

# **COST Action CA18103 INNOGLY: INNOVation with Glycans new frontiers from synthesis to new biological targets.**

## **WG3 Report**

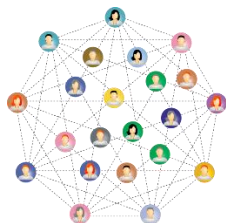
**Leader: Dr. Barbara Richichi.** [barbara.richichi@unifi.it](mailto:barbara.richichi@unifi.it)

**Co-Leader: Dr. Sandra van Vliet.** [s.vanvliet@amsterdamumc.nl](mailto:s.vanvliet@amsterdamumc.nl)

According to Deliverable 3 (D.3 Report on the main advances in the field and developed activities related to WG3) in the INNOGLY's MoU, the activities related to Working Group 3 (WG3: Glycan dependent fine-tuning of immunity) at month 36 and 54 (6 months extension) have been listed below.

Citations on the specific Objectives (Obj or O), Milestones (M), Tasks (T) of WG3 and more in general of INNOGLY Action, as reported in the MoU, have been included.

During these two years the Objectives and Tasks of the WG3 have been addressed including the publication of co-authored papers, organization of workshops/meetings, short term scientific missions (STSM), and dissemination activities as described below.



Notably, since the kick-off in April 2019, 46 new members have joined the WG3. A list of the 81 WG3 members is included.

## **Month 24 (May 2021-May 2022)**

### **1) WG3 M 3.1: Workshop related to the topics of WG3.**

- *Obj1 INNOGLY:* Develop a collaborative effort to achieve a common ground on the topics 1) Glycan profiling in health and disease, and 2) Glycan-based diagnostics and therapeutics, as well as the related subtopics.
- *Obj 3 INNOGLY:* Foster progress in existing research projects.
- *Obj 10 INNOGLY:* Bridge the gap between scientific communities with complementary knowledge and common interests in glycan-related topics.
- *Obj 15 INNOGLY:* Enhance public communication to boost the promotion of glycoscience within the mainstream of biological sciences.

## May 5<sup>th</sup> 2022, WG1-WG3 joint meeting, Lugano (Switzerland)

Networking activities. Opened discussion within WG1-WG3 members on the following topics:

1. EMERGING DISCOVERIES ON CANCER AND IMMUNITY
2. LOOKING FORWARD: unmet needs in the field of glycobiology of cancer and glycoimmunology (from a biological and chemical perspective).

- a) Cancer biology
- b) Cancer biomarkers and therapeutics
- c) Immunology of infectious diseases
- d) Immunology of cancer
- e) Immunology of autoimmune diseases
- f) Development of glycan-coated nanomaterials and saccharide-based biotools (nanometric and small molecules). Applications in cancer and immunity.

Enclosed to this document is the detailed program of the meeting and the .ppt of the presentation of the WG3 leaders.

## 2) Publications from WG3 members (May 2021 - May2022)

### Publications

1. Brunori, F.; Padhi, K. D.; Alshanski, I.; Freyse, J.; Dürig, J-N.; Penk, A.; Vaccaro, L.; Hurevich, M.; Rademann, J.; Yitzchaik, S. Sulfation pattern dependent Iron (III) mediated interleukin-8 glycan binding ChemBioChem 2021, 22, 1–7. <https://doi.org/10.1002/cbic.202100552>
2. Alshanski, I.; Shitrit, A.; Sukhran, Y.; Unverzagt, C.; Hurevich, M.; Yitzchaik, S. Effect of interfacial properties on impedimetric biosensing of sialylation process with biantennary N-glycan-based monolayer, Langmuir 2022, 38, 849–855. <https://doi.org/10.1021/acs.langmuir.1c02995>
3. Wavelet-Vermuse, C., Groux-Degroote, S., Vicogne, D., Cogez, V., Venturi, G., Trinchera, M., ... & Harduin-Lepers, A. (2021). Analysis of the proximal promoter of the human colon-specific B4GALNT2 (Sda synthase) gene: B4GALNT2 is transcriptionally regulated by ETS1. Biochimica et Biophysica Acta (BBA)-Gene Regulatory Mechanisms, 1864(11-12), 194747. [doi.org/10.1016/j.bbagr.2021.194747](https://doi.org/10.1016/j.bbagr.2021.194747)
4. Groux-Degroote, S., Vicogne, D., Cogez, V., Schulz, C., & Harduin-Lepers, A. (2021). B4GALNT2 Controls Sda and SLex Antigen Biosynthesis in Healthy and Cancer Human Colon. ChemBioChem, 22(24), 3381-3390. [doi.org/10.1002/cbic.202100363](https://doi.org/10.1002/cbic.202100363).
5. MORELLI L., LEGNANI L., RONCHI S., CONFALONIERI L., IMPERIO D., TOMA L., COMPOSTELLA F. 2,3-Carbamate mannosamine glycosyl donors in glycosylation reactions of diacetone-D-glucose. An experimental and theoretical study. Carbohydrate Research 509, 108421 (2021) DOI: [10.1016/j.carres.2021.108421](https://doi.org/10.1016/j.carres.2021.108421)
6. MORELLI L., LAY L., SANTANA-MEDEROS D., VALDES-BALBIN Y., VEREZ BENCOMO V., VAN DIEPEN A., HOKKE C. H., CHIODO F., COMPOSTELLA F. Glycan Array Evaluation of Synthetic Epitopes between the Capsular Polysaccharides from Streptococcus pneumoniae 19F and 19A. ACS Chemical Biology 16(9), 1671-1679 (2021). DOI: [10.1021/acschembio.1c00347](https://doi.org/10.1021/acschembio.1c00347)
7. Magalhães A, Duarte HO, Reis CA. The role of O-glycosylation in human disease. Mol Aspects Med. 2021 Jun;79:100964. doi: [10.1016/j.mam.2021.100964](https://doi.org/10.1016/j.mam.2021.100964). Epub 2021 Mar 26. PMID: 33775405.

8. Marques C, Reis CA, Vivès RR, Magalhães A. Heparan Sulfate Biosynthesis and Sulfation Profiles as Modulators of Cancer Signalling and Progression. *Front Oncol.* 2021 Nov 11;11:778752. doi: [10.3389/fonc.2021.778752](https://doi.org/10.3389/fonc.2021.778752). PMID: 34858858; PMCID: PMC8632541.
9. Matos R, Amorim I, Magalhães A, Haesebrouck F, Gärtner F, Reis CA. Adhesion of Helicobacter Species to the Human Gastric Mucosa: A Deep Look Into Glycans Role. *Front Mol Biosci.* 2021 May 7;8:656439. doi: [10.3389/fmolb.2021.656439](https://doi.org/10.3389/fmolb.2021.656439). PMID: 34026832; PMCID: PMC8138122.
10. Biagiotti, G.; Angeli, A.; Giacomini, A.; Toniolo, G.; Landini, L.; Salerno, G.; Di Cesare Mannelli, L.; Ghelardini, C.; Mello, T.; Mussi, S.; Ravelli, C.; Marelli, M.; Cicchi, S.; Menna, E.; Ronca, R.; Supuran, C.T.; Richichi, B. Glyco-Coated CdSe/ZnS Quantum Dots as Nanoprobes for Carbonic Anhydrase IX Imaging in Cancer Cells. *ACS Appl. Nano Mater.* 2021, 4, 14153–14160. <https://doi.org/10.1021/acsanm.1c03603>
11. Reina, G.; Ruiz, A.; Richichi, B.; Biagiotti, G.; Giacomazzo, G.E.; Jacquemin, L.; Nishina, Y.; Menard-Moyon, C.; Al-Jamal, W.T.; Bianco, A. Design of a graphene oxide-BODIPY conjugate for glutathione depletion and photodynamic therapy. *2D Mater.* 2022 9: 015038. DOI [10.1088/2053-1583/ac4572](https://doi.org/10.1088/2053-1583/ac4572)
12. Stefanetti, G.; Borriello, F.; Richichi, B.; Zandoni, I.; Lay, L. Immunobiology of Carbohydrates: Implications for Novel Vaccine and Adjuvant Design Against Infectious Diseases. *Front. Cell. Infect. Microbiol.* 2022, 11:808005. <https://doi.org/10.3389/fcimb.2021.808005>
13. Anderluh, M.; Berti, F.; Bzducha-Wróbel, A.; Chiodo, F.; Colombo, C.; Compostella, F.; Durlik, K.; Ferhati, X.; Holmdahl, R.; Jovanovic, D.; Kaca, W.; Lay, L.; Marinovic-Cincovic, M.; Marradi, M.; Ozil, M.; Polito, L.; Reina, J.J.; Reis, C.A.; Sackstein, R.; Silipo, A.; Švajger, U.; Vaněk, O.; Yamamoto, F.; Richichi, B.; S. J. van Vliet, Emerging glyco-based strategies to steer immune responses. *FEBS J.*, 2021. doi: [10.1111/febs.15830](https://doi.org/10.1111/febs.15830)
14. Anderluh, M.; Berti, F.; Bzducha-Wróbel, A.; Chiodo, F.; Colombo, C.; Compostella, F.; Durlik, K.; Ferhati, X.; Holmdahl, R.; Jovanovic, D.; Kaca, W.; Lay, L.; Marinovic-Cincovic, M.; Marradi, M.; Ozil, M.; Polito, L.; Reina, J.J.; Reis, C.A.; Sackstein, R.; Silipo, A.; Švajger, U.; Vaněk, O.; Yamamoto, F.; Richichi, B.; S. J. van Vliet, Recent advances on smart glycoconjugate vaccines in infections and cancer. *FEBS J.*, 2022. <https://dx.doi.org/10.1111/febs.15909>

The publications/conferences above cover the topics related to INNOGLY Objectives:

*Obj 1:* Develop a collaborative effort to achieve a common ground on the topics 1) Glycan profiling in health and disease, and 2) Glycan-based diagnostics and therapeutics, as well as the related subtopics.

*Obj 2:* Develop glycan-based tools (nanometric and small molecules) to track glycosylation pathways and dissect immunomodulatory functions.

*Obj 3:* Foster progress in existing research projects.

*Obj 4:* Develop biosensors to investigate glycan-protein interactions.

*Obj 5:* Promote the synthesis of glycomimetics and glycan-based analogs of specific target epitopes.

*Obj 6:* Develop glycan-based and glycan-integrated biopolymers.

*Obj 7:* Improve manipulation and engineering of glycan-based systems.

*Obj 8:* Develop straightforward methodologies to synthesize oligosaccharides and glycoconjugates.

*Obj 10:* Bridge the gap between scientific communities with complementary knowledge and common interests in glycan-related topics.

*Obj 15:* Enhance public communication to boost the promotion of glycoscience within the mainstream of biological sciences.

Some of the publications above were announced on Twitter (according to *Obj 15 INNOGLY*).

### 3) Joint review papers

- Obj 2: Develop glycan-based tools (nanometric and small molecules) to track glycosylation pathways and to dissect immunomodulatory functions.
- Obj 7 INNOGLY: Improve manipulation and engineering of glycan-based systems.
- Obj 10 INNOGLY: Bridge the gap between scientific communities with complementary knowledge and common interests in glycan-related topics.
- Obj 15 INNOGLY: Enhance public communication to boost promotion of glycoscience within the mainstream of biological sciences.

The intense discussion between members of the WG3 resulted in the preparation of two reviews (published in **Open Access**) containing the current state of the art in nanotools and glycovaccines for immunomodulation.

Indeed, some of the WG3 members (25 co-authors) with interdisciplinary expertise, joined their efforts in preparing of two review papers focused on the role of glycans in the modulation of the immune response. This initiative comes from the idea that 'A close and continuous crosstalk between glycochemists and glycoimmunologists is essential for the successful development of efficient immune modulators'. Thus, they highlighted some tips to:

- i) O 3.1 of WG3: promote the investigation of the modulatory role of glycans in innate and adaptive immune response;
- ii) O 3.2 of WG3: promote the investigation of the modulatory role of glycans in immune tolerance.

- T 3.3 of WG3: Promote the development of glycan-coated nanomaterials as mimicking systems.

These review papers published in a high-impact journal (FEBS Journal) in the section of **Emerging Methods**: <https://febs.onlinelibrary.wiley.com/doi/10.1111/febs.15830>, **State of the art**: <https://febs.onlinelibrary.wiley.com/doi/10.1111/febs.15909> describe the latest advances and the future perspectives on the development of glycan-coated nanomaterials as mimicking systems.

Indeed, in the review paper *Emerging glyco-based strategies to steer immune responses* (doi: 10.1111/febs.15830) they discuss some of the latest developments in glycan-based therapies to achieve targeting of tumor-associated glycan-specific epitopes, as well as the use of glycan moieties to suppress ongoing immune responses, especially in the context of autoimmunity.

In the review paper *Recent advances on smart glycoconjugate vaccines in infections and cancer* (doi: 10.1111/febs.15909) they discuss the latest advancements in the development of vaccines against glycan epitopes to gain selective immune responses, and provide an overview of the role of different immunogenic constructs in improving glycovaccine efficacy.

- Obj 15 INNOGLY: Enhance public communication to boost the promotion of glycoscience within the mainstream of biological sciences.

The review papers were announced on the INNOGLY website and on Twitter.

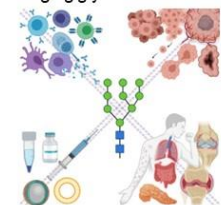
<https://innogly.eu/emerging-glyco%e2%80%90based-strategies-to-steer-immune-responses>

Moreover, one of the two review papers was mentioned by the journal as **the most downloaded article in 2022** (see below).

**WG3 members:** 25 co-authors with interdisciplinary expertise

### March 2021

Anderluh, M.; Berti, F.; Bzducha-Wróbel, A.; Chiodo, F.; Colombo, C.; Compostella, F.; Durlík, K.; Ferhati, X.; Holmdahl, R.; Jovanovic, D.; Kaca, W.; Lay, L.; Marinovic-Cincovic, M.; Marradi, M.; Ozil, M.; Polito, L.; Reina, J.J.; Reis, C.A.; Sackstein, R.; Silipo, A.; Švajger, U.; Vaněk, O.; Yamamoto, F.; Richichi, B.; S. J. van Vliet, Emerging glyco-based strategies to steer immune responses. *FEBS J.*, 2021.



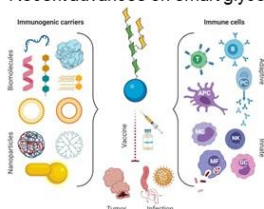
466 Reads

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220 References

### May 2021

Anderluh, M.; Berti, F.; Bzducha-Wróbel, A.; Chiodo, F.; Colombo, C.; Compostella, F.; Durlík, K.; Ferhati, X.; Holmdahl, R.; Jovanovic, D.; Kaca, W.; Lay, L.; Marinovic-Cincovic, M.; Marradi, M.; Ozil, M.; Polito, L.; Reina, J.J.; Reis, C.A.; Sackstein, R.; Silipo, A.; Švajger, U.; Vaněk, O.; Yamamoto, F.; Richichi, B.; S. J. van Vliet, Recent advances on smart glycoconjugate vaccines in infections and cancer. *FEBS J.*, 2021



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336 References

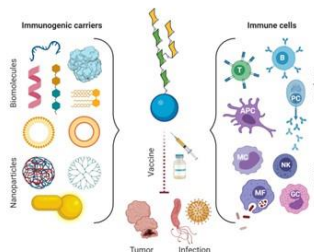
## Publications from WG3 members

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• [Recent advances on smart glycoconjugate vaccines in infections and cancer](#)

ANDERLUH M., BERTI F., BZDUCHA-WROBEL A., CHIODO F., COLOMBO C., COMPOSTELLA F., DURLIK K., FERHATI X., HOLMDAHL R., JOVANOVIĆ D., KACA W., LAY L., MARINOVIC-CINCOVIC M., MARRADI M., OZIL M., POLITO L., REINA J. J., REIS C. A., SACKSTEIN R., SILIPO A., ŠVAJGER U., VANEK O., YAMAMOTO F., RICHICHI B., VAN VLIET S. J. Recent advances on smart glycoconjugate vaccines in infections and cancer. *FEBS*, 2022 DOI: 10.1111/febs.15909 (Open access)

## 3) Activities related to Early Career Investigators (ECIs).

- Obj 11 INNOGLY: Set up a platform for early career researchers
- Obj 10 INNOGLY: Bridge the gap between scientific communities with complementary knowledge and common interests in glycan-related topics.
- Obj 12 INNOGLY: Help early career researchers to access and build new networks.

The first INNOGLY-ECI meeting was organized with the support of the WG3. The organizing committee included only ECI (INNOGLY members). Please find below some information about the meeting:

**INNOGLY-ECI-WG3-2021- Young Glyco-Scientists on stage** (September 27<sup>th</sup> 2021 10:00 am-6:00 pm)

In Memory of Prof. Hans-Joachim Gabius whose work and dedication to the Glycoscience will be of inspiration for the next generation of glycoscientists.

**Number of participants:** 80

## **2 Keynote lectures**

Francesca Micoli, PhD: “Professional growth in an international company working on polysaccharide based vaccines” (Industry)

Prof. Ryan A. Flynn, PhD: “Small RNAs are modified with N-glycans and displayed on the surface of living cells” (Academia)

**Total number of speakers:** 25 OL

## **Organizing Committee:**

- Dr. Giacomo Biagiotti (*Post-doc fellow*) (Italy).
- Elena Loi (*Phd student*) (Slovenia).
- Dr. Davide Ret (*Post-doc fellow*) (Austria).
- Cristiano Conceição (*PhD Student*) (Portugal).
- Dr. Kristina Zlatina (*Post-doc Fellow*) (Germany).

## **4) Training School organized by WG3**

Conjugation of glycans onto nanomaterials: opportunities in therapy and diagnosis.

September 12<sup>th</sup> (2 pm, CET) to 14<sup>th</sup> (12 pm) in Strasbourg (France).

**Organizers:** Cécilia Ménard-Moyon (CNRS, Strasbourg, +33 669 068 369, [c.menard@ibm-ccnrs.unistra.fr](mailto:c.menard@ibm-ccnrs.unistra.fr)) & Barbara Richichi (University of Florence, Italy, [barbara.richichi@unifi.it](mailto:barbara.richichi@unifi.it)).

Topic of the training school: How nanomaterial-based glycoconjugates can be exploited for therapeutic and diagnostic applications in cancer, infection, personalized medicine and for modulating innate and adaptive immune responses.

## **Trainers:**

- Cécilia Ménard-Moyon (France)
- Barbara Richichi (Italy)
- Jean-François Nierengarten (CNRS, France)
- Jose M. Palomo (CSIC, Spain)
- Laura Polito (CNR, Italy)
- Dejian Zhou (University of Leeds, UK)
- Francesco Stellacci (EPFL, Switzerland)
- Marco Marradi (University of Florence, Italy)

During the school working groups for scientific article analysis were planned. Open discussions were fostered.

**Trainees:** 19

## 5) Attendance to conferences:

- *Obj 10 INNOGLY*: Bridge the gap between scientific communities with complementary knowledge and common interests in glycan-related topics.
- *Obj 15 INNOGLY*: Enhance public communication to boost promotion of glycoscience within the mainstream of biological sciences.

1. Oral online presentation. Rénio, M.; Murtinho, D.; Ventura, M. R. "Exploring thioureas versatility as organocatalysts" – IsySyCat 2021. Évora, 31 August-3 September 2021.
2. Oral online presentation. Rénio, M.; Murtinho, D.; Ventura, M. R. "Thioureas for stereoselective glycosylation reactions" - 6th CATSUS Workshop. Lisbon 14 November 2021.
3. Virtual event. Miranda, V.; Torcato, I.M.; Carrau, G.; Xavier, K. B.; Ventura, M. R. "Synthesis of AI-2 derived sugar prodrugs and chemical probes". ESOC2021-European Symposium on Organic Chemistry 2021, July 5-6, 2021.
4. Oral communication. Cristiano A. Conceição, Federico Issoglio, Vanessa T. Almeida, José Rodrigues, Margarida Archer, M. Rita Ventura, "Towards a novel functional assay for the discovery of membrane proteins involved in mycobacteria cell wall biosynthesis". INNOGLY Annual Meeting 2022, COST Action CA18103, 4-6 May 2022, Lugano, Switzerland.
5. Poster. Cristiano A. Conceição, Federico Issoglio, Vanessa T. Almeida, José Rodrigues, Margarida Archer, M. Rita Ventura, "Development of a new functional assay to study potential anti-tuberculosis drug targets – Arabinofuranosyltransferases". 12<sup>th</sup> ITQB NOVA PhD Students' Meeting, 20-22 April 2022, Oeiras, Portugal
6. Poster. Cristiano A. Conceição, Federico Issoglio, Vanessa T. Almeida, José Rodrigues, Margarida Archer, M. Rita Ventura, "Development of a new functional assay to study potential anti-tuberculosis drug targets – Arabinofuranosyltransferases". 22<sup>th</sup> Tetrahedron Symposium: Catalysis for a Sustainable World, 28 June-1 July 2022, Lisbon, Portugal.
7. FLASH ORAL AND POSTER PRESENTATION, Elena M. Loi, Matjaž Weiss, Stane Pajk, Daniel Yasini, Doroteja Novak, Martina Gobec, Tihomir Tomašič, Roland J. Pieters and Marko Anderluh. "The quest for the first potent in vivo acting OGT inhibitor." XXVII EFMC International Symposium on Medicinal Chemistry, September 4-8, 2022, Nice, France.
8. POSTER PRESENTATION, Elena M. Loi, Matjaž Weiss, Cyril Balsollier, Tihomir Tomašič, Roland J. Pieters, Marko Anderluh. "Different drug design approaches to tackle O-GlcNAc transferase inhibition". XXVI EFMC International Symposium on Medicinal Chemistry, August 29-September 2, 2021, virtual event
9. Poster presentation: DECLOQUEMENT M.\*, NOEL M., COGEZ V., LION C., RIGOLOT V., BIOT C. GUERARDEL Y., HARDUIN-LEPERS A. Innovative tools for the study of sialylation deficiencies: Glycosyltransferase engineering and use of unnatural sialic acid donors. 12th edition of the Young Researchers in Life Sciences Virtual Symposium 16-18 June, 2021. Paris, France
10. Oral presentation: DECLOQUEMENT M.\*, NOEL M., COGEZ V., LION C., RIGOLOT V., BIOT C. GUERARDEL Y., HARDUIN-LEPERS A. Innovative tools for the study of sialylation processes: Glycosyltransferase engineering and use of unnatural sialic acid donors. Scientific CDG Symposium 2021, Virtual Euroglycan Symposium 23-24 June, 2021. Leuven, Belgium
11. Oral presentation: DECLOQUEMENT M.\*, NOEL M., COGEZ V., LION C., RIGOLOT V., BIOT C. GUERARDEL Y., HARDUIN-LEPERS A. Innovative tools for the study of sialylation processes: Glycosyltransferase engineering and use of unnatural sialic acid donors. Congrès SFBBM, 1-2 Juillet 2021. Paris, France
12. Oral presentation: DECLOQUEMENT M.\*, VENUTO M, COGEZ V., NOEL M., LION C., RIGOLOT V., BIOT C. GALUSKA S, HARDUIN-LEPERS A. Diversity of polysialylation machinery in fish species highlights exciting perspectives to generate original high therapeutic biomaterials. 21<sup>ème</sup> édition Journée André Verbert des doctorants. Sept. 22<sup>th</sup>, 2021. Lille, France
13. Oral presentation: DECLOQUEMENT M.\*, VENUTO M, COGEZ V., NOEL M., LION C., RIGOLOT V., BIOT C. GALUSKA S, HARDUIN-LEPERS A. Diversity of polysialylation

machinery in fish species highlights exciting perspectives to generate original high therapeutic biomaterials. Selected talk Innogly-ECI-WG3-2021 Young Glyco-Scientists on stage. 27th Sept, 2021. Visio. Firenze, Italy.

14. Oral presentation: DECLOQUEMENT M.\*, VENUTO M, COGEZ V., NOEL M., LION C., RIGOLOTT V., BIOT C. GALUSKA S, HARDUIN-LEPERS A. Diversity of polysialylation machinery in fish species highlights exciting perspectives to generate original high therapeutic biomaterials. 3-min thesis video. 6th Latin American Glycobiology Congress Oct. 5-8th, 2021 (Best presentation price). Mexico, Mexique.
15. Poster presentation: DECLOQUEMENT M.\*, VENUTO M, COGEZ V., STEINMETZ A, LION C., RIGOLOTT V., BIOT C. GALUSKA S, HARDUIN-LEPERS A. Diversity of polysialylation machinery in fish species highlights exciting perspectives to generate original high therapeutic biomaterials. Innogly COST Action CA18103. 4-6 May, 2022. Lugano, Switzerland. (Best poster presentation)
16. Poster presentation: HARDUIN-LEPERS A\* COGEZ V, DECLOQUEMENT M, GROUX-DEGROOTE S, SCHULZ C, VICOONE D. Regulation of glycosyltransferases involved in terminal glycosylation. Innogly COST Action CA18103. 4-6 May, 2022. Lugano, Switzerland.
17. van Vliet S.J. Glycan-dependent signalling routes and transcriptional programs in human dendritic cells after triggering of the C-type lectin MGL. INNOGLY Cost Action Annual Meeting. 06/05/2022 Lugano, Switzerland.
18. Anderluh, Marko, Loi, Elena Maria, Weiss, Matjaž, Ballsolier, Cyril, Tomašič, Tihomir, Gobec, Martina, Pieters, Roland J. Inhibition of O-GlcNAc transferase - the cell's metabolic gauge that alters its fate : keynote lecture at the 15BSS Bratislava Symposium on Saccharides, June 20-24, 2022, Smolenice, Slovakia. [https://www.saccharides.sav.sk/15BBS\\_programme.pdf](https://www.saccharides.sav.sk/15BBS_programme.pdf)
19. Loi, Elena Maria, Weiss, Matjaž, Pajk, Stane, Yasini, Daniel, Novak, Doroteja, Gobec, Martina, Tomašič, Tihomir, Pieters, Roland J., Anderluh, Marko. The quest for the first potent in vivo acting OGT inhibitor. In: Book of abstracts, p067. EFMC-ISMIC 2022, Nice, France, September 4-8, 2022. <https://www.efmc-ismc.org/v2/data/1661849465EFMC-ISMIC-Book-Web-HD3.pdf>.
20. Purić, Edvin, Toplak, Žan, Tomašič, Tihomir, Hassan, Mujtaba, Nilsson, Ulf, Anderluh, Marko. 2-substituted galactosides as selective and potent galectin-8 ligands. In: Book of abstracts, p426. EFMC-ISMIC 2022, Nice, France, September 4-8, 2022. <https://www.efmc-ismc.org/v2/data/1661849465EFMC-ISMIC-Book-Web-HD3.pdf>.
21. Girardi, Benedetta, Manna, Martina, Nilsson, Ulf, Tomašič, Tihomir, Anderluh, Marko, Mravljak, Janez, Ricklin, Daniel, Schwardt, Oliver. 1,3-substituted galactosides as selective monovalent galectin-8 ligands. In: Book of abstracts, a007. EFMC-ISMIC 2021, Basel, Switzerland, August 29 - September 2, 2021. <https://www.efmc-ismc.org/v2/data/1630081893EFMC-ISMIC-BookOfAbstracts-webHD.pdf>.
22. Hassan, Mujtaba, Baussière, Floriane, Guzelj, Samo, Sundin, Anders, Håkansson, Maria, Walse, Björn, Diehl, Carl, Tomašič, Tihomir, Anderluh, Marko, Jakopin, Žiga, et al. Design, synthesis and evaluation of D-galactal derivatives as selective inhibitors of galectin-8 N-terminal domain. In: Book of abstracts. a008. EFMC-ISMIC 2021, Basel, Switzerland, August 29 - September 2, 2021. <https://www.efmc-ismc.org/v2/data/1630081893EFMC-ISMIC-BookOfAbstracts-webHD.pdf>.
23. Loi, Elena Maria, Weiss, Matjaž, Ballsolier, Cyril, Tomašič, Tihomir, Pieters, Roland J., Anderluh, Marko. Different drug design approaches to tackle o-GlcNAc transferase inhibition. In: Book of abstracts, a009. EFMC-ISMIC 2021, Basel, Switzerland, August 29 - September 2, 2021. <https://www.efmc-ismc.org/v2/data/1630081893EFMC-ISMIC-BookOfAbstracts-webHD.pdf>.
24. Van Klaveren, Sjors, Hassan, Mujtaba, Sundin, Anders, Anderluh, Marko, Tomašič, Tihomir, Nilsson, Ulf. How phthalazinone-derivatives bind the galectin-8n carbohydrate recognition domain with excellent selectivity. In: Book of abstracts, a012. EFMC-ISMIC 2021, Basel, Switzerland, August 29 - September 2, 2021. <https://www.efmc-ismc.org/v2/data/1630081893EFMC-ISMIC-BookOfAbstracts-webHD.pdf>.
25. Sterle, Maša, Weiss, Matjaž, Anderluh, Marko. Fragment based design, synthesis and evaluation of novel O-GlcNAc transferase inhibitors : 45th FEBS Congress, Molecules of Life: Towards New Horizons, Ljubljana, Slovenia, July 3-8, 2021. FEBS open bio. 2021, 11, s1, 309-310. <https://febs.onlinelibrary.wiley.com/doi/10.1002/2211-5463.13205>, DOI: 10.1002/2211-5463.13205.



26. Weiss, Matjaž, Anderluh, Marko, Gobec, Martina. In vitro modulation of protein O-GlcNAcylation and its impact on function of selected immune cells : presented at 45th FEBS Congress, Molecules of Life: Towards New Horizons, Ljubljana, Slovenia, July 3-8, 2021. FEBS open bio. 2021, 11, s1, 402. <https://febs.onlinelibrary.wiley.com/doi/epdf/10.1002/2211-5463.13235>, DOI: 10.1002/2211-5463.13205.

## Month 54 (May 2022- September 2023, 6 months extension)

### 1) WG3 M 3.1: Workshops related to the topics of WG3

- *Obj1* Develop a collaborative effort to achieve a common ground on the topics 1) Glycan profiling in health and disease, and 2) Glycan-based diagnostics and therapeutics, as well as the related subtopics.
- *Obj 3*: Foster progress in existing research projects.
- *Obj 10 INNOGLY*: Bridge the gap between scientific communities with complementary knowledge and common interests in glycan-related topics.
- *Obj 15 INNOGLY*: Enhance public communication to boost promotion of glycoscience within the mainstream of biological sciences.

During the closing meeting in Heraklion (May 2023) the WG3 meeting was performed.

It is worth noting that 6 WG3 members delivered oral presentations during the meeting. In addition, several members of WG3 had the opportunity to display a poster sharing their scientific expertise and available research tools.

This event was announced on the INNOGLY website and on Twitter.

Enclosed this document the detailed program of the meeting and attached the .ppt presentation of the WG3 leader including the planned activities.

### **WP3 Glycans Role in Immunity**

09:00-09:10 Summary of WP3 activities by Barbara Richichi Chairs: Barbara Richichi & Gornik Olga

P13. 09:10-09:30 Cellulose nanocrystal-gold nanoparticles hybrid is a modular and functional glyconanomaterial with biomolecular recognition properties. Giacomo Biagiotti and Barbara Richichi.

P14. 09:30-09:50 N-glycosylation of plasma proteins and its genetic regulation in type 1 diabetes mellitus. Najda Rudman, Domagoj Kifer, Simranjeet Kaur, Dinko Šoić, Flemming Pociot, Grant Morahan & Olga Gornik.

P15. 09:50-10:10 Tumor-associated glycan structures: friend or foe in immunity to cancer? Irene van der Haar Àvila, Victor Lorrain, Laraib Ali, Lenneke A.M. Cornelissen, Athanasios Blanas, Yvette van Kooyk & Sandra J. van Vliet.

P16. 10:10-10:30 A microfluidic photo-induced platform to synthesize ultrasmall glyco-nanoparticles. P. Perez Schmidt, L. Ragona, K. Pagano, L. Lay, Evangelisti, M. Marelli & L. Polito.

P17. 10:30-10:50 A nanotechnological approach to potentiate the immunogenicity of pneumococcal glycoconjugate vaccines. Maruthi Prasanna, Rubén Varela Calvino, Daphnée Soulard, Lorenzo Albertazzi, Annie Lambert, Sylvia Pujals, François Trottein, Emilie Camberlein, Noemi Csaba & Cyrille Grandjean.

In collaboration with the WG1' leaders, we have organized a virtual meeting (8-9<sup>th</sup> October 2021, Zoom platform) on: *Glycosylation in Cancer and Tumour Immunology*.

## 2) Attendance to conferences and Lectures on glycoscience

- *Obj 10 INNOGLY*: Bridge the gap between scientific communities with complementary knowledge and common interests in glycan-related topics.

- *Obj 15 INNOGLY*: Enhance public communication to boost promotion of glycoscience within the mainstream of biological sciences.

1. Nadya Bozakova and Veselin Ivanov, 2022. Possibilities of using *Saccharomyces cerevisiae* as a dietary supplement in sheep production. Book of abstracts NUTRICON 2022, I. FOOD INGREDIENTS, FOOD STRUCTURE, ADDITIVES, SUPPLEMENTS, FORTIFICATION, pp. 35-36. Food Quality and Safety, Health and Nutrition, NUTRICON Congress, June, 8-10, 2022, Ohrid, Macedonia.
2. Anderluh M, Loi EM, Weiss M, Ballsolier C, Tomašič T, Gobec M, Pieters RJ. Inhibition of O-GlcNAc transferase - the cell's metabolic gauge that alters its fate. 15th Bratislava Symposium on Saccharides (15BSS), June 20-24, 2022, Smolenice, Slovakia. <https://www.saccharides.sav.sk/>
3. Anderluh M. Plenary Lecture: Glycoscience Fights Bacterial Diseases: Case Studies of FimH and Galectin-8 Inhibitors INNOGLY & GLYCONanoPROBES Cost Actions – Young Investigators Meeting, Iasi, Romania, 2023.
4. M. Rita Ventura, Synthesis of (oligo)arabinosides and development of a functional assay for the study of enzymes involved in mycobacteria cell wall biosynthesis 14th International Meeting of the Portuguese Carbohydrate Group – GLUPOR 14, Caparica, Portugal, 16-18 January 2023.
5. van Vliet S.J. CRISP-Cas9 generation of tumor glycovariants, impact on survival and immune recognition. Transferable skills course and workshop. 2nd Network Wide Event of the GLYTUNES consortium. Amsterdam, the Netherlands, 2022.
6. van Vliet S.J. Glycan-dependent signalling routes and transcriptional programs in human dendritic cells after triggering of the C-type lectin MGL. INNOGLY Cost Action Annual Meeting. Lugano, Switzerland, 2022.
7. Van Vliet S.J. Tumor-associated glycan structures: friend or foe in immunity to cancer? INNOGLY & GLYCONanoPROBES Cost Actions – Young Investigators Meeting, Iasi, Romania, 2023.
8. Mattan Hurevich, and Shlomo Yitzchaik
9. “Glycan based electrochemical biosensors for enzymes: catalysis vs. recognition” 2nd General INNOGLY Symposium; Lugano, Switzerland, from 4th to 6th May 2022.
10. “Catalysis vs. recognition in glycan-based electrochemical biosensors” The 15th Bratislava Symposium on Saccharides (15th BSS), Smolenice Castle, Slovakia. June 20 - 24, 2022.
11. “BIOCATALYSIS AND MOLECULAR RECOGNITION IN ENZYMES BIOSENSING” Institute of Electronic Structure and Laser (IESL) of the Foundation for Research and Technology – Hellas (FORTH), Heraklion - Crete, Greece, October 19, 2022.
12. “Catalysis versus molecular recognition in enzyme biosensing” Workshop on Antimicrobial Peptides - The University of Melbourne, Australia; February 1-3, 2023.
13. “Conformationally Responsive Electrochemical Biosensors” MSE NTU Bioengineering tools for next-generation cellular agriculture, Singapore; March 6, 2023.
14. Rosa Peracaula Miro. Llop E, Ferrer-Batallé M, Gratacós-Mulleras A, Duran A, de Llorens R, Comet J, Peracaula R. Talk “Importance of PSA glycosylation as Aggressive Prostate Cancer

- biomarker” and practical workshop about laboratory techniques (electrophoresis and chromatography). 29Th November 2022. IES La Salle. Girona, Spain.
15. Biocatalysis versus binding in enzyme biosensing” NUS FST Seminar on Cellular Agriculture, Singapore.; March 8, 2023.
  16. “Automated and accelerated glycan synthesis” 15th Bratislava Symposium on Saccharides. June 2022, Bratislava, Slovakia.
  17. Automated and accelerated glycan synthesis” 5th Glycobasque symposium. November 2022, San-Sebastian, Spain.
  18. “Automated and accelerated glycan synthesis” Workshop on antimicrobial peptides. February 2023, Melbourne, Australia.
  19. “Automated and accelerated glycan synthesis” ACS Spring 2023. March 2023, Indianapolis, USA.
  20. “Accelerated solid-phase synthesis of post-translationally modified peptides” ACS Spring 2023. March 2023, Indianapolis, USA.
  21. “Electrochemical strategies for studying the effect of modifications on glycans binding preferences” ACS Spring 2023. March 2023, Indianapolis, USA.
  22. Anne Harduin-Lepers. “Molecular and functional evolution of vertebrate  $\alpha$ 2,8-sialyltransferases (ST8SIA)”. Sialoglyco 2022, Nagoya, Japan
  23. Mathieu Decloquement, Marzia Tindara Venuto, Virginie Cogez, Anna Steinmetz, Cédric Lion, Vincent Rigolot, Nicolas Szydowski, Christophe Biot, Sebastian Galuska and Anne Harduin-Lepers. Diversity of polysialylation machinery in fish species highlights exciting perspectives to generate original high therapeutic biomaterials. Annual COST Innogly meeting 4-6 May, Lugano, Switzerland
  24. Laura Polito "Glycosylated nanovaccines in infections and cancer" at the training school "Conjugation of glycans onto nanomaterials: opportunities in therapy and diagnosis" 12-14 September 2022 – Strasbourg (France)
  25. Marco Marradi "Gold glyconanoparticles for steering immune responses" at the training school "Conjugation of glycans onto nanomaterials: opportunities in therapy and diagnosis" 12-14 September 2022 – Strasbourg (France)
  26. Innogly meeting at Alicante (WORKSHOP “Neuroglycoproteins in Health and Disease” 24-25 March 2022 Alicante (Spain): "Llop E, Ferrer-Batallé M, Gratacós-Mulleras A, Duran A, de Llorens R, Comet J, Peracaula R. “Determination of altered Prostate Specific Antigen glycoforms in prostate cancer: clinical implications”.
  27. Innogly Annual meeting 2022, Lugano, 4th-6th May: "Adrià Duran, Pedro E Guerrero, Maria Rosa Ortiz, Dunia Pérez Del Campo, Ernesto Castro, Adelaida Garcia-Velasco, Esther Fort, Rafael de Llorens, Radka Saldoval, Esther Llop and Rosa Peracaula. “Characterization of mesothelin glycosylation in pancreatic cancer: decreased core fucosylated glycoforms in pancreatic cancer patients’ sera”.
  28. Laura Petrosilli. Synthesis of Streptococcus pneumonia 6A/6C capsular polysaccharide fragments. "Organic Chemistry Day: The 35th Annual Organic Chemistry Day, April 22, 2023". University of Missouri-Columbia
  29. Wieslaw Kaca. Past and future endotoxin studies of Proteus mirabilis (03) 1959 strain. Advances in biology and chemistry of bacterial surface polysaccharide. Poland, April 2022
  30. LOI, Elena Maria, WEISS, Matjaž, PAJK, Stane, YASINI, Daniel, NOVAK, Doroteja, GOBEC, Martina, TOMAŠIČ, Tihomir, PIETERS, Roland J., ANDERLUH, Marko. The quest for the first potent in vivo acting OGT inhibitor. V: Book of abstracts. 2022, 152, p067. <https://www.efmc-ismc.org/v2/data/1661849465EFMC-ISM-C-Book-Web-HD3.pdf>.
  31. PURIĆ, Edvin, TOPLAK, Žan, TOMAŠIČ, Tihomir, HASSAN, Mujtaba, NILSSON, Ulf, ANDERLUH, Marko. 2-substituted galactosides as selective and potent galectin-8 ligands. V: Book of abstracts. [S. l.]: [s. n.], 2022. Str. 322, p426. <https://www.efmc-ismc.org/v2/data/1661849465EFMC-ISM-C-Book-Web-HD3.pdf>.
  32. Cristiano A. Conceição, Federico Issoglio, Vanessa T. Almeida, José Rodrigues, Margarida Archer, M. Rita Ventura\*, “Synthesis of (oligo)arabinosides and development of a functional assay for the study of enzymes involved in mycobacteria cell wall biosynthesis”. BOSS XVII - 17th Belgian Organic Synthesis Symposium, 3-8 July 2022, Namur, Belgium.

33. Cristiano A. Conceição, Federico Issoglio, Vanessa T. Almeida, José Rodrigues, Margarida Archer, M. Rita Ventura\*, "A novel functional assay for the discovery of new drug targets in mycobacteria". EFMC-ISMIC 2022 - XXVII EFMC International Symposium on Medicinal Chemistry, 4-8 September 2022, Nice, France
34. Anne Harduin-Lepers, Virginie Cogez, Mathieu Decloquement, Sophie Groux-Degroote, Céline Schulz, Dorothée Vicogne. Regulation of glycosyltransferases and sialylated antigens expression. Annual COST Innogly meeting 4-6 May, Lugano, Switzerland
35. Mathieu Decloquement, Marzia Tindara Venuto, Virginie Cogez, Anna Steinmetz, Cédric Lion, Vincent Rigolot, Nicolas Szydowski, Christophe Biot, Sebastian Galuska and Anne Harduin-Lepers. Diversity of polysialylation machinery in fish species highlights exciting perspectives to generate original high therapeutic biomaterials. GFG 2022, Brainville 30 May-3 June, France
36. Poster presentation: DECLOQUEMENT M.\*, VENUTO M, COGEZ V., STEINMETZ A, LION C., RIGOLOTT V., BIOT C. GALUSKA S, HARDUIN-LEPERS A. Diversity of polysialylation machinery in fish species highlights exciting perspectives to generate original high therapeutic biomaterials. 28ième journée du groupe français des glycosciences. 30 May- 3 Juin, 2022. Branville, France (Best poster presentation)
37. Poster presentation: DECLOQUEMENT M.\*, GALUSKA S, HARDUIN-LEPERS A. Salmonid polysialyltransferases to generate a variety of sialic acid polymers. Symposium 2023 FOR2953: Sialoglycans in Development and Immunity. Oct 9-11, 2023 Hannover, Germany
38. Poster presentation: STEINMETZ A.\*, DECLOQUEMENT M., HARDUIN-LEPERS A., GALUSKA S. Characterization of the autopolysialylation properties of ST8Sia IV from *Coregonus maraena*. Symposium 2023 FOR2953: Sialoglycans in Development and Immunity. Oct 9-11, 2023 Hannover, Germany
39. van Vliet S.J. CRISP-Cas9 generation of tumor glycovariants, impact on survival and immune recognition. Transferable skills course and workshop. 2<sup>nd</sup> Network Wide Event of the GLYTUNES consortium. 07/06/2022, Amsterdam, the Netherlands.
40. Van Vliet S.J. Tumor-associated glycan structures: friend or foe in immunity to cancer? INNOGLY & GLYCONanoPROBES Cost Actions – Young Investigators Meeting. 21/4/2023, Iasi, Romania.
41. Van Vliet S.J. Tumor-associated glycan structures: friend or foe in immunity to cancer? INNOGLY Closing Meeting. 03/05/2023, Heraklion, Crete, Greece.
42. Van Vliet S.J. Tumor-associated glycan structures: friend or foe in immunity to cancer? 15th Jenner Glycobiology and Medicine Symposium. 14/6/2023, Porto, Portugal.
43. Invited talk, Cécilia Ménard-Moyon, Therapeutic applications of graphene oxide conjugates, NT'23, 5-9th June 2023 Arcachon (France)
44. PLENARY LECTURE: COMPOSTELLA F. Synthetic saccharide epitopes in pneumococcal diseases: exploring multipresentation and multivalency. Atti del XVIII Convegno-Scuola sulla Chimica dei Carboidrati, 25-28 Giugno 2023, Certosa di Pontignano, Siena (Italy). PL-6.
45. ORAL COMMUNICATION: COMPOSTELLA F., MORELLI L., LAY L., SANTANA-MEDEROS D., VALDES-BALBIN Y., VEREZ BENCOMO V., VAN DIEPEN A., H. HOKKE C., CHIODO F. Identification of common epitopes between different serotypes of *Streptococcus pneumoniae* group 19. 21st European Carbohydrate Symposium, 9-13 July 2023, Paris, France,. Abstracts, OL63.
46. Anderluh, Marko, Purić, Edvin, Hassan, Mujtaba, Van Klaveren, Sjors, Jakopin, Žiga, Tomašič, Tihomir, Nilsson, Ulf. First-in-class selective nanomolar inhibitors of galectin-8 N-terminal domain (oral lecture). EUROCARB . Paris, France, July 9-13 2023. <https://www.eurocarb2023.com/eurocarb-program-abstracts/>.
47. Anderluh, Marko. Glycoscience fights bacterial diseases : case studies of FimH and galectin-8 inhibitors (plenary lecture). Sour turned sweet : glycans bridging technology and precision medicine. International Meeting of Young Researchers – INNOGLY & GLYCONanoPROBES Iasi – Romania, 20th-21st April 2023. <https://glyconanoprobes.eu/2023/04/14/sour-turned-sweet-international-meeting-of-young-researchers-innogly-glyconanoprobes/>
48. Poster. Cristiano A. Conceição, Vanessa T. Almeida, Federico Issoglio, Margarida Archer, M. Rita Ventura, New functional assay to study potential anti-tuberculosis drugs targeting arabinofuranosyltransferases. 14th International Meeting of the Portuguese Carbohydrate Group – GLUPOR 14, Caparica, Portugal, 16-18 January 2023.

49. Poster. Kis, P.; Miranda, V.; Rodrigues, V. M.; Xavier, B. K.; Ventura, M. R. Chemoenzymatic strategy towards new autoinducer-2 prodrugs. 14th International Meeting of the Portuguese Carbohydrate Group – GLUPOR 14, Caparica, Portugal, 16-18 January 2023.
50. Invited lecture. Ana Maranhã, Mafalda Costa, Jorge Ripoll-Rozada, José A. Manso, Vanessa Miranda, Vera M. Mendes, Bruno Manadas, Sandra Macedo-Ribeiro, M. Rita Ventura, Pedro José Barbosa Pereira, Nuno Empadinhas, Methylglucose vs methylmannose polysaccharides: biosynthesis, distribution, and proposed roles in mycobacterial adaptation to heat or cold. 14th International Meeting of the Portuguese Carbohydrate Group – GLUPOR 14, Caparica, Portugal, 16-18 January 2023.
51. Prize for the best flash presentation. Poster. Cristiano A. Conceição, Federico Issoglio, Vanessa T. Almeida, Margarida Archer, M. Rita Ventura, Identification of Novel Drug Targets in Mycobacterium Tuberculosis Using an Innovative Functional NMR Assay Targeting Arabinofuranosyltransferases. International Meeting of Young Researchers of Innogly and Glyconanoprobes, 20-21 April 2023, Iasi, Romania.
52. Poster. Conceição, C. A.; Almeida, V. T.; Issoglio, F.; Archer, M.; Ventura, M. R. Development of a <sup>13</sup>C-NMR functional assay for the functional characterisation of arabinosyltransferases. Closing Meeting of the INNOGLY COST Action, 2-3rd May 2023, Heraklion, Crete, Greece.
53. Invited lecture. Conceição, C. A.; Issoglio, F.; Almeida, V. T.; Rodrigues, J.; Archer, M.; Ventura, M. R. Synthesis of (oligo)arabinosides and development of a functional assay for the study of enzymes involved in mycobacteria cell wall biosynthesis. 14th International Meeting of the Portuguese Carbohydrate Group – GLUPOR 14, Caparica, Portugal, 16-18 January 2023.
54. Oral and poster presentations, Alba Silipo.. Cristina Di Carluccio, ..., Siglecs interaction with glycans: A molecular view, Glyco26 26th International Symposium on Glycoconjugates, August 27th – September 1st 2023, Taipei, Taiwan.
55. “Studying glycan interactions using electrochemical impedance spectroscopy” INNOGLY COST-mini-symposium, Zoom platform; June 21, 2021.
56. Studying metal ion mediated interactions of sulfated glycans derived biosensors” GlycoAminoGlycans: What remains to be solved? Hybrid Symposium; Faculty of Medicine, University of Crete, Heraklion, Greece; September 27-30, 2021.
57. Glycan and peptide nanolayer-based biosensors” the NANO.IL.2021 Conference - at ICC Jerusalem, Israel; October 5-6, 2021.
58. “Biocatalysis and molecular recognition in enzyme biosensing” Institute of Electronic Structure and Laser (IESL) of the Foundation for Research and Technology – Hellas (FORTH), Heraklion - Crete, Greece, October 19, 2022.
59. Glycan based electrochemical biosensors for enzymes: catalysis vs. recognition” 2nd General INNOGLY Symposium; Lugano, Switzerland, from 4th to 6th May 2022.
60. “Catalysis vs. recognition in glycan-based electrochemical biosensors” The 15th Bratislava Symposium on Saccharides (15th BSS), Smolenice Castle, Slovakia. June 20 - 24, 2022.
61. “Catalysis versus molecular recognition in enzyme biosensing” Workshop on Antimicrobial Peptides - The University of Melbourne, Australia; February 1-3, 2023
62. “Conformationally Responsive Electrochemical Biosensors” MSE NTU Bioengineering tools for next-generation cellular agriculture, Singapore; March 6, 2023.
63. “Biocatalysis versus binding in enzyme biosensing” NUS FST Seminar on Cellular Agriculture, Singapore.; March 8, 2023.
64. Keynote Lecture “Biocatalysis versus binding in enzyme biosensing” Global Summit on Pharmaceutical and Medicinal Chemistry (PMC2023)- Lisbon, Portugal; September 21-23, 2023.
65. “Automated and accelerated glycan synthesis” 15th Bratislava Symposium on Saccharides. June 2022, Bratislava, Slovakia.
66. “Automated and accelerated glycan synthesis” 5th Glycobasque symposium. November 2022, San Sebastian, Spain.
67. “Automated and accelerated glycan synthesis” ACS Spring 2023. March 2023, Indianapolis, USA.
68. “Accelerated solid-phase synthesis of post-translationally modified peptides” ACS Spring 2023. March 2023, Indianapolis, USA.

69. Electrochemical strategies for studying the effect of modifications on glycans binding preferences” ACS Spring 2023. March 2023, Indianapolis, USA.
70. Developing Synthetic and Analytical Tools to Study the Effect of Modifications on Glycans and Peptides on Binding Preferences” Eurocarb XXI, the 21st European Carbohydrate Symposium, July 2023, Paris, France
71. Carbohydrate-functionalised metal complexes: lectin-targeting glycoclusters for therapy and detection, Joseph Byrne, Karolina Wojtczak, Ian Murphy, Gordon Cooke, Ciarán O'Reilly - 21st European Carbohydrate Symposium, Paris (France), 9th-13th July 2023
72. Carbohydrate-functionalised metal complexes: targeting pathogens, Karolina Wojtczak, Ian Murphy, Gordon Cooke, Ciarán O'Reilly, Alexander Titz, Joseph Byrne - InnoGly Closing Meeting, Heraklion (Greece), May 2023.

### 3) Courses on Glycoscience within Laurea Degrees

- Obj 10 INNOGLY: Bridge the gap between scientific communities with complementary knowledge and common interests in glycan-related topics.
- Obj 15 INNOGLY: Enhance public communication to boost promotion of glycoscience within the mainstream of biological sciences.

1. **Rosa Peracaula Miro.** Master of Molecular Biology and Biomedicine at the University of Girona within the subject: "Regulation of gene expression and post-translational modifications" (17th November 2022)
2. **Rosa Peracaula Miro.** Llop E, Ferrer-Batallé M, Gratacós-Mulleras A, Duran A, de Llorens R, Comet J, Peracaula R. "The investigator career: cancer research". Spanish Association Against Cancer (AECC) dissemination program. Talks to High School Students. 26th April 2022. IES Olivar Gran, Figueres, Spain.
3. **Barbara Richichi.** Glycoconjugates: structure, synthesis and molecular recognition in physiological and pathological events. Laurea Course in Biotechnology, University of Florence (ITALY)

### 4) Publications/Conferences of WG3 members:

#### Publications

1. Structural and mechanistic insights into the cleavage of clustered O-glycan patches-containing glycoproteins by mucinases of the human gut. <https://doi.org/10.1038/s41467-022-32021-9>
2. Loi EM, Tomašič T, Balsollier C, van Eekelen K, Weiss M, Gobec M, Alteen MG, Vocadlo DJ, Pieters RJ, Anderluh M. Discovery of a New Drug-like Series of OGT Inhibitors by Virtual Screening. Molecules. 2022 Mar 19;27(6):1996. doi: 10.3390/molecules27061996.
3. Brunori, F.; Padhi, K. D.; Alshanski, I.; Freyse, J.; Dürig, J-N.; Penk, A.; Vaccaro, L.; Hurevich, M.; Rademann, J.; Yitzchaik, S. Sulfation pattern-dependent Iron (III) mediated interleukin-8 glycan binding ChemBioChem 2022, 23, e2021005. <https://doi.org/10.1002/cbic.202100552>
4. Shitrit, A.; Alshanski, I.; Kikkeri, R.; Hurevich, M.; Yitzchaik, S. Profiling Heparan Sulfate-Heavy Metal Ions Interaction Using Electrochemical Techniques Chem. Eur. J. 2022, e202202193; Cover page. doi: 10.1002/chem.202202193
5. Alshanski, I.; Shitrit, A.; Gordon, D.; Kikkeri, R.; Hurevich, M.; Yitzchaik, S. Biocatalysis versus molecular recognition in sialoside-neuraminidase biosensing and its use for evaluating inhibitors' efficacy ACS Chem. Biol. 2022, 28, 55, e202202193. <https://doi.org/10.1021/acschembio.2c00913>
6. Ben Abba Amiel, D.; Hurevich, M. Expedient Synthesis of a Glycopeptide Library Eur. J. Org. Chem 2022, e202200623. <https://doi.org/10.1002/ejoc.202200623>
7. Bakhatan, Y, Alshanski, I, Chan, C-K, Lo, W-C, Lu, P-W, Liao, P-H, Wang, C-C, Hurevich, M, Accelerated solid phase glycan synthesis: ASGS. Chem. Eur. J. 2023, e202300897 <https://doi.org/10.1002/chem.202300897>

8. Cogež, V.; Vicogne, D.; Schulz, C.; Portier, L.; Venturi, G.; de Ruyck, J.; Decloquement, M.; Lensink, M. F.; Brysbaert, G.; Dall'Olio, F.; Groux-Degroote, Sophie and Harduin-Lepers, Anne. N-Glycan on the Non-Consensus N-X-C Glycosylation Site Impacts Activity, Stability, and Localization of the Sda Synthase B4GALNT2. *International Journal of Molecular Sciences* 2023, 24 (4), 4139. doi:10.3390/ijms24044139
9. Fliniaux, I.; Marchand, G.; Molinaro, C.; Decloquement, M.; Martoriati, A.; Marin, M.; Bodart, J. F.; Harduin-Lepers, A.; Cailliau, K. Diversity of sialic acids and sialoglycoproteins in gametes and at fertilization. *Front Cell Dev Biol* 2022, 10, 982931. DOI: 10.3389/fcell.2022.982931.
10. P. Perez Schmidt, K. Pagano, C. Lenardi, M. Penconi, R. Mateu Ferrando, C. Evangelisti, L. Lay, L. Ragona, M. Marelli, L. Polito "Photo-Induced Microfluidic Production of Ultrasmall Glyco Gold Nanoparticles" *Angew. Chem. Int. Ed.* 2022, e202210140. <https://doi.org/10.1002/anie.202210140>
11. *Cancers* 2022, 14, 2413. <https://doi.org/10.3390/cancers14102413> "Gold Glyconanoparticles Combined with 91–99 Peptide of the Bacterial Toxin, Listeriolysin O, Are Efficient Immunotherapies in Experimental Bladder Tumors“.
12. Duran A, Guerrero PE, Ortiz MR, Pérez Del Campo D, Castro E, Garcia-Velasco A, Fort E, de Llorens R, Saldoval R, Llop E, Peracaula R. Characterization of Mesothelin Glycosylation in Pancreatic Cancer: Decreased Core Fucosylated Glycoforms in Pancreatic Cancer Patients' Sera. *Biomedicines*. 2022 Aug 10;10(8):1942. doi: 10.3390/biomedicines10081942. PMID: 36009489
13. Miró L, López J, Guerrero PE, Martínez-Bosch N, Manero-Rupérez N, Moreno M, Ortiz MR, Llop E, Navarro P, Peracaula R. Sialyltransferase Inhibitor Ac53FaxNeu5Ac Reverts the Malignant Phenotype of Pancreatic Cancer Cells, and Reduces Tumor Volume and Favors T-Cell Infiltrates in Mice. *Cancers (Basel)*. 2022 Dec 12;14(24):6133. doi: 10.3390/cancers14246133. PMID: 36551619 Free PMC article.
14. Antibodies Isolated from Rheumatoid Arthritis Patients against Lysine-Containing *Proteus mirabilis* O3 (S1959) Lipopolysaccharide May React with Collagen Type I. *Int. J. Mol. Sci.* 2020, 21, 9635; doi:10.3390/ijms21249635
15. MORELLI L., COMPOSTELLA F., PANZA L., IMPERIO D. Unusual promoters and leaving groups in glycosylation reactions: The evolution of carbohydrate synthesis. *Carbohydrate Research* 519, 108625 (2022) DOI: 10.1016/j.carres.2022.108625. (Open access)
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The publications/conferences above cover the topics related to INNOGLY Objectives:

*Obj 1:* Develop a collaborative effort to achieve a common ground on the topics 1) Glycan profiling in health and disease, and 2) Glycan-based diagnostics and therapeutics, as well as the related subtopics.

*Obj 2:* Develop glycan-based tools (nanometric and small molecules) to track glycosylation pathways and to dissect immunomodulatory functions.

*Obj 3:* Foster progress in existing research projects.

*Obj 4:* Develop biosensors to investigate glycan-protein interactions.

*Obj 5:* Promote the synthesis of glycomimetics and glycan-based analogues of specific target epitopes.

*Obj 6:* Develop glycan-based and glycan-integrated biopolymers.

*Obj 7:* Improve manipulation and engineering of glycan-based systems.

*Obj 8:* Develop straightforward methodologies to synthesize oligosaccharides and glycoconjugates.

*Obj 10:* Bridge the gap between scientific communities with complementary knowledge and common interests in glycan-related topics.

*Obj 15:* Enhance public communication to boost promotion of glycoscience within the mainstream of biological sciences.

Some of the publications above were announced on twitter (according with *Obj 15* INNOGLY).

## 5) INNOGLY networking activities: Grant Applications.

### HORIZON EUROPE

#### MSCA-Doctoral Network

- **GlyCanDrug**, A training network on the design of precision therapeutics that target key glycan motifs implicated in cancer HORIZON-MSCA-2022-DN, (successful). Coordinator University of Florence, **6 INNOGLY Members**
- **ACINETWORK**, A training network for the design of synthetic carbohydrate-based vaccines in the fight against multi-drug resistant nosocomial pathogen *Acinetobacter baumannii* HORIZON-MSCA-2022-DN-01 (successful). Coordinator University of Milan, **4 INNOGLY Members**



- **GlyconanoApp**, HORIZON-MSCA-2021-DN, (not successful).  
**ERA Talent Action**
- **PROTAG-8**, HORIZON-WIDERA-2022-TALENTS-04-01 (successful).  
**EU platforms for service**
- Research stay at CIC biomaGUNE of the PhD student Francesca Buco (an **NFFA EUROPE** proposal)
- 2022-2025: Horizon: HORIZON-EIC-2021-PATHFINDEROPEN-01. Type of action: RIA  
Proposal number: 101046369 Proposal acronym: SMELLODI. Mattan Hurevich and Shlomo Yitzchaik (HUJI).

## NATIONAL PROGRAMS

- **Glycofoldamers as bacterial toxin inhibitors** - 2022.03561.PTDC funded by Fundação para a Ciência e Tecnologia.
- **Evaluation of sialyltransferase inhibitors in colorectal cancer** 2022 – Ligue Nationale contre le cancer (French association) (successful)
- Martin Kurfiřt spent two weeks in Bilbao in Chemical Glycobiology Lab (head prof Jesus Jimenes-Barbero) learning NMR experiments. It was paid from an **INTER COST LTC20052** project which was obtained thanks to our participation in INNOGLY.
- **Study of galectin-glycan interactions using fluoroglycomimetics**. GA23-05146S from Czech Science Foundation (2023-2025).
- **Development of Electroanalytical Methods for Interaction of Galectins and Glycomimetic Ligands – New Potential Anticancer Drugs**. Czech Science Foundation (GA23-06115S)
- **Development of a machine learning-based model for the early diagnosis of rheumatoid arthritis**. Submitted on 2021-12-14 to NCN.
- **Marine Polysialyltransferases for the Generation of Immunomodulatory Bioconjugates** (PsaMar) PRCI: ANR-21-CE44-0032. France A Harduin-Lepers Germany: SP Galuska. 2021
- **FUCOSYLATED GLYCAN EPITOPES AS NOVEL IMMUNE CHECKPOINT MOLECULES IN COLORECTAL CANCER**. Sandra J. van Vliet, Dutch Cancer Society (KWF) – Research grant. 2022
- **Application of a novel very fast reduced matrix approach to get 3D protein-ligand complexes validated by STD NMR spectroscopy**. Cristina Di Carluccio (from Alba Silipo group, Italy) Jesus Angulo, Spain. 2023
- **Recombinant production of Siglec-7 in human cell line and characterization of its complexes with bacterial glycans by analytical ultracentrifugation and other biophysical techniques**. Cristina Di Carluccio (from Alba Silipo group, Italy). Ondrej Vanek, Czech Republic. 2021
- 2022-2026: Israel Science Foundation: Automated Carrageenan Synthesis. No. 1805/22. Mattan Hurevich
- 2023-2025: Israel Innovation Authority – “Sialosides-based Biosensing for Rapid Neuraminidase Detection and Inhibition”; Mattan Hurevich and Shlomo Yitzchaik (HUJI).

## 6) ECI activities:

1. PhD thesis of Elena Maria Loi. Structure-based design, synthesis and biological evaluation of novel O- $\beta$ -N-acetylglucosaminyltransferase inhibitors (Strukturno podprto načrtovanje, sinteza in biološko vrednotenje novih zaviralcev O- $\beta$ -N-acetilglukozaminil transferase) PhD on interdisciplinary doctoral programme in biomedicine (Pharmacy) PhD programme in drug Innovation : doctoral dissertation. Ljubljana: [L. Elena Maria], 2023. 185 pp. <https://repozitorij.uni-lj.si/IzpisGradiva.php?id=144929>, <http://www.dlib.si/details/URN:NBN:SI:doc-CDN2PGNO>. A part of the research work was done in Utrecht University in the laboratory of Prof. Dr. Roland J. Pieters, which was partially financed by the INNOGLY STSM
2. PhD studies of Mathieu Decloquement. PhD defence September 6th, 2023.
3. Sandra van Viet. Training activity for ECI. Participation as an invited speaker to the **International meeting of Young Researchers of INNOGLY & GLYCONanoPROBES**: “Sour

turned Sweet: Glycans bridging Technology and Precision Medicine”  
20-21 April 2023, Iasi, Romania

4. International Young Researchers Meeting 2023 Sour turned Sweet: Glycans bridging technology & precision medicine, April 1st – 2nd 2023, Iasi, Romania:
5. Flash Presentation, Alessandro Antonio Masi, Exploring the Interaction Between Siglec-7 and Disialylated Gangliosides, University of Naples Federico II, Italy
6. Oral Presentation, Maria Pia Lenza: Structural Details of Siglec-8 in Complex with a Therapeutic Antibody and a High Affinity Glycomimetic, University of Naples Federico II, Italy
7. Poster Presentation, Cristina Di Carluccio, Multidisciplinary Approach to Study the  $\alpha$ 2–3-Sialylated OGlycans Recognition by Siglec-Like Adhesins, University of Naples Federico II, Italy
8. Poster Presentation, Miguel de Azevedo Moreira, Studying the Activity, Substrate Specificity and Enzymatic Kinetics of Sialidase26 using qNMR, University of Naples Federico II, Italy
9. Invited Keynote lecture book of abstract pg 67: “The Breakthrough Of Nanomaterials: “Don’t Call Me Carrier!”. Biagiotti G. XLVI INTERNATIONAL SUMMER SCHOOL ON ORGANIC SYNTHESIS A.CORBELLA – ISOS 2022, 12-16 June 2022, Gargnano, BS, IT.
10. Oral communication Biagiotti G., Toniolo G., Rojo J., Cicchi S., Urbancic I., van Kooyk Y., Chiodo F. and Richichi B. XLI Convegno Nazionale della Divisione di Chimica Organica della Società Chimica Italiana, OC-103: Tailored cellulose-based hybrid glyco-nanomaterials for the specific recognition of C-type lectins. 2023, 10-14 September, Rome
11. Carbohydrate functionalised materials: towards antimicrobial surfaces" Hannah Croy, Karolina Wojtczak, Matthew Wylie, Joseph Byrne - International Meeting of Young Researchers (INNOGLY & GLYCONanoPROBES), Iasi (Romania), 20th-21st April 2023
12. "Shining a light on bacteria: lanthanide-based glycoconjugate molecular sensors for lectins, and antiadhesives", Karolina Wojtczak, Gordon Cooke, Kevin Kavanagh, Anne Imberty, Joseph Byrne - 21st European Carbohydrate Symposium, Paris (France), 9th-13th July 2023
13. Cristiano A. Conceição, Federico Issoglio, Vanessa T. Almeida, Margarida Archer, M. Rita Ventura; " Unveiling Novel Drug Targets in Mycobacterium Membrane Proteins via an Innovative Functional NMR Assay Targeting Arabinofuranosyltransferases". Slovak Academy of Sciences – Invited lecture; 8 June 2023, Bratislava, Slovakia
14. Cristiano A. Conceição, Federico Issoglio, Vanessa T. Almeida, Margarida Archer, M. Rita Ventura; " Identification of Novel Drug Targets in Mycobacterium Tuberculosis Using an Innovative Functional NMR Assay Targeting Arabinofuranosyltransferases". International Meeting of Young Researchers – INNOGLY & GLYCONanoPROBES; 20-21 April 2023, Iasi, Romania.

# **COST Action CA18103 INNOGLY: INNOVation with Glycans new frontiers from synthesis to new biological targets.**

**INNOGLY Annual Meeting 2022**

**WG1-WG3 Joint Meeting**

**Lugano, May 5, 2022**

## **Organizers:**

**Celso Reis**  
[celsor@ipatimup.pt](mailto:celsor@ipatimup.pt)

**Barbara RICHICHI**  
[barbara.richichi@unifi.it](mailto:barbara.richichi@unifi.it)

## **PROGRAMME**

2:00-2:10 PM

**Opening:** Celso Reis, Barbara Richichi, Jeanne-Bernardette Tse Sum Bui, Sandra van Vliet

2:10-2:20

**Celso Reis**

WG1: Glycan-based correlations in developmental and cancer biology.  
Tasks and Objectives: update and perspectives.

2:20-2:30

**Barbara Richichi**

WG3: Glycan dependent fine tuning of immunity.  
Tasks and Objectives: update and perspectives.

2:30-3:00 PM

**Discussion within the WG1-WG3 sub-groups**

3:00-4:00 PM

**Presentation of the results of the questionnaire**

## QUESTIONNAIRE

EMERGING DISCOVERIES ON CANCER AND IMMUNITY (include references, if possible) where glycans have a leadership role (not just related to research from your own group).

Topics may span from basic up to translational research and include the discoveries related to the identification of new intracellular pathways, new drugs/therapeutics and new nanomaterials, of the role/structure/composition of unknown glycoconjugate, biomarkers.

Please include comments on up to two emerging discoveries in the field of:

**a) Cancer biology**

**b) Cancer biomarkers and therapeutics**

**c) Immunology of infection diseases**

**d) Immunology of cancer**

**e) Immunology of autoimmune diseases**

**f) Development of glycan-coated nanomaterials and of saccharide-based biotools (nanometric and small molecules). Applications in cancer and immunity.**

LOOKING FORWARD: unmet needs in the field of glycobiology of cancer and glycoimmunology (from a biological and chemical perspective).

Please include inputs on which challenges we have to tackle and how you suggest to reach the proposed goals on:

**a) Cancer biology**

**b) Cancer biomarkers and therapeutics**

**c) Immunology of infection diseases**

**d) Immunology of cancer**

**e) Immunology of autoimmune diseases**

**f) Development of glycan-coated nanomaterials and of saccharide-based biotools (nanometric and small molecules). Applications in cancer and immunity.**

.ppt presentation of the WG3 leaders at the WG3 meeting in Lugano



### WG3: Glycan dependent fine tuning of immunity

WG3 leaders: B. RICHICHI (IT)  
S. VAN VLIET (NL)

### WG3 Members

**To date**  
**61 Members**

Updated list on INNOGLY Website

**MC2--Santiago de Compostela—10/2019**      35 Members  
(5 Early Career Investigators)

**11/2019-05/2022**

**+ 26 Members**

- ✓ 9 Early Career Investigators (34%)
- ✓ 12 Male vs 14 Female
- ✓ 4 ITC members

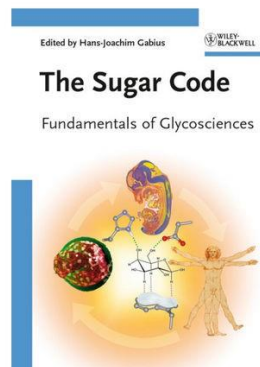
**INNOGLY Objective:** Help early career researchers to access and build new networks.

### Prof. Hans-Joachim Gabius



1955-2021

<https://doi.org/10.1093/glycob/cwab099>



## Memorandum of Understanding

**WG3 Glycan dependent fine tuning of immunity.** Discussion and exchange of knowledge and know-how between INNOGLY participants will be focused on the role of glycan in the fine tuning of immunity

- O 3.1 Promote the investigation of the modulatory role of glycans in innate and adaptive immune response.
- O 3.2 Promote the investigation of the modulatory role of glycans in immune tolerance.
- T 3.1 Employ advanced techniques to track the glycan-dependent modulation of immunity.
- T 3.2 Boost the development of synthetic methodologies to achieve complex oligosaccharides involved in self/non-self recognition processes.
- T 3.3 Promote the development of glycan-coated nanomaterials as mimicking systems
- T 3.4 Promote the development of *in vitro* and *in vivo* models to enable the functional analysis of glycans in immunomodulation.
- T 3.5 Promote the development of biosensors for detection of anti-carbohydrate antibodies.

D 3 Report on the main advances in the field and developed activities related to WG3 (month 12, 24, 36, 48)

M 3.1 Workshops related to the topics of WG3.

M 3.2 Symposia of the Action.



Lugano—May 3-5, 2022

## Publications from WG3 members

April 2019- April 2020 → 7 Original papers/review

- Venuto M.T., Decloquement M., Ribera M. J., Noel M., Rebl A., Cogež V., Petit D., Galuska S.P., Harduin-Lepers A. Vertebrate alpha2,8-sialyltransferases (ST8Sia): a Teleost perspective. *IJMS*, 2020
- Papakyriakou, A.; Cencetti, F.; Puliti, E.; Morelli, L.; Tricomi, J.; Bruni, P.; Compostella, F.; Richichi, B. Glycans meet sphingolipids: structure-based design of new Sphingosine Kinase 1 inhibitors. *ACS. Med. Chem. Lett.*, 2020, 11, 913–920.
- Marradi, M.; Tricomi, J.; Matassini, C.; Richichi, B. in *Comprehensive Glycoscience 2nd edition*, (Eds: Ravian Narain, Elvesier). Carbohydrate Functionalized Quantum Dots in Sensing, Imaging and Therapy Applications. 2020. DOI: 10.1016/B978-0-12-819475-1.00041-9.
- García Caballero, G., Kaltner, H., Kutzner, T. J., Ludwig, A.-K., Manning, J. C., Schmidt, S., Sinowatz, F. and Gabius, H.-J. How galectins have become multifunctional proteins. *Histol. Histopathol.* 2020, 35, 509-539.
- Cid E, Yamamoto M, Yamamoto F. Amino acid substitutions at sugar-recognizing codons confer ABO blood group system-related  $\alpha$ 1,3Gal(NAC) transferases with differential enzymatic activity. *Sci Rep.*, 2019, 9(1):846.
- Yamamoto M, Tarasco MC, Cid E, Kobayashi H, Yamamoto F. (2019). ABO blood group A transferase and its codon 69 substitution enzymes synthesize FORS1 antigen of FORS blood group system. *Sci Rep.* 2019, 9(1):9717.
- Kutzner TJ, Higuero AM, Stüßmaier M, Kopitz J, Hingar M, Díez-Revuelta N, Caballero GG, Kaltner H, Lindner I, Abad-Rodríguez J, Reusch D, Gabius HJ. How presence of a signal peptide affects human galectins-1 and -4: Clues to explain common absence of a leader sequence among adhesion/growth-regulatory galectins. *Biochim Biophys Acta Gen Subj.* 2020, 1864:129449.



Lugano—May 3-5, 2022

## Publications from WG3 members

May 2020- May 2021 → 17 Original papers/review

- Anderluh, M.; Berti, F.; Bzducha-Wróbel, A.; Chiodo, F.; Colombo, C.; Compostella, F.; Durlik, K.; Ferhati, X.; Holmdahl, R.; Jovanovic, D.; Kaca, W.; Lay, L.; Marinovic-Cincovic, M.; Marradi, M.; Ozil, M.; Polito, L.; Reina, J.J.; Reis, C.A.; Sackstein, R.; Silipo, A.; Švajger, U.; Vaněk, O.; Yamamoto, F.; Richichi, B.; S. J. van Vliet. Emerging glyco-based strategies to steer immune responses. *FEBS J.* 2021
- Morelli, L.; Polito, L.; Richichi, B.; Compostella, F. Glycanonparticles as tools to prevent antimicrobial resistance. *Glycoconj. J.* 2021
- Anderluh, M.; Berti, F.; Bzducha-Wróbel, A.; Chiodo, F.; Colombo, C.; Compostella, F.; Durlik, K.; Ferhati, X.; Holmdahl, R.; Jovanovic, D.; Kaca, W.; Lay, L.; Marinovic-Cincovic, M.; Marradi, M.; Ozil, M.; Polito, L.; Reina, J.J.; Reis, C.A.; Sackstein, R.; Silipo, A.; Švajger, U.; Vaněk, O.; Yamamoto, F.; Richichi, B.; S. J. van Vliet. Recent advances on smart glycoconjugate vaccines in infections and cancer. *FEBS J.* 2021
- Katarzyna Durlik-Popinska, Paulina Zamowicz, Łukasz Lechowicz, Józef Gawęda, Wiesław Kaca. Antibodies isolated from Rheumatoid Arthritis Patients against Lysine-Containing Protexin mirabilis O3 (S1959) Lipopolysaccharide May React with Collagen Type I. *Int. J. Mol. Sci.* 2020
- Andreozzi, P.; Tambari, L.; Tasca, E.; Giacomazzo, G.E.; Martinez, M.; Severi, M.; Marradi, M.; Cicchi, S.; Moya, S.; Biagiotti, G.; Richichi, B. The B & B approach: Ball-milling conjugation of dextran with phenylboronic acid (PBA)-functionalized BODIPY. *Beilstein J. Org. Chem.* 2020
- Martin, K.C.; Tricomi, J.; Corzana, F.; Garcia-García, A.; Ceballos-Laita, L.; Hicks, T.; Monaco, S.; Angulo, J.; Hurtado-Guerrero, R.; Richichi, B.; Sackstein, R. Fucosyltransferase-specific inhibition via next generation of fucose mimetics. *ChemCommun.* 2021, 57, 1145-1148.
- G. Biagiotti; E. Punić; I. Urbanić; A. Krišelj; M. Weiss; J. Mravjak; C. Gellini; L. Lay; F. Chiodo; M. Anderluh; S. Cicchi; B. Richichi. Combining cross-coupling reaction and Knoevenagel condensation in the synthesis of glyco-BODIPY probes for DC-SIGN super-resolution bioimaging. *BioorgChem.* 2021
- Hamala, V., Červenková Štátná, L., Kurfit, M., Čuřinová, P., Balouch, M., Hrstka, R., Voňka, P.; Karban, J. The effect of deoxyfluorination and O-acylation on the cytotoxicity of N-acetyl-d-glucosamine and d-galactosamine hemiacetals. *Org. Biomol. Chem.* 2021.
- Hamala, V.; Červenková Štátná, L.; Kurfit, M.; Čuřinová, P.; Dračinský, M.; Karban, J. Synthesis of multiply fluorinated N-acetyl-d-glucosamine and d-galactosamine analogs via the corresponding deoxyfluorinated glucosazide and galactosazide phenyl thioglycosides. *Beilstein J. Org. Chem.* 2021
- Loi EM, Weiss M, Pajk S, Gobec M, Tomasić T, Pieters RJ, Anderluh M. Intracellular Hydrolysis of Small-Molecule O-Linked N-Acetylglucosamine Transferase Inhibitors Differs among Cells and Is Not Required for Its Inhibition. *Molecules.* 2020.
- Magalhães A, Duarte HO, Reis CA. The role of O-glycosylation in human disease. *Mol Aspects Med.* 2021.
- Petit D, Teppa RE, Harduin-Lepers A. A phylogenetic view and functional annotation of the animal  $\beta$ 1,3-glycosyltransferases of the GT31 CAZy family. *Glycobiology.* 2021.
- Murphy, P. V.; Romero, A.; Xiao, Q.; Ludwig, A.-K.; Jogula, S.; Shilova, N. V.; Singh, T.; Gabba, A.; Javed, B.; Zhang, D.; Medrano, F. J.; Kaltner, H.; Koptz, J.; Bovin, N. V.; Wu, A. M.; Klein, M. L.; Percec, V. and Gabius, H.-J. Probing sulfatide-tissue lectin recognition with functionalized glycodendrimersomes. *iScience* 2021
- Diercks, T., Medrano, F. J., FitzGerald, F. G., Beckwith, D., Pedersen, M. J., Reihill, M., Ludwig, A.-K., Romero, A., Oscarson, S., Cudic, M. and Gabius, H.-J. Galectin-Glycan Interactions: Guidelines for Monitoring by (77) Se NMR Spectroscopy, and Solvent (H2 O/D2 O) Impact on Binding. *Chemistry.* 2021.
- Klein, M. L., Romero, A., Kaltner, H., Percec, V. and Gabius, H. J. From examining the relationship between (corona)viral adhesins and galectins to glyco-perspectives. *Biophys J.* 2021
- Loi EM, Weiss M, Pajk S, Gobec M, Tomasić T, Pieters RJ, Anderluh M. Intracellular Hydrolysis of Small-Molecule O-Linked N-Acetylglucosamine Transferase Inhibitors Differs among Cells and Is Not Required for Its Inhibition. *Molecules.* 2020, 25:3381.
- Pending US patent application: Martin, K.C.; Sackstein, R.; Richichi, B. Fucosyltransferase specific inhibition using fucose mimetic. December 29, 2020, as Senal No. 17/136.839.

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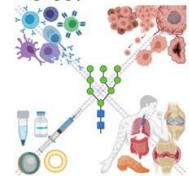
**Publications from WG3 members** 12 Original papers/review May 2021- to date

1. Brunori, F.; Padhi, K. D.; Alshanski, I.; Freyre, J.; Dürig, J.-N.; Penk, A.; Vaccaro, L.; Hurevich, M.; Rademann, J.; Yitzchaik, S. Sulfation pattern dependent Iron (III) mediated interleukin-8 glycan binding ChemBioChem 2021, 22, 1–7.
2. Alshanski, I.; Shriti, A.; Sukhran, Y.; Unverzagt, C.; Hurevich, M.; Yitzchaik, S. Effect of interfacial properties on impedimetric biosensing of sialylation process with biantennary N-glycan-based monolayer. Langmuir 2022, 38, 849–855.
3. Wavelet-Vermeuse, C.; Groux-Degroote, S.; Vicogne, D.; Cogez, V.; Venturi, G.; Trincherà, M., ... & Harduin-Lepers, A. (2021). Analysis of the proximal promoter of the human colon-specific B4GALNT2 (Sda synthase) gene: B4GALNT2 is transcriptionally regulated by ETS1. Biochimica et Biophysica Acta (BBA)-Gene Regulatory Mechanisms, 1864(11-12), 194747. doi.org/10.1016/j.bbagr.2021.194747
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12. Stefanetti, G.; Borriello, F.; Richichi, B.; Zanoni, I.; Lay, L. Immunobiology of Carbohydrates: Implications for Novel Vaccines and Adjuvant Design Against Infectious Diseases. Front. Cell. Infect. Microbiol. 2022, 11:808005 **Lugano—May 3-5, 2022**

**WG3 members: 25 co-authors with interdisciplinary expertise**

**March 2021**

Anderlüh, M.; Berti, F.; Bzducha-Wróbel, A.; Chiodo, F.; Colombo, C.; Compostella, F.; Durlik, K.; Ferhati, X.; Holmdahl, R.; Jovanovic, D.; Kaca, W.; Lay, L.; Marinovic-Cincovic, M.; Marradi, M.; Ozil, M.; Polito, L.; Reina, J.J.; Reis, C.A.; Sackstein, R.; Silipo, A.; Švajger, U.; Vaněk, O.; Yamamoto, F.; Richichi, B.; S. J. van Vliet, Emerging glyco-based strategies to steer immune responses. *FEBS J.*, 2021.



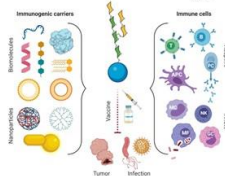
466 Reads

Fonts: <https://www.researchgate.net/publication/350296226>

220 References

**May 2021**

Anderlüh, M.; Berti, F.; Bzducha-Wróbel, A.; Chiodo, F.; Colombo, C.; Compostella, F.; Durlik, K.; Ferhati, X.; Holmdahl, R.; Jovanovic, D.; Kaca, W.; Lay, L.; Marinovic-Cincovic, M.; Marradi, M.; Ozil, M.; Polito, L.; Reina, J.J.; Reis, C.A.; Sackstein, R.; Silipo, A.; Švajger, U.; Vaněk, O.; Yamamoto, F.; Richichi, B.; S. J. van Vliet, Recent advances on smart glycoconjugate vaccines in infections and cancer. *FEBS J.*, 2021



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336 References

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Remember to acknowledge INNOGLY in your manuscripts



INNOGLY Obj: Help early career researchers to access and build new networks.

## INNOGLY-ECI-WG3-2021 Young Glyco-Scientists on stage

In Memory of Prof. Hans-Joachim Gabius whose work and dedication to the GlycoScience will be of inspiration for the next generation of GlycoScientists.

Date: September 27, 2021 10:00-18:00 CEST

Number of participants: 80

### 2 Keynote lectures

Francesca Micoli, PhD: "Professional growth in an international company working on polysaccharide based vaccines" (Industry)

Prof. Ryan A. Flynn, PhD: "Small RNAs are modified with N-glycans and displayed on the surface of living cells" (Academia)

Total number of speakers: 25 OL

Submit your proposal!

### Organizing Committee

-Dr. Giacomo Biagiotti (Post-doc fellow)  
(Italy).

-Elena Loi (Phd student)  
(Slovenia).

-Dr. Davide Ret (Post-doc fellow)  
(Austria).

-Cristiano Conceição (PhD Student)  
(Portugal).

-Dr. Kristina Zlatina (Post-doc Fellow)  
(Germany).

Lugano—May 3-5, 2022



### Memorandum of Understanding

WG3 Glycan dependent fine tuning of immunity. Discussion and exchange of knowledge and know-how between INNOGLY participants will be focused on the role of glycan in the fine tuning of immunity

O 3.1 Promote the investigation of the modulatory role of glycans in innate and adaptive immune response.

O 3.2 Promote the investigation of the modulatory role of glycans in immune tolerance.

T 3.1 Employ advanced techniques to track the glycan-dependent modulation of immunity.

T 3.2 Boost the development of synthetic methodologies to achieve complex oligosaccharides involved in self/non-self recognition processes.

T 3.3 Promote the development of glycan-coated nanomaterials as mimicking systems

T 3.4 Promote the development of *in vitro* and *in vivo* models to enable the functional analysis of glycans in immunomodulation.

T 3.5 Promote the development of biosensors for detection of anti-carbohydrate antibodies.

D 3 Report on the main advances in the field and developed activities related to WG3 (month 12, 24, 36, 48)

M 3.1 Workshops related to the topics of WG3.

M 3.2 Symposia of the Action.



Lugano—May 3-5, 2022



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Lugano—May 3-5, 2022

## Grant Period 1

### Santiago de Compostela- 10/2019

11 WG3 members delivered oral presentations

Obj 1,3,10,15 INNOGLY

The event was announced :

<https://innogly.eu/first-innogly-symposium>

<https://twitter.com/InnoglyA/status/1187667107229634560>

<https://twitter.com/InnoglyA/status/1187347634094247937>

## Grant Period 2

Virtual WG1-WG3 meeting (8-9<sup>th</sup> October 2021, Zoom platform)  
*Glycosylation in Cancer and Tumour Immunology*

**Number of participants:** 92 on 8<sup>th</sup> October, 72 on 9<sup>th</sup> October

**Keynote lectures:** 7

**Total number of speakers:** 14

A didactic talk has been delivered by the Editor in Chief of ChemBioChem Journal (Dr. Ruben RAGG): *Getting Published in 2020 and Beyond: How to Adapt to a Rapidly Changing Publication Landscape* (<https://twitter.com/InnoglyA/status/1314526277945241601>)

This event was announced on the INNOGLY website and on twitter.

<https://innogly.eu/wg1-wg3-joint-meeting-glycosylation-in-cancer-and-tumour-immunology-2>

<https://twitter.com/InnoglyA/status/1314531048030646273>

<https://twitter.com/InnoglyA/status/1314201085284737024>

A MC meeting has been included in this event.

## Grant Period 3

WG1-WG3 joint meeting, Lugano, May 5

### EMERGING DISCOVERIES ON CANCER AND IMMUNITY

LOOKING FORWARD: unmet needs in the field of glycobiology of cancer and glycoimmunology (from a biological and chemical perspective).

- a) Cancer biology
- b) Cancer biomarkers and therapeutics
- c) Immunology of infection diseases
- d) Immunology of cancer
- e) Immunology of autoimmune diseases
- f) Development of glycan-coated nanomaterials and of saccharide-based biotools (nanometric and small molecules). Applications in cancer and immunity.



Lugano—May 3-5, 2022

## Grant Period 3

### TRAINING SCHOOL

Conjugation of glycans onto nanomaterials: opportunities in therapy and diagnosis

September 12<sup>th</sup> (2 pm, CET) to 14<sup>th</sup> (12 pm) in Strasbourg (France)



IBMC - CNRS  
Cecilia MENARD-MOYON

#### Trainers (Tentative LIST)

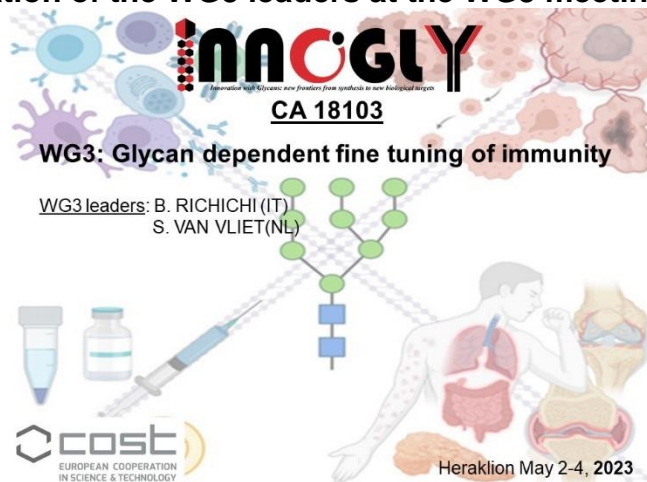
*Francesco Stellacci (EPFL, Switzerland), Laura Polito (CNR, Italy)  
Marco Marradi (University of Florence, Italy)  
Jean-François Nierengarten (CNRS, France)  
Jose M. Palomo (CSIC, Spain)*


How nanomaterial-based glycoconjugates can be exploited for therapeutic and diagnostic applications in cancer, infection, personalized medicine and for modulating innate and adaptive immune responses.




Lugano—May 3-5, 2022

## .ppt presentation of the WG3 leaders at the WG3 meeting in Heraklion



 **nnoGLY**  
Innovation with Glycans: new frontiers from synthesis to new biological targets  
**CA 18103**  
**WG3: Glycan dependent fine tuning of immunity**  
WG3 leaders: B. RICHICHI (IT)  
S. VAN VLIET (NL)

 **cost**  
EUROPEAN COOPERATION  
IN SCIENCE & TECHNOLOGY

Heraklion May 2-4, 2023

The slide features a central diagram of a glycan structure (green and blue spheres) with arrows pointing to various biological and medical illustrations: a virus, a cell, a syringe, a vial, a human torso with internal organs, and a joint. The background is a collage of these elements.

## WG3 Members

To date  
81 Members

### MC2--Santiago de Compostela—10/2019

35 Members

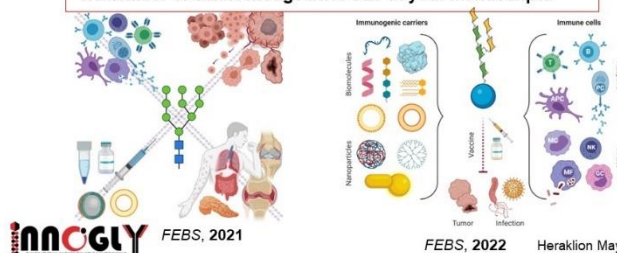


Heraklion May 2-4, 2023

### Publications from WG3 members

April 2019- April 2020	➔	7 Original papers/review
May 2020- May 2021	➔	17 Original papers/review
May 2021- May 2022	➔	17 Original papers/review
May 2022- May 2023	➔	25 Original papers/review

### Remember to acknowledge INNOGLY in your manuscripts



FEBS, 2021

FEBS, 2022

Heraklion May 2-4, 2023

### Publications from WG3 members

25 Original papers/review

- Structural and mechanistic insights into the cleavage of clustered O-glycan patches-containing glycoproteins by mucinases of the human gut. <https://doi.org/10.1038/s41467-022-32021-9>
- Balsollier C, Tomašić T, Yasini D, Bijkerk S, Anderluh M, Pieters RJ. Design of OSM-4 Analogs Using Scaffold Hopping: Investigating the Importance of the Uridine Mimic in the Binding of OGT Inhibitors. *ChemMedChem*. 2023 Feb 8:e202300001. doi: 10.1002/cmde.202300001.
- Loi EM, Tomašić T, Balsollier C, van Eekelen K, Weiss M, Gobec M, Alteen MG, Vocadlo DJ, Pieters RJ, Anderluh M. Discovery of a New Drug-like Series of OGT Inhibitors by Virtual Screening. *Molecules*. 2022 Mar 19;27(6):1996. doi: 10.3390/molecules27061996.
- Brunori, F.; Padhi, K. D.; Alshanski, I.; Freyse, J.; Dürig, J.-N.; Penk, A.; Vaccaro, L.; Hurevich, M.; Rademann, J.; Yitzchaik, S. Sulfation pattern-dependent iron (III) mediated interleukin-8 glycan binding. *ChemBioChem* 2022, 23, e2021005.
- Alshanski, I., Shitrit, A., Sukhran, Y., Unverzagt, C., Hurevich, M., Yitzchaik, S. Effect of interfacial properties on impedimetric biosensing of sialylation process with biantennary N-glycan-based monolayer. *Langmuir* 2022, 38, 849–855.
- Shitrit, A., Alshanski, I., Kikkeri, R., Hurevich, M., Yitzchaik, S. Profiling Heparan Sulfate-Heavy Metal Ions Interaction Using Electrochemical Techniques. *Chem Eur. J.* 2022, e202202193; Cover page.
- Alshanski, I.; Shitrit, A.; Gordon, D.; Kikkeri, R.; Hurevich, M.; Yitzchaik, S. Biocatalysis versus molecular recognition in sialoside-neuraminidase biosensing and its use for evaluating inhibitors' efficacy. *ACS Chem. Biol.* 2022, 28, 55, e202202193. <https://doi.org/10.1021/acscchembio.2c00913>
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- Cogez, V.; Vicogne, D.; Schulz, C.; Portier, L.; Venturi, G.; de Ruyck, J.; Dedoquemet, M.; Lensink, M. F.; Brysbaert, G.; Dall'Olio, F.; Groux-Degroote, Sophie and Harduin-Lepers, Anne. N-Glycan on the Non-Consensus N-X-C Glycosylation Site Impacts Activity, Stability, and Localization of the Sda Synthase B4GALNT2. *International Journal of Molecular Sciences* 2023, 24 (4), 4139. doi:10.3390/ijms24044139



Heraklion May 2-4, 2023



## Dissemination of Glycoscience: Meetings

- LOI, Elena Maria, WEISS, Matjaž, PAJK, Stane, YASINI, Daniel, NOVAK, Doroteja, GOBEC, Martina, TOMAŠIĆ, Tihomir, PIETERS, Roland J., ANDERLUH, Marko. The quest for the first potent in vivo acting OGT inhibitor. V. Book of abstracts. 2022, 152, p067. <https://www.efmc-ismc.org/v2/data/1661849465EFMC-ISM-Book-Web-HD3.pdf>.
- PURIC, Edvin, TOPLAK, Zan, TOMAŠIĆ, Tihomir, HASSAN, Mujaba, NILSSON, Ulf, ANDERLUH, Marko. 2-substituted galactosides as selective and potent galectin-3 ligands. V. Book of abstracts. [S. l.] : [s. n.], 2022. Str. 322, p426. <https://www.efmc-ismc.org/v2/data/1661849465EFMC-ISM-Book-Web-HD3.pdf>.
- Cristiano A. Conceição, Federico Issoglio, Vanessa T. Almeida, José Rodrigues, Margarida Archer, M. Rita Ventura", "Synthesis of (oligo)arabinosides and development of a functional assay for the study of enzymes involved in mycobacteria cell wall biosynthesis". BOSS XVII - 17th Belgian Organic Synthesis Symposium, 3-8 July 2022, Namur, Belgium.
- Cristiano A. Conceição, Federico Issoglio, Vanessa T. Almeida, José Rodrigues, Margarida Archer, M. Rita Ventura", "A novel functional assay for the discovery of new drug targets in mycobacteria". EFMC-ISM 2022 - XXVII EFMC International Symposium on Medicinal Chemistry, 4-8 September 2022, Nice, France.
- Anne Harduin-Lepers, Virginie Cogez, Mathieu Decloquement, Sophie Groux-Degroote, Céline Schulz, Dorothée Vicogne. Regulation of glycosyltransferases and sialylated antigens expression. Annual COST InnoGly meeting 4-6 May, Lugano, Switzerland.
- Mathieu Decloquement, Marzia Tindara Venuto, Virginie Cogez, Anna Steinmetz, Cédric Lion, Vincent Rigolot, Nicolas Szydowski, Christophe Biot, Sebastian Galuska and Anne Harduin-Lepers. Diversity of polysialylation machinery in fish species: highlighting exciting perspectives to generate original high therapeutic biomaterials. FG 2022, Brainville 30 May-3 June, France.

Remember to include INNOGLY logo in your presentation



Heraklion May 2-4, 2023

## INNOGLY-WG3 Networking activities



HORIZON EUROPE

### GRANT APPLICATIONS

#### MSCA-Doctoral Network

- GlyCanDrug**. A training network on the design of precision therapeutics that target key glycan motifs implicated in cancer. HORIZON-MSCA-2022-DN, (successful). Coordinator University of Florence, 6 INNOGLY Members
- ACINETWORK**. A training network for the design of synthetic carbohydrate-based vaccines in the fight against multi-drug resistant nosocomial pathogen *Acinetobacter baumannii*. HORIZON-MSCA-2022-DN-01 (successful). Coordinator University of Milan, 4 INNOGLY Members
- GlyconanoApp**. HORIZON-MSCA-2021-DN, (not successful).

#### ERA Talent Action

- PROTAG-8**, HORIZON-WIDERA-2022-TALENTS-04-01 (successful).

#### EU platforms for service

- Research stay at CIC biomaGUNE of the PhD student Francesca Buco (an NFFA EUROPE proposal)

#### NATIONAL PROGRAMS

- Glycofoldamers as bacterial toxin inhibitors** - 2022.03561.PTDC funded by Fundação para a Ciência e Tecnologia.
- Evaluation of sialyltransferase inhibitors in colorectal cancer 2022** - Ligue Nationale contre le cancer (French association) (successful)
- Martin Kurfitz spent two weeks in Bilbao in Chemical Glycobiology Lab (head prof Jesus Jimenes-Barbero) learning NMR experiments. It was paid from an INTER-COST LTC20052 project which was obtained thanks to our participation in INNOGLY.
- Study of galectin-glycan interactions using fluoroglycomimetics**. GA23-05146S from Czech Science Foundation (2023-2025).
- Development of Electroanalytical Methods for Interaction of Galectins and Glycomimetic Ligands – New Potential Anticancer Drugs**. Czech Science Foundation (GA23-06115S)
- Development of a machine learning-based model for the early diagnosis of rheumatoid arthritis**. Submitted on 2021-12-14 to NCR.



Heraklion May 2-4, 2023

## INNOGLY-WG3 Networking activities

### WG1-WG3 joint meeting, Lugano, May 5, 2022

#### EMERGING DISCOVERIES ON CANCER AND IMMUNITY

LOOKING FORWARD: unmet needs in the field of glycobiology of cancer and glycoimmunology (from a biological and chemical perspective).

- Cancer biology
- Cancer biomarkers and therapeutics
- Immunology of infection diseases
- Immunology of cancer
- Immunology of autoimmune diseases
- Development of glycan-coated nanomaterials and of saccharide-based biotools (nanometric and small molecules). Applications in cancer and immunity.



## TRAINING SCHOOL

### INNOGLY-WG3 Networking activities

#### New collaborative efforts

1. Barbara Richichi (Italy) and Jose Palomo (Spain) on the synthesis of sialic acid derivatives
2. Mattan Hurevich (Israel) and Barbara Richichi (Italy) on Sialyltransferase inhibitors and with Grandjean (France) group on bacterial NAs.
3. Anne Harduin-Lepers (France), Ramon Hurtado Guerrero (Spain): production of recombinant sialyltransferases and with Sebastian Galuska (France) on polysialyltransferases
4. Shavandi Amin (3BIO-BioMatter, ULB, Brussels) and Dr. Dodi Grigore T. Popa University of Medicine and Pharmacy (Romania) on saccharidic based biomaterials and hydrogels for tissue engineering (2 PhD fellowships through FNRS Aspirant, which is a funding agency in Wallonia, Belgium. These fellowships will support the research work of our PhD students who are in their second year of studies)
5. Karban Jindrich (Praga) and Jesus Jimenes-Barbero (Spain)
6. Karban Jindrich (Praga) and Celso Reis (Portugal) on fluorinated monosaccharides as metabolic inhibitors of cell surface glycosylation.
7. Federica Compostella (University of Milano, Italy), Fabio Parmeggiani (Politecnico di Milano, Italy), Sabine Flitsch (University of Manchester, UK): Activity of Galactose oxidase mutants towards a family of galactolipids.

Conjugation of glycans onto nanomaterials: opportunities in therapy and diagnosis  
September 12-14<sup>th</sup> 2022, Strasbourg (France)



IBMC - CNRS  
Cecilia MENARD-MOYON

#### Trainers

- Nanoparticles for biomedical applications (**Cécilia Ménard-Moyon**)
- Nanomaterials: A look ahead (**Barbara Richichi**)
- Biological applications of glycofullerenes (**Jean-François Nierengarten**)
- Glyconanomaterials for virus detection and inhibition (**Jose M. Palomo**)
- Glycosylated nanovaccines in infections and cancer (**Laura Polito**)
- Multifunctional nanoprobe for multivalent lectin-carbohydrate recognition (**Dejian Zhou**)
- Antiviral nanoparticles targeting glycosaminoglycan-binding viruses (**Francesco Stellacci**)
- Gold glyconanoparticles for steering immune responses (**Marco Marradi**)

19 Trainees

How nanomaterial-based glycoconjugates can be exploited for therapeutic and diagnostic applications in cancer, infection, personalized medicine and for modulating innate and adaptive immune responses.

Heraklion May 2-4, 2023



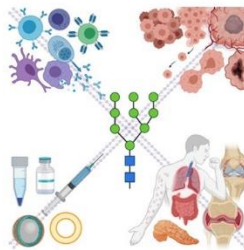
Heraklion May 2-4, 2023



CA 18103

### WG3: Glycan dependent fine tuning of immunity

WG3 leaders: B. RICHICHI (IT)  
S. VAN VLIET (NL)



Heraklion May 2-4, 2023