Minutes of

The 17th MIRAGE Meeting

September 1, 2026, 9:00 – 17:30 BST

Worcester College
University of Oxford

United Kingdom

October, 2026

Dr. Carsten Kettner

(with notes from Prof. James C. Paulson)

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List of Participants

- Kiyoko Aoki-Kinoshita, Soka University, Tokyo, Japan
- Cathy Costello, Boston University, USA
- Ten Feizi, Imperial College London, UK
- Heeyoun Hwang, Korea Basic Science Institute, Cheongiu-si, Republic of Korea
- Guinevere Lageveen-Kammeijer, University of Groningen, The Netherlands (online)
- Niclas Karlsson, Oslo Metropolitan University, Norway
- Carsten Kettner, Beilstein-Institut, Frankfurt am Main, Germany
- Yan Liu, Imperial College London, UK
- Marissa Maciej-Hulme, Oslo Metropolitan University, Norway
- Georg Niggemeyer, MPI of Colloids and Interfaces, Potsdam, Germany
- Jim Paulson, The Scripps Research Institute, La Jolla, USA
- René Ranzinger, University of Georgia, Athens, USA (online)
- Pauline Rudd, Conway Institute, Abingdon, UK
- Sagar Dalal, Macquarie University, Sydney, Australia
- Weston Struwe, University of Oxford, UK
- Hiroaki Tateno, AIST, University of Tsukuba, Japan (online)
- Michael Tiemeyer, University of Georgia, Athens, USA
- Manfred Wuhrer, Leiden University, The Netherlands (online)

Excused: Daniel Kolarich, Frédérique Lisacek, René Ranzinger, Nicolle Packer, Erdmann Rapp, Joseph Zaia

The Working group

Agenda

Monday, September 1

9:00	Opening and Welcome *Carsten Kettner*
9:30	**Reports and discussions** Last year's activities, results, tatus and task list • Outreach • HUPO-PSI • GlyTouCan@NFDI4Chem • MS guidelines for glyan and glycoprotein database • Guideline builder • Glycan Microarray guidelines – extension and metadata *Carsten Kettner*
10:30	*Coffee break*
11:00	**Infrastructure** (ctd) • GlycoPOST – integration of the new MS Guidelines • GlyCouTan - update • GlyComb et al. *Kiyoko Aoki-Kinoshita*
11:30	**MS Guidelines for glycans and glycoproteins** comment from the community – revision needed? *Carsten Kettner*
12:30	*Lunch*
13:30	**Standards for lectin names** Proposal *Jim Paulson*
14:15	**Reporting issues for saponines** Proposal

	Georg Niggemeyer
15:00	*Coffee break*
15:30	**Outreach** • Social Media • Webinar *All*
16:00	**Outlook and tasklist** *All*
16:30	**General comments** feedback on this meeting/organisation, etc.
17:00	Closing remarks

Additional suggestions for the agenda

None

Welcome

All participants introduced themselves and gave many references to their participation in past MIRAGE meeting.

Reports

Past Activities

Outreach

This year marks the 75th anniversary of Beilstein-Institut which celebrates this landmark with its community at many opportunities such as symposia, working group meeting etc.

Jim will give a **Beilstein-Talk** on October 8th
(https://www.beilstein-institut.de/en/talks/biochemistry-targeting-the-sialic-acid-axis/)

MIRAGE details collected by ChatGPT

- Jim's ChatGPT search of MIRAGE and its usage shows that it is being used (pasted at the end of these minutes)
- Need to consider how to raise more awareness
- Including MIRAGE in the Global Roadmap would be effective (Marissa)

HUPO-PSI

The 2026 HUPO-PSI Workshop took place in Rome, Italy, April 13-16.
Frédérique was the only member from MIRAGE who was able to attend in person. We have planned a session on Glycomics. Most speakers were scheduled to give remote talks as they were unable to travel, either. However, due to organizational reasons, our session has been moved to another room without prior announcement so nobody on site was aware of this and thus the room was empty. In the end we cancelled our session. As the proteomics community is becoming aware of the impact of glycosylation of proteins, we consider the membership at HUPO-PSI with our own PSI-Glyco working group important to get in contact and still have further opportunities to talk with each other.
The 2027 HUPO-PSI Workshop will take place in Antwerp, Belgium, April 6-9, 2027.

Further suggestions for outreach

Building relationship with the European Glycoscience Community - affiliated with European Chemical Society https://www.euchems.eu/divisions/division-of-glycoscience/

- representatives from most countries in Europe
- meetings 2x a year

- now official
- contact person:
- Chair: Rachel Havey-best **person to contact**
- Treasurer: Marissa
- Vice Chair: Amelia Rauter
- Secretary: Trinidad Vilasco-Torrijos

Getting included in the Glycoscience Roadmap

- *Nature Communications* (Antonio Cerullo, editor) is interested to publish the roadmap, but other options are being considered for a launch
- Coordinate announcement of release with MIRAGE to enhance visibility across platforms (social and others)

Infrastructure

NFDI4Chem

Beilstein-Institut is partnering organisation of the Germany National Research Data Initiative for Chemistry. The foundation takes part (via CK and the scientific director, Dr. Wendy Patterson) in a number of task groups such as Repositories and Standards, and STRENDA DB is one of the core repositories of this consortium. Apart from NFDI4Chem, there are many other NFDI consortia, see Network.

As presented and agreed on previous MIRAGE meetings, CK contacted the NFDI4Chem consortium's leads with the aim to associate GlyTouCan and/or GlycoPOST to the NFDI4Chem's list of recommended databases or repositories.

Even though the feedback was very positive, and after Kiyoko has submitted the requested metadata we haven't made any progress with the onboarding process.

Carsten will make another inquiry.

Update on Database Infrastructures

Kiyoko presented an update on database infrastructure

- GlyTouCan v4 will be launched soon
  - New browser interface
  - Archetypes to be enabled to find families of structures where not all structural features are found
  - Archetype symbol form is being worked on with the SNFG group
- Glycan Scope Initiative: What is a glycan?
- GlycoPost

  - Detailed experimental information on glyycans
  - GlyTouCan ID will help link databases
- Jamboree happening early October in Tskuba
- GlyComb
  - glycopeptides and glycoproteins;
  - Glycolipids coming: Lipidomics nomenclature being updated by Lipid Maps
- PGAtlas
  - Under development, consortium established
  - MS guidelines under consideration

Other activities

MS guidelines for glycan and glycoprotein data

Published in MCP,**25**(2):101473. doi:10.1016/j.mcpro.2025.101473.

Guideline builder: https://tinyurl.com/44uchvx5

We haven‘t made further progress. However, as CK is also in charge of (technically and design-wise) of the Beilstein-Institut‘s webpage, this topic will be re-addressed with the further extensions of functionalities of the pages.

Glycan Microarray guidelines - extension and metadata

There are four subgroups working on updating the guidelines, extending the metadata to coordinate better with GlyGen’s microarray repository

According to René, the group has not made any further progress due to other commitments.

Task list from the last year

Here, the group reviewed the task list compiled at the previous MIRAGE meeting. Some tasks have been finalized, some other raised new questions. The corresponding tasks will be listed in a new task list at the end of this document.

- Letter to editors: 15 years of MIRAGE (Daniel contacted, will start soon)
- LC template (Kiyoko) - not needed? Already included in the latest MS guidelines in GlycoPOST
  - **ACTION**: CE should also be handled (Kiyoko to check)

- Recommendations on the website (Carsten) – drafted
  - Comments:
    - NAN (NMR advanced network) - NSF-funded NMR database (directed by member from CCRC, U. Madison-Wisconsin and UConn) could be considered for NMR database
    - Swap Description and Guidelines in the table (Carsten) Reorder columns Data/Description/Repository/Mirage Guidelines
    - IR spectra should be added to MS
    - ion mobility should be in the latest MS guidelines
    - IMEx consortium data could be considered
    - Liquid chromatography data could be moved to “Glycans” since it is a method like sample preparation, then the database repository is the ultimate glycan structure
    - change Glycans -> Glycan structures
    - Change the name from Lectin to Glycan-binding protein (or even a broader term e.g Glycan-binding things? Glycan-binding molecules (GBMs))
    - (Niclas:) Glycan probes now often used. guidelines for specificity specification? (NO: see above)
    - The Guideline Builder should have the keywords (like antibodies) to ensure that people are aware and use the right guidelines
  - **ACTION**: small group should consider how this table could be better organized (**Jim, Cathy, Carsten**)

- Should we include antibodies in this list? (Marissa)
  - **DECISION**: No, they are already covered in glycan and lectin array data guidelines (Weston and Jim)

- Suggestion for Spatial glycomics guidelines?
  - **ACTION**: MikeT contacts Rick, Peggy, Arun, Ron (Hopkins)

MS Guidelines - revision

We received a comment upon our publication of the update of the MS guidelines saying that the complete details about the mass spectrometer used, according to MIRAGE are missing.

We should revise the Guidelines in this perspective and add these details as they are also asked by other MS Guidelines (e.g. NFDI4Chem MS Guidelines).

In addition, in the "old" Guidelines, these statements are still required. So, some information must have been gone lost during the update.

A formal agreement about the status of the MIRAGE guidelines is required before any amendments can be implemented in GlycoPOST.

DECISION/SUGGESTION: re-introduce and update the guidelines accordingly and publish the revised version.

Proposals

Proposal: Standards for lectin names

Hiroaki proposes guidelines for naming convention for lectins (using UniLectin or UniProt)

- Kiyoko proposes LfDB IDs
- vendors should be contacted
- similar to MHC nomenclature standardization efforts (Ten)
- machine-readable naming may be considered (Carsten)
    - unique name should be attached to IDs
- specificity data guidelines? (Marissa)
- IUPAC could be considered (Carsten)

ACTION: small working group needs to gather to identify the problem (Hiroaki, Jim, Kiyoko, Frederique?) and next steps

Proposal: Saponine reporting standard

Georg presented his findings on saponins (steroids that are complexly glycosylated) deposited in the Coconut Database which inlcudes all natural products (~700,000 structures with citations). Out of them 144,000 are glyco-molecules of them 31,000 are saponins. More filtering revealed 8000 saponins and the validation resulted in 936 validated saponins (~10%) while remaining structures made no sense. The reason is that the structures are translated wrong from one structural representation to the next. With a tool, they were able to fix it so that in the end 11,000 structures could be validated and linked to their sources. With these, a new database PeaNUT was created.

This raised the following questions:

- How can IDs be assigned to saponines, or other glycoconjugates/glycosides (glycans attached to molecules that are not lipids or peptides; glycosylated natural products)?
- Would reporting standards and data deposition requirements for journals overcome this issue?

In an open discussion the following suggestion/decision has been made:

- Georg will prepare a draft/framework for some guidelines for the next meeting.

Outreach

MIRAGE Flyer

At the previous meeting, we agreed on the general appearance of the flyer. However, before finally producing the flyer, Carsten let the group to revise the draft, again. In general, the flyer was considered looking good. However, some questions have been raised and some comments/suggestions need to be implemented in the final version:

- Biorender images need to be confirmed – Guinevere confirmed that none were used
- Glycolipids are not the same size, make sure that all glycan classes are equally represented and same size (to not bias/suggest that one class is more important than the other.
- Glycans can be made consistent using SNFG (can take from GlyTouCan?)
- Integration with Repositories, Databases and Software tools has been possible through MIRAGE (Jim) → need to advertise more/better

Three-fold, six pages flyer

- Update Joe Zaia -> Joseph Zaia
- Typo in Guinevere‘s name
- SNFG symbols under Aims should be the official symbols and the same size
- Official symbols: Table 2 of https://www.ncbi.nlm.nih.gov/glycans/snfg.html
- Update guidelines list (remove “Analysis”) and make sure the fonts are the same:
  - Mass Spectrometry of glycans and glycoconjugates
  - Liquid Chromatography
  - Capillary Electrophoresis

- Glycan Microarrays
- Lectin Microarrays

- Move QR code to Contact area
  - The image under Guidelines:
  - “Enhancing Glycoscience” is not centered
  - Make the text bigger
  - MIRAGE fonts should be the same
  - Make the “Scientific Community” groups plural
- Why Glycoscience?
  - “How the data *were* generated”
  - “access data that *are* interoperable”

ACTION: Carsten will finalize the flyer and print a bunch for the next meeting. Guinevere is willing to give a hand with the final polishing. However, more volunteers for proof reading are welcome.

Relevance of MIRAGE Guidelines

Google scholar search showed that MIRAGE guidelines are useful (Jim)

- https://scholar.google.com/scholar?cites=10281636613363682043&as_sdt=2005 scion=0,5 &hl=en
- Use this information to go to Journals to recommend MIRAGE
- there are 121 citations of the MIRAGE Guidelines (by October 16, 2026)

General

Everyone to add links to MIRAGE on their websites (MIRAGE can link back).

ChatGPT‘s findings on MIRAGE

Jim prompted ChatGPT for the usage of the MIRAGE guidelines in publications and beyond. Here is the answer:

Yes, the MIRAGE (Minimum Information Required for a Glycomics Experiment) guidelines are used in publications and integrated into major journals and repositories within the

glycobiology field, though adoption varies from strict enforcement to serving as a conceptual framework. [1, 2, 3]

Extent of Adoption

- Journal Integration: Leading specialty publications—such as the Oxford journal *Glycobiology* and *Molecular & Cellular Proteomics*—helped shape and promote the standards (such as the foundational mass spectrometry and Athens guidelines). Journals use them as baselines or direct checklists for metadata parameters (instrument setup, sample preparation, and chromatography). [1, 2, 3, 4]
- Database and Repository Compliance: MIRAGE standards directly dictate how data structures are organized in major international glycomics informatics resources. Compliant repositories that ingest structured data and metadata from publications include UniCarb-DB, UniCarb-DR, GlycoStore, and GlycoPOST. [5]
- Practical Implementation: While explicit, line-by-line compliance for every single metadata parameter is not universally mandatory across all general biology journals, the principles are widely cited by analytical experts, reviewers, and specialized papers to ensure experimental reproducibility. The framework continues to expand into adjacent areas, with updated modules covering advanced areas like glycoproteomics and capillary electrophoresis. [2, 3, 6, 7]

If you'd like, I can:

- Detail the specific metadata requirements for mass spectrometry or liquid chromatography under MIRAGE
- List the compliant repositories where you can deposit or search standardized glycomics data

Let me know how you'd like to proceed.

[1] https://www.sciencedirect.com
[2] https://pmc.ncbi.nlm.nih.gov
[3] https://pure.mpg.de
[4] https://pure.mpg.de
[5] https://en.wikipedia.org
[6] https://scholarlypublications.universiteitleiden.nl
[7] https://www.sciencedirect.com

Several core public repositories and integrated databases allow you to deposit or search standardized glycomics data in accordance with the MIRAGE Guidelines. These resources are organized by the specific type of experimental data they host: [1]

Mass Spectrometry (MS) Repositories

- GlycoPOST: The primary repository for raw and processed glycomics and glycoproteomics MS data. It fully integrates MIRAGE presets (such as sample preparation, liquid chromatography, and peak list generation) directly into its multi-step submission workflow. It includes a secure embargo feature that allows researchers to keep data private until a paper is published. [2, 3, 4]
- UniCarb-DR: A specialized repository designed for depositing annotated glycomics MS data, specifically tailored to ingest structural interpretations and annotations generated using GlycoWorkbench software. [5, 6]
- UniCarb-DB: A searchable public database containing high-quality, structurally annotated MS/MS spectra of glycans that conforms to standardized reporting conventions. [7, 8]

Glycan Structure Registries

- GlyTouCan: The official international glycan structure repository. It assigns unique, global accession numbers to glycan structures based on structural topology data. Obtaining a GlyTouCan ID is standard practice for identifying experimental structures before publishing or submitting data to other platforms. [7, 9, 10]
- GlyComb: A companion repository to GlyTouCan that specifically tracks and assigns unique registry accession numbers to complex glycoconjugates. [5, 7]

Chromatography & Microarray Repositories

- GlycoStore: A curated database built to store and search standardized liquid chromatography (LC) and capillary electrophoresis elution profiles. It provides cross-referenced metadata for composition analysis.
- CarbArrayART: The Carbohydrate Microarray Analysis and Reporting Tool. This database archives and manages glycan microarray data in adherence with MIRAGE's functional glycan array standards. [1, 6, 11]

Unified Search Portals

Instead of searching each archive individually, you can use central semantic hubs like the GlyCosmos Portal or GlyGen. These platforms pull, cross-reference, and unify data across GlycoPOST, GlyTouCan, and public proteomic datasets to offer an integrated, multi-omics search environment. [7, 12, 13]
Are you planning to deposit new experimental data for a pending publication, or are you looking to query existing raw data for a meta-analysis? Let me know so I can guide you through the process.

[1] https://www.beilstein-institut.de
[2] https://glycopost.glycosmos.org
[3] https://glycopost.glycosmos.org
[4] https://bioregistry.io
[5] https://pmc.ncbi.nlm.nih.gov
[6] https://link.springer.com
[7] https://glycosmos.org
[8] https://glic.glycoinfo.org
[9] https://core.ac.uk
[10] https://www.glygen.org
[11] https://www.psidev.info
[12] https://www.glycoforum.gr.jp
[13] https://pmc.ncbi.nlm.nih.gov

Next meeting

The 18th MIRAGE meeting is planned to take place in Limburg, July 12, 2027, in conjunction with the Beilstein Glyco-Bioinformatics Symposium (https://www.beilstein-institut.de/en/symposia/glyco-bioinformatics/)

Task list

The following tasks have been agreed and the task list will be monitored on a monthly basis by CK. The complete, current list is available on Google drive. In this table, you will find the new tasks as negotiated at our meeting.

Task	Description	Who (lead)
NFDI4Chem	Onboarding GlyTouCan, contact NFDI4Chem, again	KAK, CK
MS Guidelines / Glyocproteomics	Update guidelines by missing statement	CK, FL (co-authors)
Align MIRAGE with EGC	Connect with EuChemS, contact Rachel Havey; goal: collaboration, harmonization, standardization of efforts	CK
Web site: recommendation	Revision of the table	CK, JP, CC
Lectin nomenclature	taskgroup to sort out the next steps, draft for the next meeting	JP, HT
Saponin standards	draft of the requirements	GN
Letter to editors	15th anniversary of MIRAGER, list of guidelines	DK
Outreach	MIRAGE flyer, finalisation, print	CK, GLK
Open tasks from last meeting		
Webinar	Planning a webinar on data upload and sharing	CK, KAK; RR
MS Guideline Builder	Integrate changes from discussion	CK, KAK, RR
Social Media Messages	Provide CK with MIRAGE content	CK, al
Validation White Paper	Working title „How to make lots of enemies“	MW, NK, MMH, CC, WS, MT, GLK, Morton, Nick
Webpage	Revise MIRAGE project page regarding the content, mission etc. which needs some update	CK
	Update reference paper page (5 most recent papers each)	CK, all
News page	Add news feed from Bluesky, LI, etc.	CK

Task	Description	Who (lead)
	Provide recent papers that use MIRAGE	JP, WS, MF, NK
Links to MIRAGE page	CCRC webpage	MT
	MW webpage?	MW
Next Meeting	In conjunction with Warren Workshop	CK, WS