



Minutes of

The 15th **MIRAGE** **Meeting** **WIBACE**

July 17 - 18, 2024
9:00 – 17:30 CEST
Dom Hotel Limburg
Germany

July, 2024
Dr. Carsten Kettner

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List of Participants



Maria Angeles Canales Mayodomo, University of Madrid, Spain

Cathy Costello, University of Boston, USA

Kiyoko Aoki-Kinoshita, Soka University, Tokyo, Japan

William Hackett, Boston University, USA (online)

Niclas Karlsson, Oslo Metropolitan University, Norway (online)

Carsten Kettner, Beilstein-Institut, Frankfurt, Germany

Josh Klein, Boston University, USA (online)

Daniel Kolarich, Griffith Institute, Gold Coast, Australia

Guinevere Lageveen-Kammeijer, University of Groningen, The Netherlands

Frédérique Lisacek, Swiss Institute of Bioinformatics, Geneva

René Ranzinger, University of Georgia, CCRC, Athens, USA

Pauline Rudd, Oxford, UK

Weston Struwe, University of Oxford, UK

Hiroaki Tateno, AIST, Ibaraki (online), Japan

Michael Tiemeyer, University of Georgia, CCRC, Athens, USA

Manfred Wuhrer, Leiden University Medical Center, The Netherlands

Excused: Yukie Akune, Ten Feizi, Yan Liu, Jim Paulson, Nicki Packer, Erdmann Rapp,
Joe Zaia

Agenda

Wednesday, July 17

9:00	Opening and Welcome Carsten Kettner
	Overview of MIRAGE activities
10:00	Status Reports Lectin Array Guidelines (~10 min) - Hiroaki Tateno Glycoproteomics Guidelines (~10 min) - Frédérique Lisacek Glycan Array Guidelines (~10 min) - Rene Ranzinger MS guidelines (~10 min) - Kiyoko Aoki Kinoshita, Daniel Kolarich
10:45	<i>Coffee break</i>
11:00	Collaboration with PSI (~30 min) - Carsten Kettner
11:30	Template LC-Guidelines (~45 min)- Kiyoko Aoki-Kinoshita https://glycopost.dev.glycosmos.org/review
12:15	<i>Lunch</i>
13:15	Outreach: Support of Speakers (~30 min) Integration of MIRAGE into talks?
13:45	Drafting MIRAGE slide in breakout groups (~30 min) Discussion MIRAGE slide (~30 min)
14:45	<i>Coffee break</i>
15:00	What is minimum information? René Ranzinger
16:00	Discussion glycan function representation Mike Tiemeyer
17:30	Closing Remarks

Thursday, July 18

9:00	Opening and reconciliation Carsten Kettner
9:15	Revision: MIRAGE recommendations
10:00	Revision: MIRAGE landscape image Intro: what's difficult with this image? Organization of 3 break out groups
10:15	<i>Coffee break</i>
10:30	Breakout groups - Landscape draft and update
11:00	Consolidation
11:30	MIRAGE and journals
12:00	<i>Lunch</i>
13:00	Breakout groups in <ul style="list-style-type: none">• Finalization of the MS manuscript• Revision: MIRAGE flyer, flyer pptx template
14:00	Consolidate breakout groups
14:30	Outreach: Social media activity <ul style="list-style-type: none">• survey: who is using which social media channel?• Twitter/LinkedIn accounts?• What and who posts?
15:00	<i>Coffee break</i>
15:15	Outreach: Logging of activities and papers? Background: Showing the impact of MIRAGE, journals not sure about activities of the project
15:45	Open discussion
17:00	Closing Remarks

Results

Past Activities

NFDI4Chem

Beilstein-Institut is partnering organisation of the [Germany National Research Data Initiative for Chemistry](#) funded by the German Ministry for Research and Education (BMBF) for 10 years maximum. The foundation takes part (via CK and the scientific director, Dr. Wendy Patterson) in a number of task groups (e.g. TA3 – Repositories, TA4 – Standards), and STREND DB is one of the [core repositories](#) of this consortium. Apart from NFDI4Chem, there are many other NFDI consortia, see [Network](#).

CK suggested to contact the head of the NFDI4Chem consortium to also associate one of the glyco-related databases or repositories.

Result: Yes, GlyTouCan and GlycoPOST

Further contacts are suggested to make with other NFDI consortia such as [DataPLANT](#), [NFDI4Microbiota](#), [NFDI4Cat](#) *et al.*

Additional questions have been discussed:

- Is there a place for Knowledge bases? → Yes, NFDI4Chem is maintaining a Knowledge base on RDM in general.
- What about PubChem?
- Can we get them to make Glyco part of the training initiatives? → Would be part of TA5 of NFDI4Chem (Community and Training), depends on our interest to bring in our expertise
- Do they consolidate/integrate ontologies or dictionaries? → There is a collaboration between NFDI4Chem and NFDI4Cat to consolidate common ontologies and CVs. In addition, one of the demands of the BMBF is to avoid multiple inventions of the same service but this will be done in Phase 2 of the funding period (which has just started)
- They are going to implement a public common login scheme (like google account)? → Yes, TA3 offers some services for e.g. Oauth, i.e. authentication techniques.

HUPO-PSI

As agreed at the previous MIRAGE meeting held in June 2023, a sub-group (FL, KAK, CK) drafted a proposal for a group charter between MIRAGE and HUPO-PSI. This charter (see appendix) has been presented at the HUPO-PSI meeting in March in Japan by KAK and as of July 15, the proposal has been accepted by the PSI Steering Committee.

The charter is an agreement between a working group and the PSI to work on the designated topics that are described in the proposal. The aim for MIRAGE is to increase visibility and use of the MIRAGE guidelines and to cooperate with PSI on overlapping areas such as glycoproteomics. This means that, of course, MIRAGE is still independent but joining forces with other initiatives.

Our current role is orientation and learning from the existing infrastructure rather than immediately actively contributing

Some minor modifications still need to be made in the group charter document before it will be integrated in PSI's online infrastructure.

Glycan Microarray Guidelines

A working group has been established to define metadata for glycan microarray experiments that are required to potentially create repositories and databases. In addition, this working group is discussing further extensions of the guidelines where necessary.

MIRAGE webpage

After the survey on all members of the MIRAGE Commission on their willingness to still dedicate time to the project, the "People" list on the website has been consolidated. Those members that did not respond were removed from the Commission list and moved into the "Contributors" list. If these people are willing to work more actively in the Commission, they are welcome to be moved back into the Commission's list.

Status Reports

Lectin Microarray Guidelines

HT presented the last version of the guidelines and commented on some changes. He also presented a generated example based on a real manuscript. This example is the guidelines along with the information given in the manuscript.

As soon as this example is approved by JP and LM, it can be published on the MIRAGE website followed by drafting a manuscript to publish the guidelines in a peer-reviewed journal which may happen by the end of this year (see task list at the bottom of this document).

Glycoproteomics Guidelines

These guidelines have been evaluated by members of the glycoproteomics community and extensively commented. This comments have been incorporated in the guidelines. Since then, the guidelines did not make further progress as at the previous MIRAGE meeting it was suggested to incorporate the glycoproteomics guidelines into the MIRAGE MS guidelines due to the strong overlap in the description of the techniques used. A break-out group will continue working on this (see task list at the bottom of this document).

Mass spec Guidelines

NK presented the revised MS guidelines. He suggested to include an orbitrap and additional parameters. In addition, he made a suggestion for a validation and scoring schema which opened a wide discussion on both the schema itself and whether the guidelines should prescribe how to validate data. Consensus was that validation should be elaborated by the user rather being prescribed by MIRAGE.

Some unclear definitions in the revised document may lead to various developers' interpretation and thus should be clarified. The revised document is accessible on Google drive.

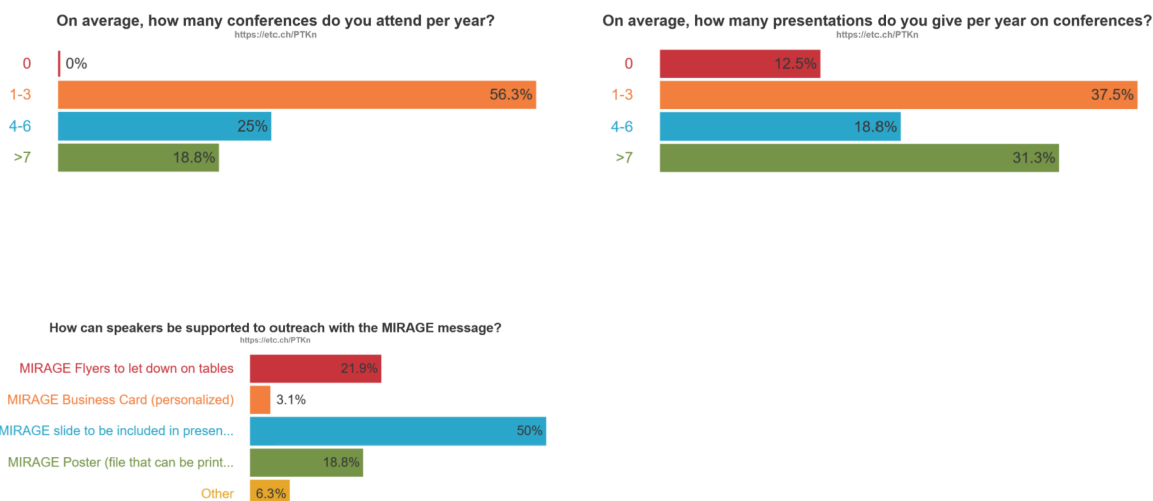
LC guidelines

The LC guidelines have been incorporated in GlycoPOST. Yushi presented the LC template that comes along with sample preparations and mass spec. The template is open for review on the GlycoPOST pages.

Working Results

Outreach – Support of Speakers

Survey on conference attendances by the members of the MIRAGE Commission:



Obviously, MIRAGE members speaking at conferences could be best supported with a general slide to present the MIRAGE activities. Flyers and posters are considered medium support, and other materials such as business cards were considered least relevant.

Other suggestions included kitchen magnets, key chains, MIRAGE as wifi password at glyco conferences, standard QR codes, unique hashtags and webinars.

Break-out groups

Three working groups were working on (conceptual) drafts for a slide. The drafts have been presented and discussed

Further action points, see task list on the bottom of this document.

RR collected meetings held in 2024 and 2025 which the members of the MIRAGE are planning to attend either as speakers or as participants and at which the new slide could be presented.

Discussion – What is Minimum Information?

RR initialized this discussion with the question: what is minimum and who is user/consumer of that information?

- starting with Will's proposal for definition of minimum information, i.e. understandable, reproducible
- who benefits from MI:
 - reviewer- identifies error sources & confounders
 - editors- ensures quality
 - authors- promotes quality
 - readers- error sources
 - experimentalists- reference points and confounders
 - educators
 - bioinformaticians- confounding factors, machine learning ref
 - investigators
 - database curators
- what populations do we serve?
 - all of them? if so we need a maximum minimum
 - 10 commandments of machine learning for reference:
<https://ryortho.com/breaking/the-ten-commandments-of-machine-learning/>
but also:
check: <https://www.nature.com/articles/s41592-021-01205-4/tables/1>
and: <https://www.dome-ml.org/>
- interactive guidelines or sub-guidelines may be advisable (i.e. Guideline builder/compiler that meets the needs of the author)
 - alternative: headlines with links to wiki of expectations
 - how can we modularize the existing guidelines?
- rather than shrinking the guidelines to make them minimum, the focus is on making the guidelines better applicable either by
 - increasing the practicability of the paper-based guidelines or by
 - providing tools that support the community with depositing data in a MIRAGE compliant way. This case should be supported by the journals

Presentation and Discussion – Glycan function representation

MT gave a summary of 1st & 2nd workshops on glycan function annotation

- where is the functional data of glycans found?
 - we need consensus terms that interconnect functions across data types
 - No GO for glycans. can we make it one
- manuscript coming soon from BioCuration2023
- need a lexicon of glycan functions from glycoscientists for making informatic terms
- 2nd workshop- developing lexicon
 - didn't have rep for GAGs or O-GlcNAc
 - developed basic vocabs
 - function map also needs a hierarchical relationship between glycan types, structures, structural motifs, features, and patterns
 - glycans can have different functions depending on localization
 - glycan substructures may provide function
 - functionality is not necessarily solely a function of factors related to the glycan
 - deliverables:
 - new framework with high level functions:
 - signaling, masking, structural, membrane org, metabolism, binding
 - function hierarchy dev
 - skeleton with room for filling out within hierarchies
- Glycan Function
 - Biological function
 - *in vivo* or *in vitro*
 - Does it need a metadata
 - GWAS association
 - clinical data/observations

Discussion/Revision – MIRAGE Recommendations

The MIRAGE website provides the community with a service, i.e. an overview of glycan data types, MIRAGE guidelines and data repositories and databases. Of course, this overview is not complete but a good start for all those interested in standardized data reporting and deposition.

The table will be completed soon, in particular with regards to NMR and CE repositories and/or databases. In addition, all resources will be hyperlinked to their webpages.

Further action points, see task list on the bottom of this document.

Data	MIRAGE Guidelines	Repository ³	Database ⁴
Glycans	multiple guidelines	GlyTouCan	Carbohydrate Structure DB GlyCosmos GlyGen GlyConnect
MS Data	MS Analysis	GlycoPOST ¹ UniCarb-DR ¹ ProteomeXchange ²	UniCarbDB ¹
Glycan Array Data	Glycan Microarray Analysis	GlyGen (correct link) Glycan Array Data Repository ¹	Imperial College MA Portal ²
LC Data	LC Analysis	GlycoPOST ¹	(GlycoStore in GlyCosmos)
NMR for Glycan Structures	Glycan Recognition Glycan Structures	BMRB ² MetaboLights (EBI) ² Metabolomics Workbench (NIH) ²	NMRShiftDB ² CASPER ² Carbohydrate Structure DB ²
Lectin Array Data	Lectin Microarray Analysis		LM Glycome Atlas ²
CE Data	CE Analysis		

¹ supports MIRAGE Guidelines

² may or may not support/implement the MIRAGE Guidelines

³ open for data submission

⁴ data retrieval only

Revision – Landscape Image

The landscape image has been drafted after the Boston MIRAGE meeting in 2018 and was slightly modified since then. However, at the last MIRAGE meeting it was suggested to revise the image and to make it more „presentable“ as in particular, the many arrows would require further explanations.

The purpose of this image is to represent the many relationships and activities of the MIRAGE Commission with the community and subsequent users of the guidelines. It can be used on the MIRAGE website, on the flyer and in the slide. In addition, it should give a deep impression at a glance what MIRAGE is doing.

Break-out groups

Three working groups were working on (conceptual) drafts for the landscape image. The drafts have been presented and discussed.

Further action points, see task list on the bottom of this document.

Discussion – Break out groups

Two break-out groups have been formed to work on two different tasks:

1. Finalization of the MS manuscript
2. Revision of the MIRAGE flyer

ad 1

Rather than finalizing the MS manuscript the strategy and aim of the manuscript has been discussed as obviously some misunderstandings arose that resulted in uncertainties with regards to the extent of the incorporation of the glycoproteomics guidelines and the aims of the manuscript. The glycoproteomics spreadsheet will be consolidated and cross-checked. FL will continue with the manuscript writing by end of August. In the beginning of September, there will be a meeting to go over the entire manuscripts and make the final edits by the end of September.

ad 2

the group created a draft of the revised flyer. Further action points, see task list on the bottom of this document.

Apart from the revision of the flyer, it was wondered if the MIRAGE logo is self-explaining. MIRAGE has several meanings (e.g. mirror, French fighter aircraft, video production) but none of these have any to do with glycosciences. Therefore, it was decided to add a tagline to the logo which is „Enhancing Glycoscience“ to make the relationship between the MIRAGE Commission and the glycoscience community more obvious.

Discussion - MIRAGE and journals

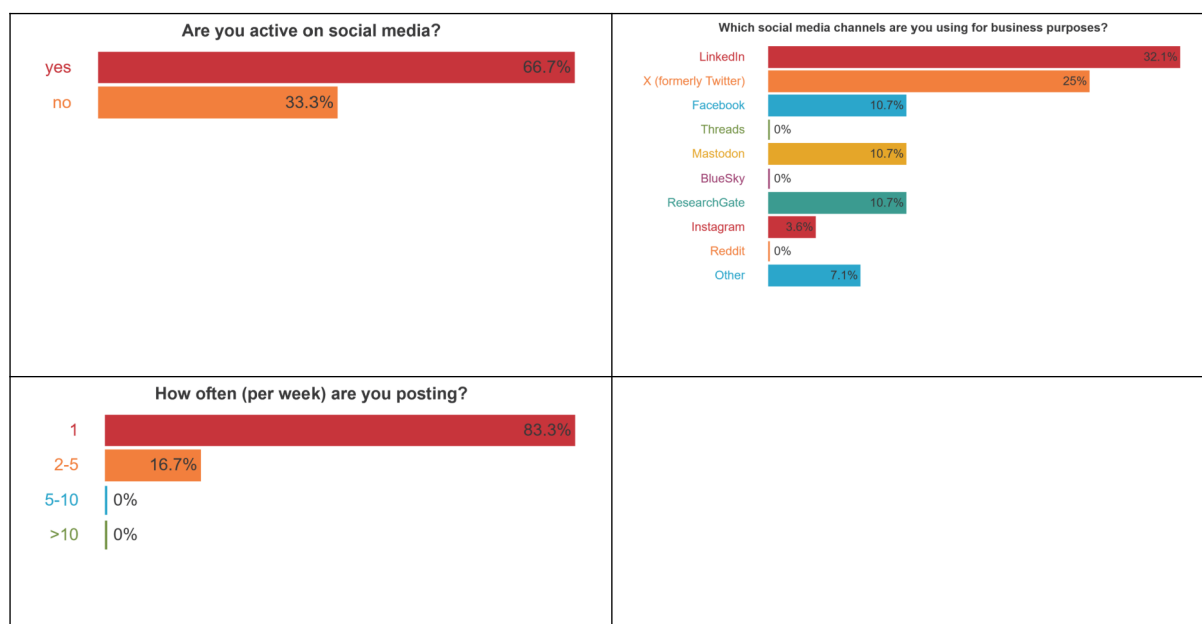
It is an ongoing discussion on how to make the journals to adopt the MIRAGE guidelines. Currently, there is only a very few number of journals that mention the MIRAGE guidelines in their instructions for authors (see table below). Most of the members of the MIRAGE Commission are members of the editorial boards of some journals. As such they can suggest topics for the editorial board meetings and then discuss the need for a standardized reporting of glycomics data in the journals. Upon general agreement that the standardized data reporting can lead to the improvement of the data quality in the journal, the MIRAGE initiative could be introduced and in consequence, the most relevant MIRAGE guidelines could be adopted for the instructions for authors.

The table below shows the degree of adoption of the MIRAGE guidelines. The selection of journals derives from past discussions when members of the MIRAGE commission expressed their willingness to contact and discuss with the journals.

Further action points, see task list on the bottom of this document.

Journal	Guidelines	Status/Comments	Data collection / repos recommended?
Nature (Springer)	Glycan Microarrays	in discussion with TF/JP	Data repository guidance
MCP	Glycan Microarrays	Authors' instructions MCP MS guidelines	
JACS (ACS)		Own guidelines for compound analysis, NMR, etc. ACS Research Data Policy	re3data , FAIRSharing.org
JPR (ACS)		Own MS and peptide identification guidelines	re3data , FAIRSharing.org
ACS Central Science		NMR guidelines for ACS Journals	re3data , FAIRSharing.org
Carbohydrate Res. (Elsevier)			
JBC (ASBMB)		MCP MS guidelines	Data deposition recom's
PLOS			Recommended Repo's
Glycobiology (OUP)	Glycan Microarrays	Authors' instructions refers to MIRAGE in general	re3data , FAIRSharing.org

Outreach – Social Media



Most members of the MIRAGE Commission are active on LinkedIn and X (formerly Twitter), some on Facebook, Mastodon, and ResearchGate.

There was consensus that any member can post MIRAGE related news on their channels and use #glycomirage as hashtag to make this content findable in the corresponding channels.

Task list

The following tasks have been agreed and the task list will be monitored on monthly basis by CK. The complete, current list is available on Google drive.

Task	Description	Who
Glyco resources into NFDI4Chem	Contact TA3 and heads of NFDI4Chem for adding GlyTouCan, GlycoPOST etc to the list of additional resources	CK, KAK, RR, FL
Lectin Microarray Guidelines	Example prepared by Hiroaki to be approved	HT, LM, JP
	Publish approved example on MIRAGE website	CK
	Prepare manuscript	LM, JP, HT
MS Guidelines / Glycoproteomics	break-out group will make a plan/strategy on the goal of the ms in preparation	KAK, FL, DK, CK, et al.
	inclusion of glycolipids?	KAK, FL, DK, CK, et al.
	revision of the current MS guidelines	NK, Commission
	review proposed scoring/evaluation procedure, description of the evaluation process rather than a prescription of procedure	NK, Commission
	integration of the glycoproteomics gl into the MS gl	WH
	manuscript on glycoproteomics gl	FL
	Letter to Editors: 15 years of MIRAGE and what we achieved	DK
	collaboration with proteomeXchange	MS working group
MS Guideline builder	making the MS guidelines more applicable, drafting a guideline compiler. How much modularity is necessary/possible?	RR, KAK, CK

Glycan Microarray guidelines	revision and definition of metadata, work already started in established working group	RR
HUPO-PSI WG	inform all included about positive PSI decision	CK
	review of proposed amendments in the charter	CK, FL, KAK
	attendance of the monthly PSI meeting	CK
	decision on satellite meeting at next HUPO-PSI meeting, March 2025 in Tübingen	CK, FL, KAK
LC Guidelines template	modularization of the rest of the guidelines for incorporation	?KAK?
MIRAGE slide	finalization or pre-finalization of two different drafts: short and long version	GLK, DK, RR
Recommendations (Repositories and Databases)	NMR databases, which db are used in the glycomics field	MAC
	CE databases or repos in the glycomics field	GLK
	publication of finalized recommendations table on MIRAGE	CK
	short paper that highlight these recommendations	KAK, CK, RR, NK
	review of recommendations page	CK
MIRAGE Landscape image	prefinal draft	GLK, CK, RR, DK
	logo extension by "Enhancing Glycoscience"	CK
MIRAGE Flyer	design the concept of a new flyer	GLK, RR, MT, CK, WS, MW
	collect feedback	Commission
	new glycoscience text for flyer	MT, MW
	production of the flyer by professional graphics designer	CK

Social Media	use hashtag #glycomirage	Commission
	reminders for meetings with latest version of the slides	RR
	LI MIRAGE account	CK
Journals	contact preprint journals (e.g.bioRxiv,...)	NK
	adoption of MS guidelines first: Nature, ACS Central Science (Carolyn Bertozzi via Ben Schumann and Nick Riley)	CK
	Glycobiology	MT, MW
Webpage	Activity section that collects outreach activities of MIRAGEes	Commission
	regular GlycoPOST export for MIRAGE-compliant papers and data submissions	KAK
	embed LI stream on Website	CK

Appendix

Group Charter proposal for PSI

0. Preamble

MIRAGE stands for “Minimum Information Required for A Glycomics Experiment”. Since 2011, the [MIRAGE Commission](#) has been supported and coordinated by the [Beilstein-Institut](#), a non-profit foundation based in Frankfurt am Main, Germany. The aim of MIRAGE is the improvement of the quality of journal articles describing glycomics analyses by providing authors with guidelines on how to include the most important data and metadata that characterize their experiments. The outcomes will contribute to the improvement of the quality of data contained in carbohydrate structure databases and make it possible to develop and implement more effective software for mining glycomics data.

Finally, with the guidelines, metadata definitions and data exchange formats in hand, the initiative will contribute to the establishment of a worldwide linked electronic infrastructure for the storage and analysis of carbohydrate structure data.

Currently, the MIRAGE Commission has developed eight [reporting guidelines](#) which are registered with [FAIRSharing.org](#) and which gain increasing acceptance by the science community.

Cooperation with HUPO-PSI (Human Proteome Organization - Proteomics Standardization Initiative) is envisaged with the aim of increasing the visibility and use of the MIRAGE guidelines and subsequent outcomes. However, in order to avoid confusion with regards to the MIRAGE project and “dilution” of brands, the MIRAGE group decided to apply as PSI Glycomics working group.

1. Administrative Section

Status (New/Update):

Group Name: PSI Glyco

Minimum Information Required for A Glycomics Experiment - (MIRAGE)

Alternatively: PSI Glycomics - ()

Chair (with affiliation and current email address):

- Carsten Kettner, Beilstein-Institut, Frankfurt am Main, Germany; ckettnr@beilstein-institut.de

Co-Chairs (1 or 2) (with affiliation and current email address):

- Frédérique Lisacek - Swiss Institute for Bioinformatics, Geneva, Switzerland; frederique.lisacek@sib.swiss
- Kiyoko Aoki-Kinoshita - Soka University, Tokyo, Japan; kkiyoko@soka.ac.jp

Secretary:

- Vacant

Other officers (optional) (with affiliation and current email address):

- Morten Thaysen-Andersen, Macquarie University, Sydney, Australia;
- William Hackett, Boston University, Boston, MA, USA;
- Robert Chalkley, University of California, San Francisco, CA, USA;
- René Ranzinger, University of Georgia, CCRC, Athens, GA, USA;
- Kay-Hooi Khoo, Academia Sinica, Taipei, Taiwan;
- Stacy Malaker, Yale University, New Haven, CT, USA;
- Katherine Wongtrakul-Kish, Macquarie University, Sydney, Australia;
- Sriram Neelamegham, State University of New York at Buffalo, USA;
- Sylvie Ricard-Blum, University Lyon 1, Villeurbanne, France;

Mailing list: n/a

2. Description and objectives

Focus and Purpose

In 2006, the glycoscience community agreed to establish a worldwide linked electronic infrastructure for the storage and analysis of carbohydrate structural data. Following the 'minimum information' standards developed within PSI ([MIAPE](#), etc), standardized protocols were discussed and proposed for the exchange as well as the publication of experimental data and metadata. This work was carried out under the auspices of the Beilstein-Institut, and in 2011 the MIRAGE project (MIRAGE = Minimum Information Required for A Glycomics Experiment) was launched to define requirements for the publication of data in glycomics. MIRAGE is composed of academic researchers, software developers, and journal representatives. With mass spectrometry (MS) being the most popular analytical method to solve glycan structures, the first set of guidelines covered [MS-based analytics](#) for glycomics. Later on, other sets were published relative to [Liquid Chromatography](#) and [Capillary Electrophoresis](#). Interactomics is addressed in the [Glycan Array](#) set and the next expected release targets glycoproteomics, which will bridge with proteomics. [Note that the Beilstein Institute also supports the implementation of STREND](#) (Standards for Reporting Enzymology Data) and that earlier involvement has entailed suggestions to extend MzIdentML to cover glycopeptide identification.

Goals/Milestones

Goal 1: extension of existing formats, e.g mzTab, and development of new data exchange formats based on the reporting guidelines

Goal 2: involving journals and funding agencies

Goal 3: tight collaboration with groups developing repositories and databases that are MIRAGE compliant

Goal 4: collaboration with groups developing software tools for data analysis

Website: <https://www.beilstein-institut.de/en/projects/mirage/>