 assigns accession numbers to glycans



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

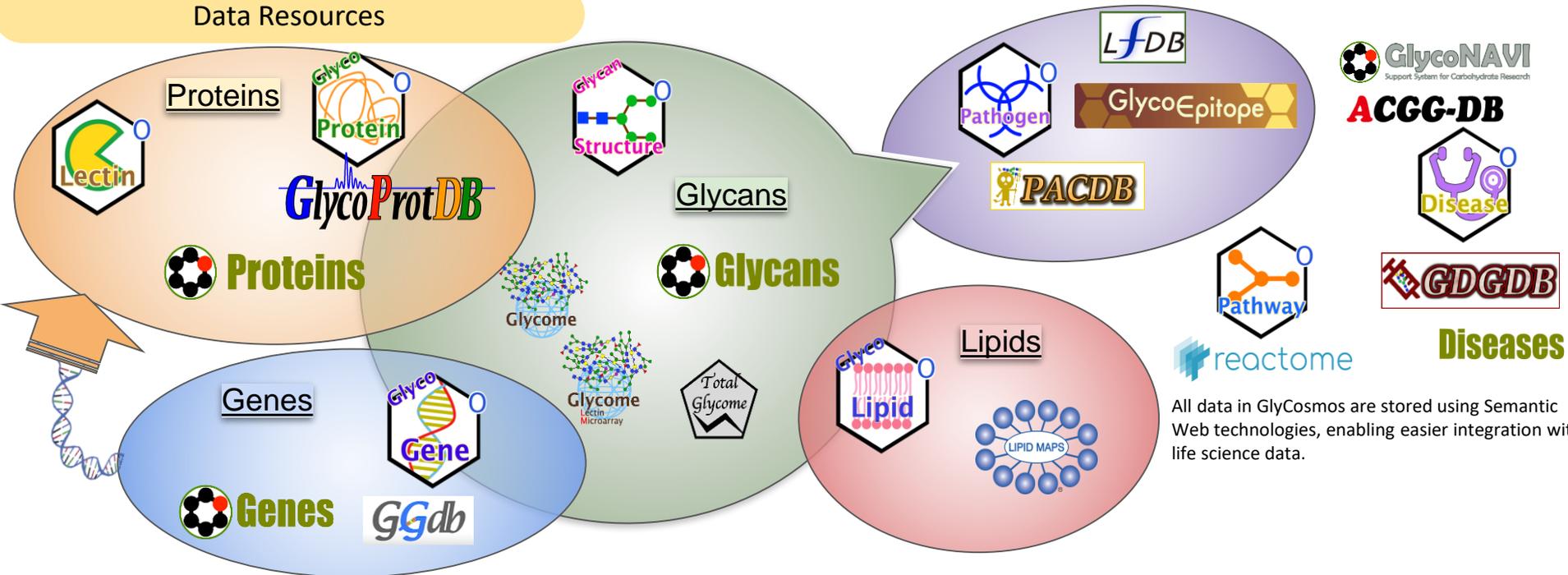


The Glycoconjugate repository GlyComb (TBA)
 will assign accession numbers to glycoconjugates such as
 glycoproteins, glycolipids

UniProt ID/Lipid MAPS ID + glycosylation site + GlyTouCan ID



Data Resources



正式に日本糖質学会のオフィシャルポータルとして承認
本年4月1日に公開

Submissions:

- GlyTouCan
- GlyComb (開発中)
- GlycoPOST

Resources:

- Genes/Proteins/Lipids
- Glycans/
Glycoconjugates
- Glycomes
- Pathways/Diseases
- Ontologies
- Notations

Release 2:

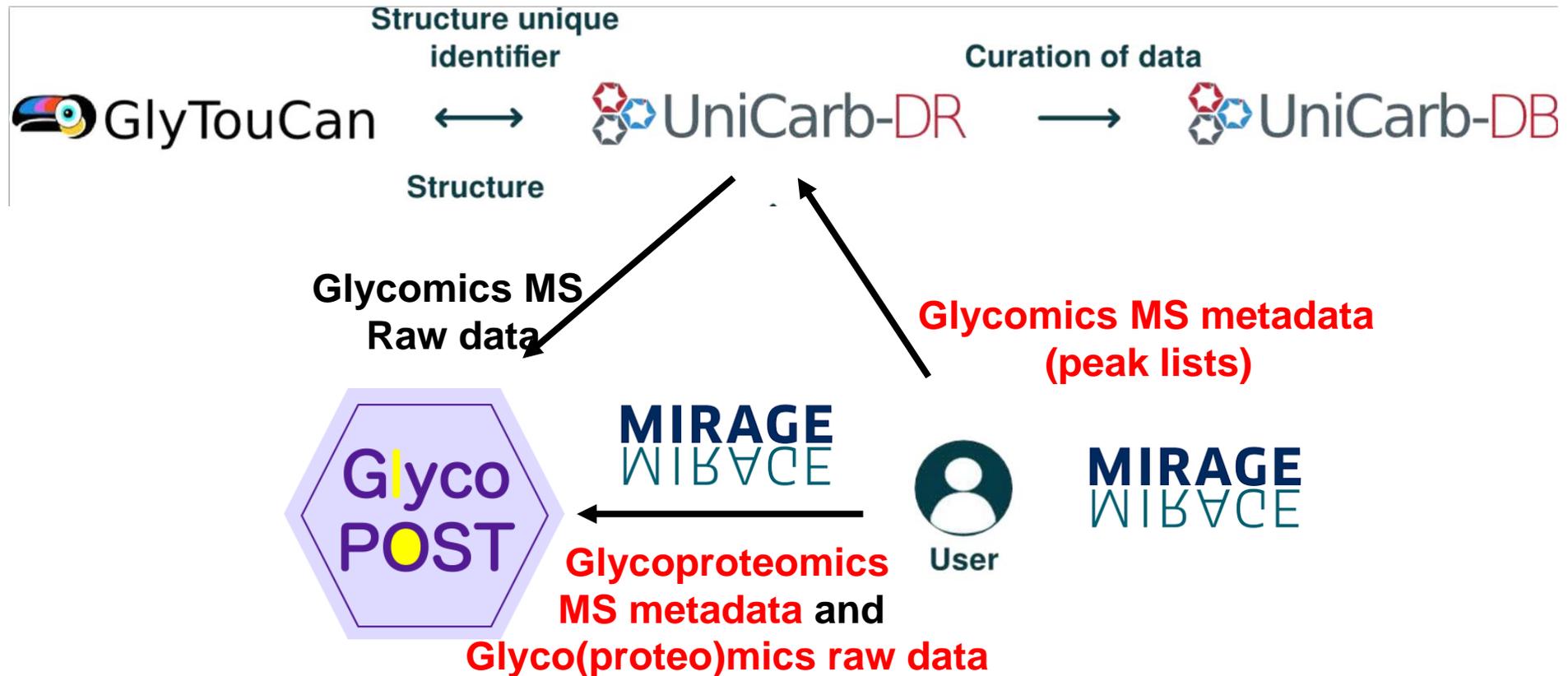
August 5, 2019

Release 3:

December 12, 2019

The screenshot shows the GlyCosmos Portal website. The main content area features a 'Welcome to GlyCosmos!!' message and a 'Submissions' section with three highlighted items: GlyTouCan, GlyComb, and GlycoPOST. The GlycoPOST item is highlighted with a red box. Below this is a 'Resources' section with four database categories: Genes/Proteins/Lipids, Glycans/Glycoconjugates, Glycomes, and Pathways/Diseases. The right-hand sidebar contains 'News' (Tweets by @GlyCosmos) and 'Other Related Resources' (Glycoinformatics Consortium (GLIC), Glycomics@ExPASy, GlyConnect, GlyGen, jPOST, MIRAGE, PDBj, PubChem, UniCarb-DB).

Aoki-Kinoshita, K.F., Karlsson N. et al. Towards a standardized bioinformatics infrastructure for N-and O-glycomics. *Nature communications*, 10(1), pp.1-10, 2019.



About GlycoPOST

GlycoPOST is a mass spectrometry data repository for glycomics and glycoproteomics. It consists of a high-speed file upload process, flexible file management system and easy-to-use

Statistics

27 projects are registered. 7 s are opened.

Data list

ID	Project title	Description	Publication	Principal investigator	Announcement date	Detail
GPST000038	UniCarb-DR	Data from UniCarb-DR	31332201	Niclas G. Karlsson	2019/10/02	Detail page
GPST000027	GnT3 KO mouse brain	Bisecting GlcNAc is a general suppressor of terminal modification of N-glycan	31375533	Miyako Nakano	2019/09/21	Detail page
GPST000031	GnT3 KO mouse kidney	Bisecting GlcNAc is a general suppressor of terminal modification of N-glycan	31375533	Miyako Nakano	2019/09/21	Detail page
GPST000030	Reference glycan structure libraries of primary human cardiomyocytes and pluripotent stem cell-derived cardiomyocytes reveal cell-type and culture stage-specific glycan phenotypes	To generate glycan structure libraries, the current study used porous graphitized carbon (PGC) LC interfaced with MS (PGC-LC-MS), a technique that resolves glycan structures and enables characterizat...		Rebekah L. Gundry	2019/08/31	Detail page
GPST000029	Standardization of PGC-LC-MS-based glycomics for sample specific glycotyping	Porous graphitized carbon (PGC) based chromatography achieves high-resolution separation of glycan structures released from glycoproteins. However, the implementation of PGC-based separations in glyco...	31065629	Nicolle H Packer	2019/06/28	Detail page
GPST000024	Discrimination of Isomers of Released N- and O-Glycans Using Diagnostic Product Ions in Negative Ion PGC-LC-ESI-MS/MS	We used porous graphitized carbon-LC-ESI-MS/MS to separate and detect released N- and O-glycan isomers from mammalian model glycoproteins using negative mode resonance activation CID-MS/MS. By interro...	29603058	Nicolle H. Packer	2019/06/28	Detail page
GPST000009	Atlantic Salmon mucus from skin, pyloric caeca and distal intestine	Diseases cause ethical concerns and economic losses in the Salmonid industry. The mucus layer comprised of highly O-glycosylated mucins is the first contact between pathogens and fish. Mucin glycans g...	30923042	Sara Lindén	2019/04/10	Detail page

GlyCosmos

Submissions:

- GlyTouCan
- GlyComb (under development)
- GlycoPOST

Resources:

- Genes/Proteins/Lipids
- Glycans/ Glycoconjugates
- Glycomes
- Pathways/Diseases
- Ontologies
- Notations

The screenshot shows the 'Resources' section of the GlyCosmos Portal. It is organized into a grid of database categories. A red box highlights the 'Genes/Proteins/Lipids' category, which contains four icons: 'Gene' (a DNA double helix), 'Protein' (a tangled orange line), 'Lectin' (a yellow Pac-Man shape), and 'Lipid' (a red and blue lipid structure). Other categories include 'Glycans/Glycoconjugates' with a 'Structure' icon, 'Glycomes' with a 'Glycome' icon, and 'Pathways/Diseases' with 'Pathway', 'Disease', and 'Pathogen' icons.

Release 2:

August 5, 2019

Release 3:

December 12, 2019

This block shows the bottom portion of the resource grid. It includes the 'Lipid' icon, the 'Glycomes' category with its 'Glycome' icon, and the 'Pathways/Diseases' category with its 'Pathway', 'Disease', and 'Pathogen' icons. On the right side, there is a text box containing information about MIRAGE, PDBj, PubChem, and UniCarb-DB.

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**

GGdb

GlycoNAVI

 GlycoNAVI-Genes

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

— **GlycoNAVI**

LIPID MAPS Gene/Proteome Database (LMPD)

  LIPID MAPS Gene/Proteome Database (LMPD)

Lipid-related genes and proteins entry from LIPID MAPS.

GlyCosmos Database

  GlyCosmos Glycoproteins

Glycoprotein entries from UniProt. Glycosylation site information is also shown where available.

GlyCosmos Database

 GlyCosmos Lectins

Protein entries from PDB annotated as lectins in UniProt. Glycosylation site information is also shown where available.

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

ACGG-DB

 Lectin Frontier DataBase (LfDB)

LfDB provides quantitative interaction data in terms of the affinity constants (K_a) of a series of lectins toward a panel of pyridylaminated (PA) glycans obtained by an automated frontal affinity chromatography with fluorescence detection (FAC-FD) system.

— **ACGG-DB**

LfDB

GlycoNAVI

  GlycoNAVI-Proteins

GlycoNAVI-Proteins is dataset of glycan and protein information. This is the content of GlycoNAVI. Currently under construction.

— **GlycoNAVI**

GlyCosmos Database

 GlyCosmos Glycolipids

Glycolipid entry from LIPID MAPS.

DONOR : UDP-GalNAc

Transferred

Expression

J. Biol. Chem. 1990 Jan 15;265(2):1139-45.

Isolation to homogeneity and partial characterization of a histo-blood group A defined Fuc alpha 1----2Gal alpha 1----3-N-acetylgalactosaminyltransferase from human lung tissue.

Clausen H. et al. PMID:[2104827](#)

Vox Sang. 1986 null ;51(3):161-71.

Genetics of ABO, H, Lewis, X and related antigens.

Oriol R. et al. PMID:[2433836](#)

Vox Sang. 1989 null ;56(1):1-20.

ABH and related histo-blood group antigens; immunochemical differences in carrier isotypes and their distribution.

Clausen H. et al. PMID:[2464874](#)

Semin. Hematol. 1981 Jan ;18(1):39-62.

Blood group ABH and Ii antigens of human erythrocytes: chemistry, polymorphism, and their developmental change.

Hakomori S. PMID:[6782678](#)

kidney

lung

Biological Resources

GGENTRtr code GGENTRtr-85

Official Symbol ABO

Vector pENTR/D-TOPO

Fusion Site aaa aaa gca ggc tcc gcg gcc gcc ccc ttc acc AGT CTA ATG CCA GGA AGC CTG GAA CGG GGG TTC TGC ATG
 GCT GTT AGG GA CAG CAG TGC AAC CCC GAT GGG CCG CTG GG

Contract 一般寄託 [NBRC](#)

ACGG-DB

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— ACGG-DB

GlycoProtDB

GlycoNAVI

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— GlycoNAVI

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— ACGG-DB

LfDB

GlyCosmos Database

 GlyCosmos Glycolipids

Glycolipid entry from LIPID MAPS.



SUBMISSIONS

 GlyYouCan

 GlyComb

 GlycoPOST

RESOURCES

Genes/Proteins/Lipids

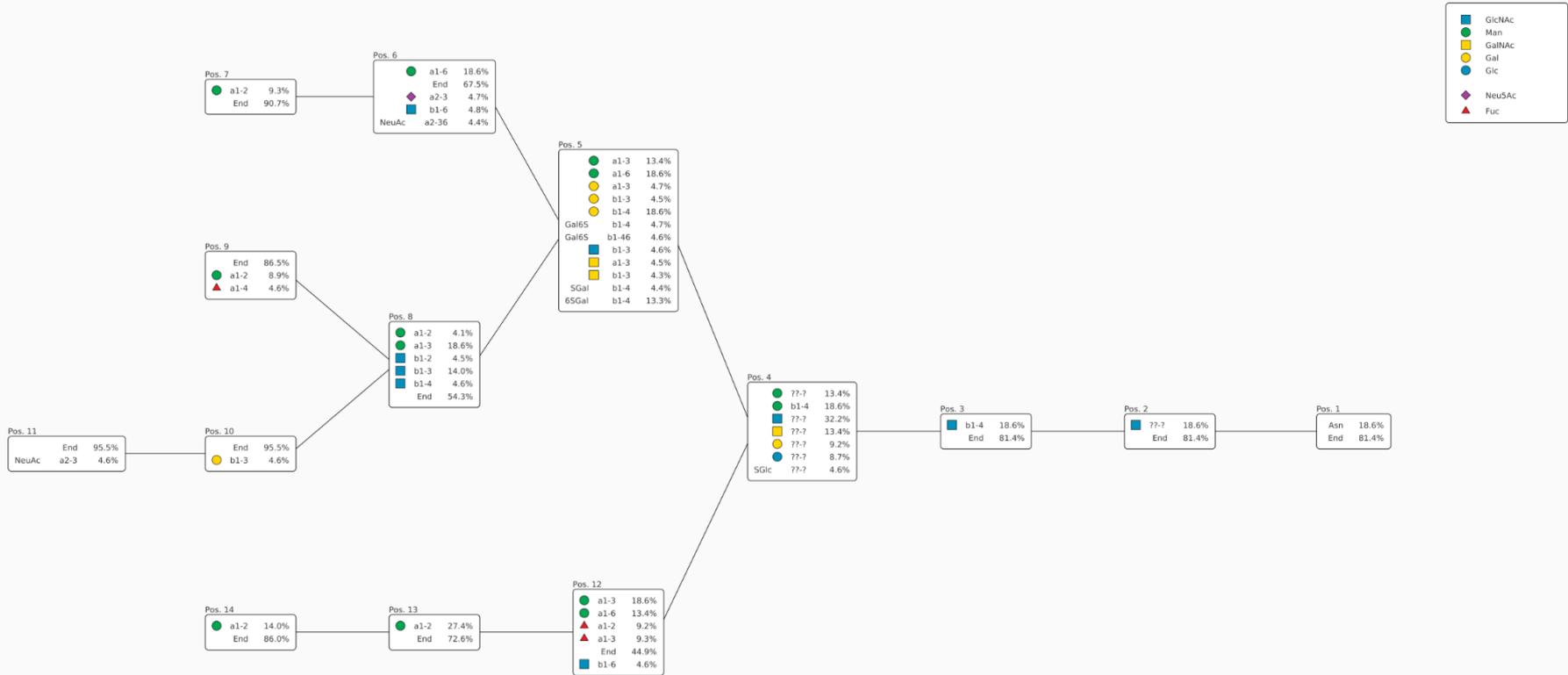
-  GGDB - glycogenes
-  GDGDB - glycogene diseases
-  GlycoNAVI-Genes
-  GlycoProtDB - glycoproteins
-  LfDB - lectins
-  GlycoNAVI-Proteins
-  GlycoProteins
- Glycans/Glycoconjugates**
-  GlyCosmos Glycans
-  GlycoProtDB - glycoproteins
-  GlycoNAVI-Glycans

Glycomes

Glycoproteins list

Extracted glycoproteins list from UniProt

Protein	UniProt	Number of Glycoslationsites	Gene Symbol	Organism
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sodium channel subunit beta-1	A5A6L6	4	SCN1B	Pan troglodytes
Killer cell immunoglobulin-like receptor 2DS4	P43632	5	KIR2DS4	Homo sapiens
Matrix protein 2	A0A290YQ92	1	M2	Influenza A virus (A/Canada/32A/2015(H3N2))
Matrix protein 2	F0TU71	1	M2	Influenza A virus (A/Puerto Rico/8-V24/1934)
Matrix protein 2	C4LP44	1	M2	Influenza A virus (A/Managua/68.01/2007(H3N2))
Germin-like protein subfamily 3 member 3	P94072	1	GER3	Arabidopsis thaliana
Type 2 lactosamine alpha-2,3-sialyltransferase	Q6KB54	6	ST3GAL6	Pan troglodytes
BTB/POZ domain-containing protein	Q9XWH8	6	btb-14	Caenorhabditis elegans



5090

Image from MCAW-DB

Human Protein Atlas

Tissue with high expression from Human Protein Atlas

- skin

[Open LiteMol Viewer](#)

[Open LiteMol Viewer](#)

[Open LiteMol Viewer](#)

[Open LiteMol Viewer](#)

ation Site from UniProt]

GlyCosmos Portal

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.

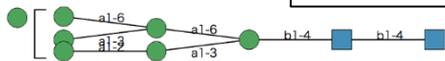
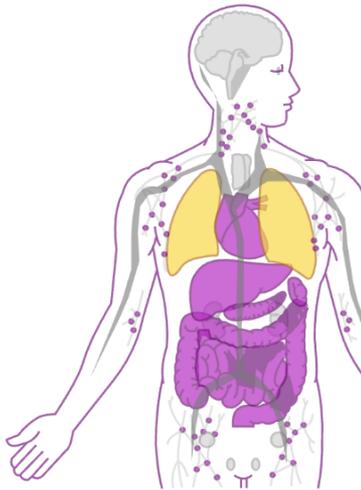
GlycomeAtlas

GlycomeAtlasV5

Human Mouse Zebrafish

Human

- New Home
- Old Home
- Help
- Feedback
- Data source
- Glycan search(β)**
- Profile input(β)



All Clear

GlycomeAtlasV5

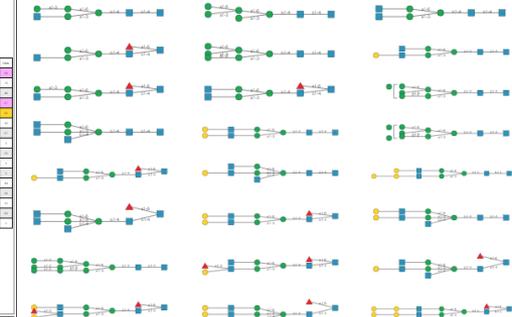
Human Mouse Zebrafish

Mouse

- New Home
- Old Home
- Help
- Feedback
- Data source
- Glycan search(β)**
- Profile input(β)



Mouse-Large Bowel

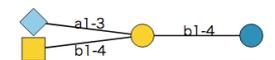


GlycomeAtlasV5

Human Mouse Zebrafish

Zebrafish

- New Home
- Old Home
- Help
- Feedback
- Data source
- Glycan search(β)**
- Profile input(β)



All Clear

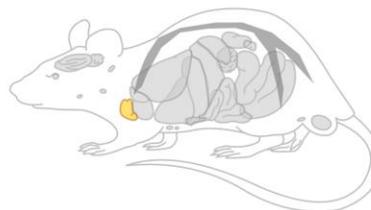
Yamakawa N, Guerardel, Y. et al. Nature communications. 9(1):4647, 2018.

LM-GlycomeAtlas

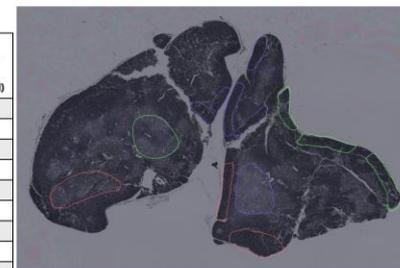


LM-GlycomeAtlas v.1.0 is a web tool visualizing the data from Lectin Microarray analyses using 45 lectins by the Kuno Laboratory at AIST.

- 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 tissue sections



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 Node	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

All Data | Averaged Data

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

Open Access

Article

LM-GlycomeAtlas Ver. 1.0: A Novel Visualization Tool for Lectin Microarray-Based Glycomic Profiles of Mouse Tissue Sections

by Chiaki Nagai-Okatani ^{1,*} , Kiyoko F Aoki-Kinoshita ² , Shuichi Kakuda ¹, Misugi Nagai ¹, Kozue Hagiwara ¹, Katsue Kiyohara ¹, Noriaki Fujita ¹, Yoshinori Suzuki ¹, Takashi Sato ¹, Kiyohiko Angata ¹ and Atsushi Kuno ^{1,*} 

¹ Glycoscience and Glycotechnology Research Group, Biotechnology Research Institute for Drug Discovery, National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Ibaraki 305-8568, Japan

² Glycan & Life Science Integration Center (GaLSIC), Faculty of Science and Engineering, Soka University, Hachioji, Tokyo 192-8577, Japan

* Authors to whom correspondence should be addressed.

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

GlyCosmos Portal

Welcome to GlyCosmos!

As a foundation for integrating glycoscience research, we have started developing the Glycoscience Portal called GlyCosmos.

[Learn more](#)

Submissions

Glycans

GlyYouCan

GlyYouCan is the international glycan structure repository.



Glycoconjugates

GlyCoMB

GlyCoMB is the international glycoconjugate repository. Currently under construction.



Glycoproteomics Data

GlycoPOST

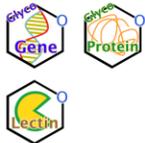
GlycoPOST is a data repository of sharing glycoproteomics data.



Resources

Database

Genes/Proteins/Lipids



Database

Glycans/Glycoconjugates



Database

Glycomes



Database

Pathways/Diseases



News

Tweets by @GlyCosmos



The beta version of the GlyCosmos Portal has been released! glycosmos.org

Oct 6, 2018

[Load more Tweets](#)

Embed

[View on Twitter](#)

[Follow @GlyCosmos](#)

Other Related Resources

Glycoinformatics Consortium (GLIC)

provides and maintains a centralized source of software and databases for glycoscientists.

Glycomics@ExpASY

is the glycomics section of the SIB Bioinformatics Resource Portal which provides access to scientific databases and software tools in different areas of life sciences.

GlyConnect

is a platform integrating sources of information to help characterise the molecular components of protein glycosylation.

GlyGen

A data integration and dissemination project for carbohydrate and glycoconjugate related data, retrieving information from multiple international data sources, integrating and harmonizing this data via a user friendly Web interface.

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

Pathways

GlyCosmos Pathway Database



GlyCosmos Pathways

Pathways from Reactome containing glycoproteins as annotated in UniProt.

[GlyCosmos link](#)

Diseases

ACGG-DB



Glyco-Disease Genes Database (GDGDB)

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

— ACGG-DB in ACGG

<https://acgg.asia/db/diseases/gdgdb>

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.

— ACGG-DB in ACGG

<https://acgg.asia/db/diseases/pacdb>

GlycoNAVI



GlycoNAVI-Diseases

GlycoNAVI-Diseases is dataset of glycanform for diseases. This is the content of GlycoNAVI. Currently under construction.

— GlycoBio in GlycoNAVI

[GlycoNAVI link](#)

[Twitter](#) [GitHub](#)



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

Funded by NIH Common Fund.

Grant # 1U01GM125267 - 01

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Powered by Ruby on Rails.

Based on Bootstrap. Icons from Font Awesome. Web fonts from Google.



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[↑ Back To Top](#)

GlyCosmos Pathways

Pathway Names :

e.g. Metabolism



Click on a **Pathway Name** from the list below.

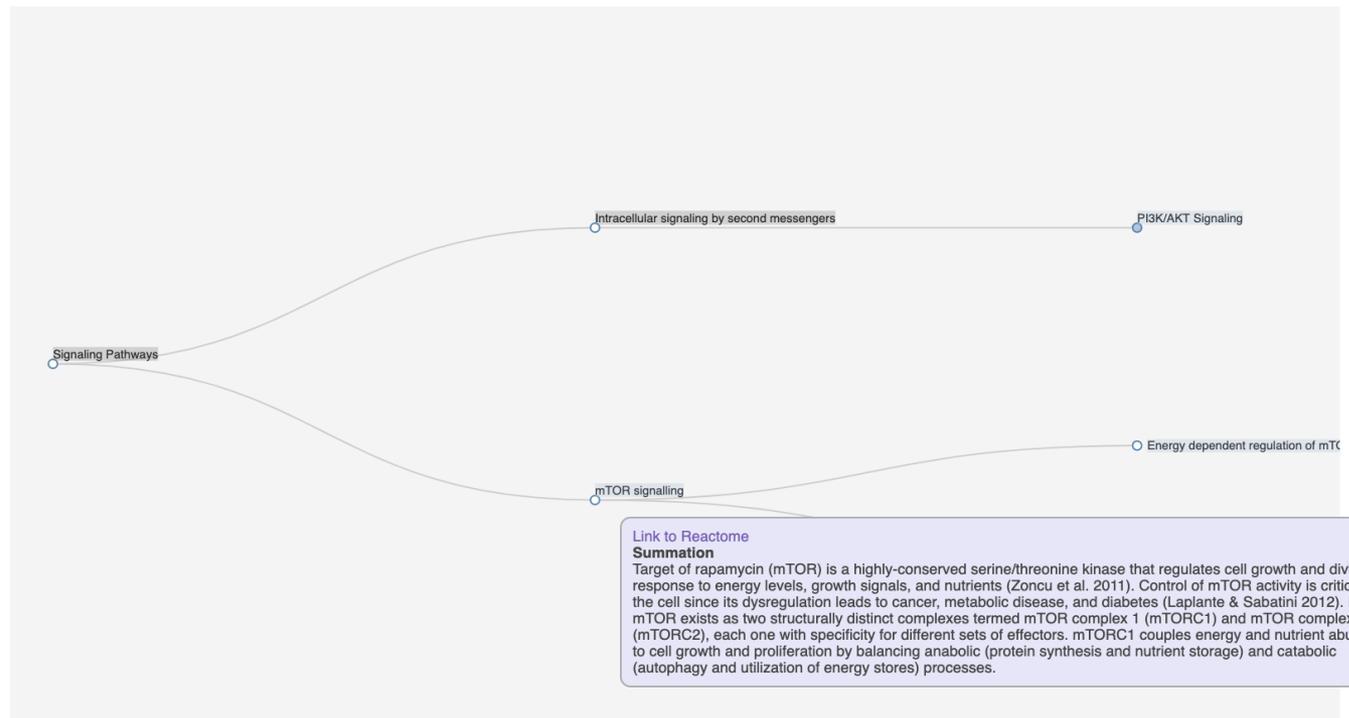
In the pathway map tree, click on circles to open/close subpathways, and click on pathways whose names are highlighted in light blue to view the detailed pathway map.

Keywords :

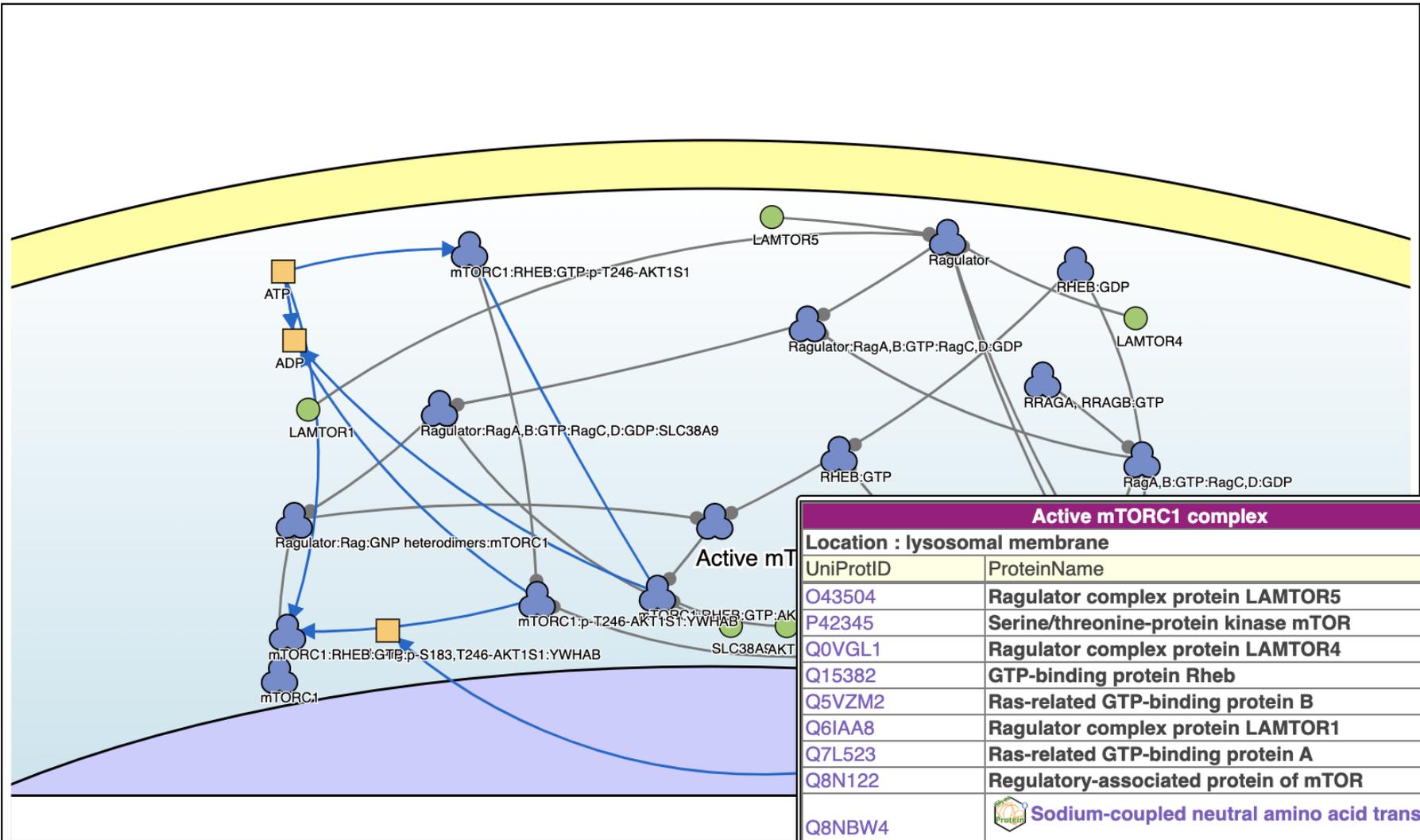
Homo sapiens regulator complex protein lamtor1

Event Hierarchy :

- [Autophagy](#)
- [Cellular responses to external stimuli](#)
- [Gene expression \(Transcription\)](#)
- [Immune System](#)
- [Signaling Pathways](#)

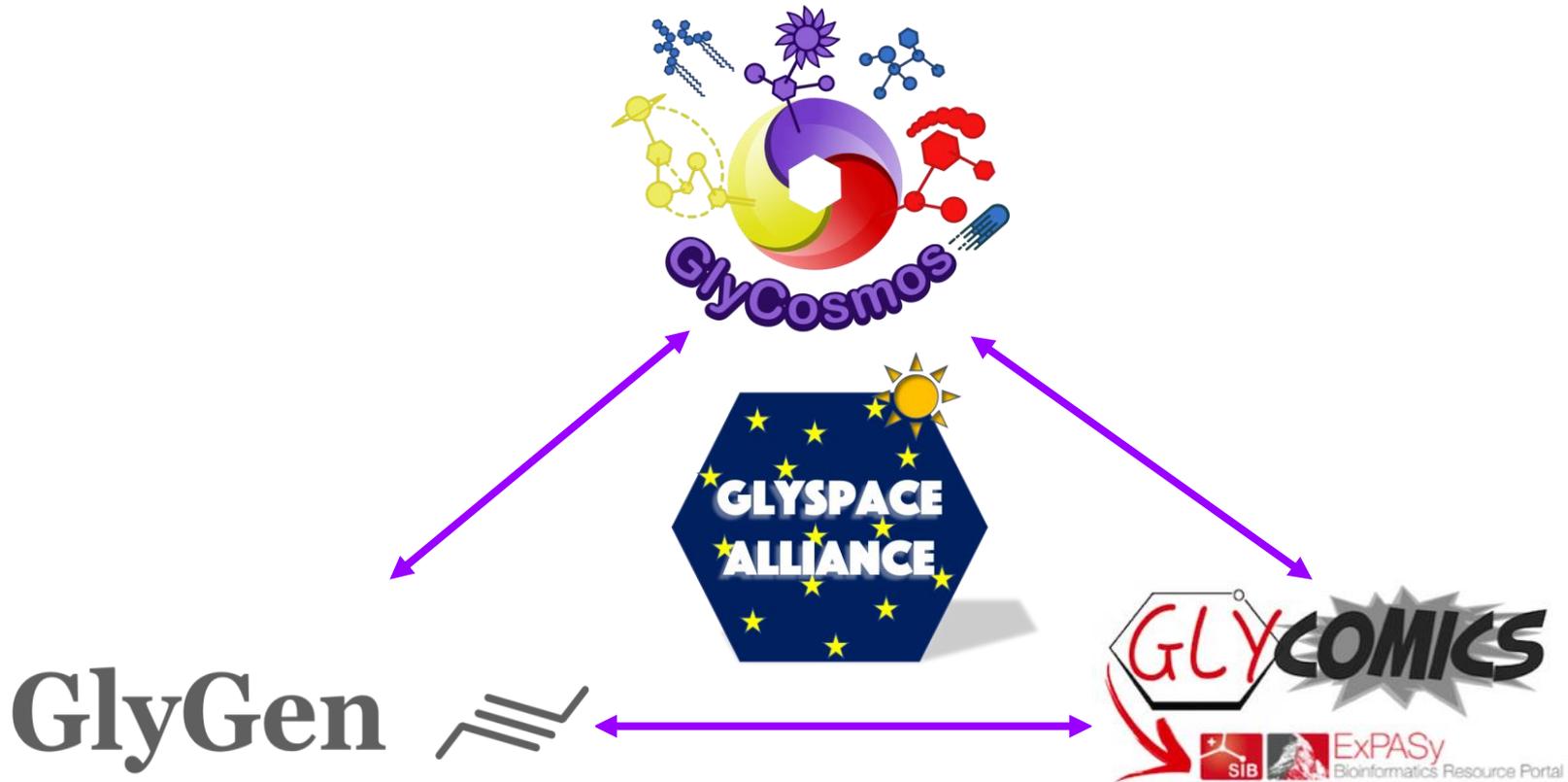


?pathway=mTOR signalling&species=48



Active mTORC1 complex	
Location : lysosomal membrane	
UniProtID	ProteinName
O43504	Ragulator complex protein LAMTOR5
P42345	Serine/threonine-protein kinase mTOR
Q0VGL1	Ragulator complex protein LAMTOR4
Q15382	GTP-binding protein Rheb
Q5VZM2	Ras-related GTP-binding protein B
Q6IAA8	Ragulator complex protein LAMTOR1
Q7L523	Ras-related GTP-binding protein A
Q8N122	Regulatory-associated protein of mTOR
Q8NBW4	 Sodium-coupled neutral amino acid transporter 9
Q9BVC4	Target of rapamycin complex subunit LST8
Q9NQL2	Ras-related GTP-binding protein D
Q9UHA4	Ragulator complex protein LAMTOR3
Q9Y2Q5	Ragulator complex protein LAMTOR2

SPV: a JavaScript Signaling Pathway Visualizer, Bioinformatics, 2018



Established August, 2018 @ Warren Workshop

<http://glyspace.org>



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
- GlyConnect, GlyCosmos and GlyGen

Established August, 2018 @ Warren
Workshop

Open Data

Dynamic aspects of Glycobiology

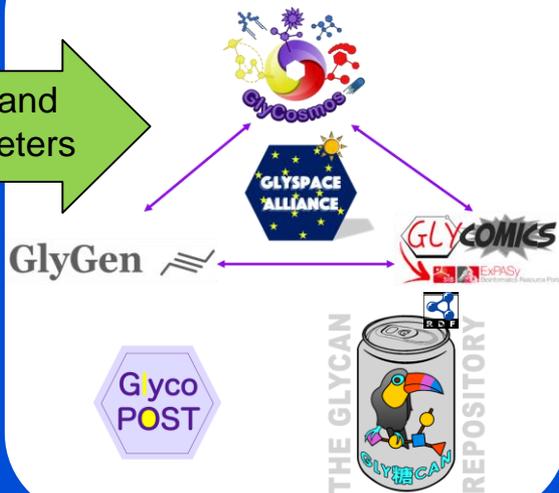
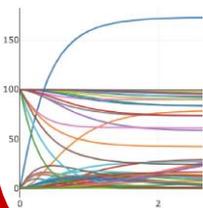
Systems Glycobiology Consortium

Life Science Data

High-throughput (cloud) computing



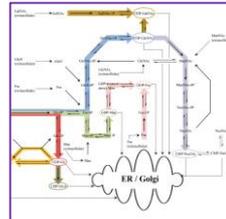
User Interfaces



Parameter estimation methods



Mathematical models



目的:

システム糖鎖生物学研究のための
のオープンプラットフォーム
の開発

- ・ データベース
 - ・ グライコミクス
 - ・ トランスクリプトミクス
 - ・ プロテオミクスなど
 - ・ 反応パラメーター
 - ・ パスウェイモデル
- ・ ソフトウェアモジュール
 - ・ オンラインでシミュレーションを実施するツール

True understanding of glycan function and applications in medicine, agriculture, energy, etc.

まとめ

- GlyCosmos が糖鎖関連データの基盤を提供している
 - 4ヶ月おきのリリースを通して継続的にデータの更新を実施している
- GlySpace Allianceと共同に信頼できるデータを共有している
- 今後の発展として、ダイナミクスを含む糖鎖の機能解析を可能にする
- 日本糖質学会のオフィシャルポータルとして、コミュニティからのコメント、提案、改良を歓迎
support@glycosmos.org

Acknowledgements

Soka University

Masaaki Shiota
Masae Hosoda
Tamiko Ono
Shinichiro Tsuchiya
Akihiro Fujita
Haruko Kitakaze

AIST

Noriaki Fujita
Yoshinori Suzuki
Kiyohiko Angata
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Funding agencies:

Integrated Database Project
(Japan Science and
Technology Agency (JST)
and National Bioscience
Database Center and NIH

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