COST Action CA18103 INNOGLY: INNOvation with Glycans new frontiers from synthesis to new biological targets.

WG3 Report

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According to Deliverable 3 (D.3 Report on the main advances in the field and developed activities related to WG3) in the INNOGLY' MoU, the activities related to Working Group 3 (WG3: Glycan dependent fine tuning of immunity) at month 12 and 24 have been listed below. During the period affected by COVID-19 restrictions (February 2020 to date), WG3 focused on the dissemination of glycoscience related to the modulation of the immune response in cancer, infection, autoimmune diseases.

Citations on the specific Objectives (Obj or O), Milestones (M), Task (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 publication of co-authored papers, organization of workshop/meeting, short term scientific missions (STSM), dissemination activities as described below.

Notably, since the kick-off on April 2019, 22 new members have joined the WG3. A list of the 48 WG3 members is included.

Month 12 (April 2019-April 2020)

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 promotion of glycoscience within the mainstream of biological sciences.

October 24, 2019. “Aula Magna”, Faculty of Mathematics, University of Santiago de Compostela. Rúa Lope Gómez de Marzoa, s/n. Campus sur, 15782, Santiago de Compostela, Spain.

Enclosed to this document the detailed program of the meeting and the .ppt presentation of the WG3 leader including the planned activities. Worth noting, 11 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:

https://innogly.eu/first-innogly-symposium
https://twitter.com/InnoglyA/status/1187667107229634560
https://twitter.com/InnoglyA/status/1187347634094247937

2) **Publications from WG3 members (April 2019- April 2020)**

Publications

1. Venuto M.T., Decloquement M., Ribera M. J., Noel M., Rebl A., Cogez V., Petit D., Galuska S.P., Harduin-Lepers A. Vertebrate alpha2,8-sialyltransferases (ST8Sia): a Teleost perspective. IJMS, **2020**, doi:10.3390/ijms21020513.
2. 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.
3. Marradi, M.; Tricomi, J.; Matassini, C.; Richichi, B. in *Comprehensive Glycoscience 2nd editio*n, (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. Just online in the book: Reference Module in Chemistry, Molecular Sciences and Chemical Engineering.
4. 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.
5. Cid E, Yamamoto M, Yamamoto F. Amino acid substitutions at sugar-recognizing codons confer ABO blood group system-related α1,3 Gal(NAc) transferases with differential enzymatic activity. Sci Rep., **2019**, 9(1):846.
6. 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.
7. Kutzner TJ, Higuero AM, Süßmair 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.

Conferences

1. Yamamoto M ‘The Role of Glycans in Transfusion Medicine and Disease: The ABO Blood Group System” at the **2020** AABB Annual Meeting. Presented the Josep Carreras Showcasing Discoveries webinar with the title of “ABO blood groups: from basics to molecular genetics/genomics, enzymology, evolution and disease association”, which has been uploaded onto YouTube.

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

Obj 3: Foster progress in existing research projects.
Obj 7: Improve manipulation and engineering of glycan-based systems.
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 above publications were announced on twitter (according with *Obj 15 INNOGLY*):

https://twitter.com/BarbaraRichichi/status/1245411943361495040
https://twitter.com/BarbaraRichichi/status/1346193350710452230

3) **STSM of WG3 members**

i) Reference code: ECOST-STSM-CA18103-45338. Applicant: Dr. Barbara RICHICHI.
STSM from Italy to USA (Florida). STSM title: Fucose mimetic architectures as tools for the custom-site modifications of cell surface fucosylations.

ii) Reference code: ECOST-STSM-CA18103-45514-46684 Applicant: Joana Grácio Rodrigues.
STSM from Portugal to Netherlands. STSM title: Glyco-Immune Checkpoint in Cancer: role of glycosylation in tumour immune response modulation.
This STSM allowed a collaboration between the Glycobiology in Cancer group at i3S-University of Porto and the Department of Molecular Cell Biology and Immunology at Amsterdam UMC. However, due to the COVID-19 pandemic, this STSM ended prematurely on 17/03/2020.

iii) Reference code: ECOST-STSM-Request-CA18103-45721. Applicant: Ms Barbora Kalouskova.
STSM from Czech Republic to Austria. STSM title: Single molecule fluorescence microscopy investigation of glycosylation role in NKp30 receptor oligomerization.

iv) Reference code: ECOST-STSM-Request-CA18103-45369. Applicant: Dr Dragana Jovanovic.
STSM from Serbia to Israel. STSM title: Saccharide-based amphiphilic carbon dots: a new facile method of their preparation and applications.

v) Reference code: ECOST-STSM-Request-CA18103-46735. Applicant: Martin Kurfirt.
STSM from Czech Republic to Spain. STSM title: Deoxofluorinated amino saccharides as probes for studying lectin-carbohydrate recognition via advanced NMR methods

4) **Activities related to Early Career Investigators (ECIs).**

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

a) Laura Morelli. Post-doc fellow. PhD got on 2012

i) *Novel non-natural saccharide antigens common to Streptococcus pneumoniae 19F and 19A capsular polysaccharides*. 4th Workshop Biometra, Milano, September 23 **2019**, "Best Presentation" Award (€ 500).

ii) *Design, preparation and biological evaluation of a small library of compounds containing the common disaccharide of Streptococcus pneumoniae 19F and 19A capsular polysaccharides*. Incontro dei Giovani Biochimici dell'Area Lombarda, V edizione, Gargnano (Brescia), June 23-25 **2019**. "Best Presentation" Award (Free membership to the Italian Society of Biochemistry (SIB) for the year 2019).

iii) *A small library of compounds, containing the common disaccharide of Streptococcus pneumoniae 19F and 19A capsular polysaccharides, as novel non-natural antibacterial saccharide antigens.* L. Morelli, F. Chiodo, L. Lay, F. Compostella, GLYCO 25 – International Symposium on Glycoconjugates, Milan (Italy), August 25-31 **2019**.

b) Msc Katarzyna-Durlik-Popinska, PhD thesis started on 2019 and will be finished in 2021.

Supervisor: Wieslaw Kaca. Thesis title: *Characterisation of rheumatoid arthritis patients antibodies binding Proteus mirabilis lipopolysaccharides*.

Month 24 (May 2020- May 2021)

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.

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

Enclosed to this document the detailed program of the meeting, whereas some selected information are listed below:

i) Number of participants: 92 on 8th October, 72 on 9th October
ii) Keynote lectures:7
iii) Total number of speakers: 14
iv) 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, https://twitter.com/BarbaraRichichi/status/1314531817559556096)
v) A MC meeting has been included in this event.

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
https://twitter.com/BarbaraRichichi/status/1314207415357767680

2) **Special Issue on peer-reviewed journals dedicated to papers co-authored by WG3 and WG1 members**

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

A special collection on "*Recent Advances in Glycobiology of Cancer and Immune Response*" has been launched as joint initiative of ChemBioChem with Advanced Biosystems Journal (https://twitter.com/ChemBioChem/status/1314545629939617792). It is dedicated to original articles/review papers submitted by WG1 and WG3 members.

Tentative deadline for papers submission: August 2021.

3) **Publications/Conferences of WG3 members (May 2020- May 2021):**

Publications

1. 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
2. Morelli, L.; Polito, L.; Richichi, B.; Compostella, F. Glyconanoparticles as tools to prevent antimicrobial resistance. *Glycoconj. J.*, **2021**, DOI: 10.1007/s10719-021-09988-6
3. 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**, doi: 10.1111/febs.15909.
4. Katarzyna Durlik-Popinska, Paulina Zarnowiec, Łukasz Lechowicz, Józef Gaweda, Wiesław Kaca. 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.
5. Andreozzi, P.; Tamberi, 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**, 16, 2272-2281.
6. Martin, K.C.; Tricomi, J.; Corzana, F.; García-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. *ChemComm*, **2021**, 57, 1145-1148.
7. G. Biagiotti; E. Purić; I. Urbančič; A. Krišelj; M Weiss; J. Mravljak; 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**, 109, 104730.
8. Hamala, V., Červenková Šťastná, L., Kurfiřt, M., Cuřínová, P., Balouch, M., Hrstka, R., Voňka, P.; Karban, J. The effect of deoxyfluorination and O-acylation on the cytotoxicity of N-acetyl-d-gluco- and d-galactosamine hemiacetals. Org. Biomol. Chem. **2021**. Advance Article. DOI: https://doi.org/10.1039/D1OB00497B
9. Hamala, V.; Červenková Šťastná, L.; Kurfiřt, M.; Cuřínová, P.; Dračínský, 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**, 17, 1086-1095. DOI: https://doi.org/10.3762/bjoc.17.85
10. Loi EM, Weiss M, Pajk S, Gobec M, Tomašič 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. doi: 10.3390/molecules25153381.
11. Magalhães A, Duarte HO, Reis CA. The role of O-glycosylation in human disease. Mol Aspects Med. **2021,** 100964. doi: 10.1016/j.mam.2021.100964. Online ahead of print.
12. Petit D, Teppa RE, Harduin-Lepers A. A phylogenetic view and functional annotation of the animal β1,3-glycosyltransferases of the GT31 CAZy family. Glycobiology. **2021**, 3, 243–259; doi: 10.1093/glycob/cwaa086

13. 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., Kopitz, 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**, 24, 101919 http://doi.org/10.1016/j.isci.2020.101919
14. 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**, 27, 316-325 http://doi.org/10.1002/chem.202003143
15. 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**, 120, 1031-1039 http://doi.org/10.1016/j.bpj.2020.11.020
16. Loi EM, Weiss M, Pajk S, Gobec M, Tomašič 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.
17. Pending US patent application: Martin, K.C.; Sackstein, R.; Richichi, B. Fucosyltransferase specific inhibition using fucose mimetic. December 29, **2020**, as Serial No. 17/136,839.

Conferences

1. Mattan Hurevich. *Stirring solid-phase peptide synthesis to a new level of efficiency*. ACS Spring 2021. Online 2021.
2. Mattan Hurevich. *Developing Tools for Understanding the Roles of Biopolymers Modification Patterns in Biological Processes*. ACBI 2021 meeting. Jerusalem/online
3. https://www.preveda.sk/conference/article/id=2228/ *Synthesis of chromogenic probes for detection and assay of diglycosidases.* Matej Cvečko, Peter Kis, Mária Mastihubová, Vladimír Mastihuba.

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*):

https://twitter.com/BarbaraRichichi/status/1389675299944685571
https://twitter.com/JJBarchiJr/status/1336748714631696384
https://twitter.com/InnoglyA/status/1375084582421299201
https://twitter.com/FedeCompos/status/1375039132737675265
https://twitter.com/BarbaraRichichi/status/1363031648951021568
https://twitter.com/BarbaraRichichi/status/1347592529710108672
https://twitter.com/BarbaraRichichi/status/1304322895829762050

4) **Joint review papers**

- 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.
- 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.

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 on the preparation 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 development of vaccines against glycan epitopes to gain selective immune responses, and to provide an overview on the role of different immunogenic constructs in improving glycovaccine efficacy.

- *Obj 15 INNOGLY*: Enhance public communication to boost 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

5) **Activities related to Early Career Investigators (ECIs).**

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

a) Laura Morelli. Post-doc fellow. PhD got on 2012

i) *Saccharide fragments common to Streptococcus pneumoniae 19A and 19F capsular polysaccharides.* 1st Italian-American Symposium on Applied and Translational Glycosciences, ACS Spring 2021, April 7 2021

ii) *Saccharide fragments common to Streptococcus pneumoniae serogroup 19.* European Glycoscience Community Webinar Series, February 11 2021.

b) **Upcoming events**

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

i) WG3 is planning to have a virtual meeting (Zoom platform) in September 2021. This meeting will be organized and moderated by five Early Carrier Investigators:

- Dr. Giacomo Biagiotti, 32 years old, Post-doctoral researcher of the Fondazione Umberto Veronesi. Affiliation: Department of Chemistry 'Ugo Schiff' University of Florence. PhD got on 2019.

- Elena Loi, 29 years old, PhD student, Researcher at Chair of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Ljubljana, Slovenia. Supervisor: Prof. Marko Anderluh. Researcher at Chemical Biology and Drug Discovery Group, Faculty of Science, Utrecht University, The Netherlands. Supervisor: Prof. Roland J. Pieters. PhD started in

- Dr. Davide Ret, 33 years old, Postdoctoral research associate, Institute of Applied Synthetic Chemistry, TU Wien, Austria; Departiment of Pathophysiology and Allergy Research, Medical University of Vienna, Austria. PhD got on 12/2017.

- Cristiano Conceiçãp, 28 years old, PhD Student, Instituto de Tecnologia Química e Biológica António Xavier, Universidade Nova de Lisboa, Av. da República, 2780-157 Oeiras, Portugal. PhD started in January 2021

- Kristina Zlatina, 30 years old, post-doc, Institute for Farm Animal Biology (FBN) and Institute of Reproductive Biology, Dummerstorf, Germany. PhD got on 2019.

Talks will be delivered by senior post-doc and PhD students. The attendance by a couple of experts in the field of Glycobiology is planned. They will deliver a didactic talk.

ii) In order to increase young researcher's participation and bridge complementary knowledge and common interests in glycan-related topics, WG3 members are actively promoting engagement in STSM. The table below displays the availability of WG3 members for STSM and for the Virtual networking tools.

Group Leader	Institution Country	I am available to host STSM (yes/no)	STSM in presence (yes/no)	Subject of the STSM project	Virtual networking tool (yes/no)	Subject of the virtual STSM project
Luigi Lay	University of Milan, Dept.of Chemistry, Italy	yes	yes	Synthesis of oligosaccharides	no	N.A.
Barbara Richichi	University of Firenze, Department of Chemistry, Italy	yes	yes	Synthesis of: glycomimetics, fluorescent probes, functionalized carbohydrate-based nanomaterials	no	N.A.
Davide Ret	TU Vienna/Medical University of Vienna	yes	yes	MALDI N-Glycan analysis, HPLC-FL DMBA sialic acid quantification, polysaccharides modification	Davide Ret	TU Vienna/Medical University of Vienna
Sandra van Vliet	Amsterdam UMC, department of Molecular Cell Biology and Immunology	Yes, but only virtual	No (our lab is still in partial lockdown, so lab members are only working	N.A.	Yes	Immunological assays using glycan-probes, lectin ELISAs and lectin immunohistochemistry.

			part-time themselves)			
Rita Ventura	Bioorganic Chemistry Lab, ITQB NOVA, Portugal	Yes	Yes	Carbohydrate synthesis. Labelled mono, di and higher-saccharides.	No	N.A.
Laura Polito	CNR-SCITEC, Milan	yes	yes	Synthesis, functionalization and characterization of nanomaterials	no	N.A.
Marco Marradi	University of Firenze, Department of Chemistry, Italy	yes	yes	Glyco-gold nanoparticles	no	N.A.
Celso Reis and Ana Magalhães	i3S/IPATIMUP/University of Porto. Portugal	yes	yes	Glycosylation in Cancer Glycosyltransferase analysis in cancer Cell and tissue glycan analysis	yes	Cancer Glycosylation
Sergio Moya	CIC biomaGUNE, Spain	yes	yes	Nanomaterials functionalization with glycomimetics and characterization; nanomaterial biomolecule interactions	no	N.A
Jindřich Karban	Institute of Chemical Process Fundamentals of the Czech Academy of Science	yes	yes	Synthesis of deoxyfluorinated monosaccharides, and disaccharides LacNAc, LacdiNAc, and chitobiose	no	N.A.
Federica Compostella	University of Milan, Dept. of Medical Biotechnology and Translational Medicine	yes	yes	Synthesis of oligosaccharides and glycoconjugates	no	N.A.

José Juan Reina Martín	University of Málaga, Department of Organic Chemistry, Spain	Yes	Yes	Synthesis of glyco-fluorescent probes and complex oligosaccharides	No	N.A.
Anne Harduin-Lepers	UMR8576-UGSF, University of Lille, France	yes	yes	Glycosylation in Cancer Glycosyltransferase analysis in cancer Cell and tissue glycan analysis	yes	Cancer glycosylation
Ondrej Vanek	Charles University, Faculty of Science Prague, Czech Republic	yes	yes	Recombinant production of glycoproteins in human cell line for their structural biology Analytical ultracentrifugation of glycoproteins, glycopolymers, glyconanoparticles,...	no	N.A.
Wieslaw Kaca	Jan Kochanowski University, Department of Microbiology and Parasitology, Kielce, Poland	yes	yes	Qualitative and quantitative serological methods of polysaccharide antigen testing	yes	Methods of bacterial genomes analysis

LIST OF WG3 members to date (JUNE 2021)

WG3 MEMBERS						
SURNAME	**NAME**	**COUNTRY**	**AFFILIATION**	**E-MAIL**	**PHONE NUMBER**	**ADMISSION**
ADAMO	ROBERTO	ITALY	GSK VACCINES	roberto.x.adamo@gsk.com		E-VOTE 13/09/2019
ANDERLUH	MARKO	SLOVENIA	University of Ljubljana	marko.anderluh@ffa.uni-lj.si	+0038614769639	KICK OFF 08/04/19
AOUN	MIKE	SWEDEN	Karolinska Institute	Mike.aoun@ki.se		E-VOTE 16/10/2019
BAHSI ORAL	ZEHRA BANU	TURKEY	Gebze Technical University	boral@gtu.edu.tr	0 262 6052614	CHAIR 06/10/2020
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WG3 MEETING

October 23-25, 2019

"Aula Magna", Faculty of Mathematics, University of Santiago de Compostela. Rúa Lope Gómez de Marzoa, s/n. Campus sur, 15782, Santiago de Compostela, Spain.

CA 18103

WG3: Glycan dependent fine tuning of immunity

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

Santiago de Compostela—23-25th October 2019

Last Name	First Name	Country	Last Name	First Name	Country
ADAMO	Roberto	Italy	REINA MARTIN	José Juan	Spain
ANDERLUH	Marko	Slovenia	RICHICHI	Barbara	Italy
AOUN	Mike	Sweden	ROBAJAC	Dragana	Serbia
BORIO	Alessio	Italy	SHAVANDI	Amin	Belgium
BZDUCHA-WROBEL	Anna	Poland	SILIPO	Alba	Italy
CHIODO	Fabrizio	Netherlands	TRICOMI	Jacopo	Italy
COMPOSTELLA	Federica	Italy	VANEK	Ondrej	Czech Republic
GABIUS	Hans-Joachim	Germany	VAN VLIET	Sandra	Netherlands
GLIGORIJEVIC	Nikola	Serbia	VENTURA	Rita	Portugal
JANJI	Bassam	Luxembourg			
JOVANOVIC	Dragana	Serbia			
KACA	Wiesław	Poland			
KARBAN	Jindrich	Czech Republic			
KARLSSON	Niclas	Sweden			
LAY	Luigi	Italy			
LAUC	Gordan	Croatia			
MOYA	Sergio	Spain			
OZIL	Musa	Turkey			
PAGLIARA	Stefano	United Kingdom			
PAJUSTE	Karlis	Latvia			
PALMA	Angelina SA	Portugal			
POLITO	Laura	Italy			
REIS	Celso	Portugal			

WG3 members to date

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.

WG3 activities (GP1)

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

REVIEW PAPER

Tentative title: **Immunology-driven (or Immunologist-driven) design of smart glycan-based chemical tools to modulate the immune response**

- AIM: State of the art on immune modulation using chemical tools.
- TIMEFRAME: Last 10 years (2009-2019).
- SELECTION: *In vivo* screening.
- AREA OF INTEREST: Bacterial and viral infections, cancer, autoimmune diseases.
- CHEMICAL TOOLS: Glycoconjugate vaccines. New strategies (short summary).

WG3 activities (GP1)

REVIEW PAPER **Immunology-driven (or Immunologist-driven) design of smart glycan-based chemical tools to modulate the immune response**

Tentative submission date: 15th December 2019

Introduction

1. **Immunologists perspective**

1.1 What immunologists are looking for?
1.2 Risks of manipulating the immune system.
1.3 How the immune system can inspire chemistry.
1.4 How chemical tools can tune a dysregulated immune response .

2. **Glycoconjugate Vaccines**

2.1 Activation of the Immune response
2.1.1 Glycoconjugate-based vaccines prototypes.
2.1.1.1 Proteins and small-peptides based glycoconjugates
2.1.1.2 Lipids and phospholipids containing glycoconjugates
2.1.1.3 Oligonucleotides containing glycoconjugates
2.1.1.4 Glycans containing glycoconjugates.

2.1.2 Glyconanomaterials-based vaccine prototype.
2.1.2.1. Bacterial infections
2.1.2.2 HIV infection
2.1.2.3 Cancer

2.2 Suppression of the Immune response

2.3 Vaccine formulation

3. **New strategies to modulate immune response**

3.1 Gut microbiota
3.2 Monovalent glycomimetics vs. multivalent conjugates as immunomodulators
3.3 Antibody neutralization with multivalent carbohydrate conjugates
3.4 Immune check point inhibitors: the Siglecs case

M. Andherluk
F. Berti
(A. Bzducha)
F. Chiodo
C. Colombo
F. Compostella
R. Holmdhal
(D. Jovanovic)
L. Lay
(M. Marinović-Cincović)
M. Marradi
(M. Ozil)
L. Polito
J.J. Reina Martin
C. Reis
B. Richichi
A. Silipo
U. Svajger
S. Van Vliet

WG3 activities (GP1)

PUBLISHED PAPER acknowledging INNOGLY (within WG3 members)

A. Romero and H.-J. Gabius, Galectin-3: is this member of a large family of multifunctional lectins (already) a therapeutic target? EXPERT OPINION ON THERAPEUTIC TARGETS, **2019**, https://doi.org/10.1080/14728222.2019.1675638

Remember to include INNOGLY logo in your presentation

@INNOGLY

Do you have any initiative to suggest for WG3?

SOME INPUTS
i) Actions: workshop, training schools
ii) Synergies with other WGs
iii) Identify new WG3 members (experts in the field)
iv) STSM applications
v) ITC conference grants

WG3 activities (GP1)

Synergies with other WGs

Special ISSUE on ChemBioChem

- Mar 2020 Author invitations
- Nov 2020 Submission deadline
- Dec 2020 - Feb 2021 Peer review
- Apr 2021 Appearance of Special Issue

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.

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

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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.

WG3 activities (GP1/GP2)

M 3.1 Workshops related to the topics of WG3.

- ✓ 1st WG3 meeting: Santiago de Compostela—23-25th October 2019
- ✓ Joined WG1-WG3 meeting: Porto---September/October 2020 (to be confirmed)

Tentative Invited Speakers:

- Dr. Robert Sackstein (Florida International University (USA))
- Dr. Ruben Ragg (ChemBioChem Editor in Chief)

CA 18103

WG3: Glycan dependent fine tuning of immunity

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

Santiago de Compostela—23-25th October 2019

1st WG3 meeting

14:45-15:00 **Hans Joachim Gabius**, Ludwig-Maximilians-University of Munich "The Sugar Code: From Concept to Functional Pairing of Tissue Lectins with Glycoconjugates Counterreceptors"

15:00-15.15 **Rikard Holmdahl**, Karolinska Institute Stockholm
"Immune Recognition of Glycoproteins"

15:15-15:30 **Ondrej Vanek**, Charles University Prague
"Production of Crystallizable Glycoproteins in Human Cell Line: Natural Killer Cell Receptor Complexes Revealed"

15:30-15:45 **Federica Compostela**, University of Milano
"Targeting Immuno-Related Mechanism Through Synthetic Glycoconjugates and Glycolipids"

15:45-16:00 **Alba Silipo**, University of Naples
"Microbial Glycoconjugates: Structure and Function"

16:00-16:15 **Wieslaw Kaca**, Jan Kochanowski University Kielce
"Correlations of Inflammatory Potential of Gram-Negative Bacterial Endotoxins (lipopolysaccharides, LPSs) of Human Microbiome with Bowel Inflammatory and Cancer Diseases"

16:15-17.15 **Coffee Break and Poster Discussion**

17:15-17:30 **Stefano Pagliara**, University of Exeter
"Dissecting the Mechanisms Underlying Molecular Accumulation and Antibiotic Efficacy in Single Gram-Negative Bacteria"

17:30-17:45 **Sergio Moya**, CIC biomaGUNE San Sebastian
"From Soft Matter Nanotechnology to Biological Fate Studies"

17:45-18:00 **Fabrizio Chiodo**, VU University Medical Center, Amsterdam
"Gold Nanoparticles to Interrogate Immunological Properties of Bacterial-Glycans in the Context of Conjugate-Vaccines"

18:00-18:15 **Dragana J. Jovanovic**, Vinca Institute of Nuclear Sciences, Belgrade "Neodymium-Based Ultrasmall Nanoparticles for Multifunctional Photothermal Therapy"

18:15-18:30 **Rita Ventura**, Instituto de Tecnologia Quimica e Biologica ITQB-UNL, Oeiras "Carbohydrates Synthesis for Solving Biological Problems"

Santiago de Compostela—23-25th October 2019

WG1-WG3 Joint Meeting

"Glycosylation in Cancer and Tumour Immunology"

Dates: 8th and 9th October 2020

i3S – Instituto de Investigação e Inovação em Saúde da Universidade do Porto, Porto, Portugal and Virtual Conference

Organizers:
Ana Magalhães
Barbara Richichi
Celso A. Reis

Programme:

8th October (Thursday)

14h00-14h30 – Registration

14h30-14h45 – **Welcome Session** (Barbara Richichi and Celso A. Reis)

> Session I

Chair: Celso A. Reis

14h45-15h05 – Keynote lecture **KL1-Robert Sackstein** (15+5 min)

15h05-15h25 – Keynote lecture **KL2-Sandra van Vliet** (15+5 min) - *FUT9-Driven Programming of Colon Cancer Cells Towards a Stem Cell-Like State*

15h25-15h55 –Selected Communications

SC1 – Dragana Nikitovic (8+2 min) - *Lumican stimulates chondrosarcoma cell growth by regulating IGF-IR activity*

SC2 – Kristina A. Thomsson (8+2 min) - *O-glycan sulfation on ovarian cancer cyst fluid mucin-type proteins*

SC3 – Tomasz Kobiela (8+2 min) - *Characterization of cell-surface glycans interactions with lectins as test for melanoma development*

16h00 – 16h30 – *Coffee-Break*

16h30-19h00 - **MC Meeting (Chair: Luigi Lay)**

9th October (Friday)

> Session II

Chair: Ana Magalhães

9h15-9h35 – Keynote lecture **KL3 – Bernadette Tse Sum Bui** (15+5 min) - *Molecularly Imprinted Polymers: Chemical Antibody Mimics for Clinical Diagnosis and Therapy*

9h35-9h55 – Keynote lecture **KL4 – Niclas Karlsson** (15+5 min) - *Gastric O-glycomic discovery is revealing surprises regarding H. pylori interaction*

9h55-10h20 – Selected Communications

SC4 – Angelina Palma (8+2 min) - *Sialyl ligands other than the α2,6-sialyl-Tn O-glycan identified for human Siglec-15*

SC5 - José Reina Martin (8+2 min) - *Selectins Ligands to Target Endothelial Cells Surrounding Metastatic Tumors*

10h30 – 11h00 – *Coffee-Break*

> Session III

Chair: Barbara Richichi

11h00-11h20 – Keynote lecture **KL5- Anne Harduin-Leppers** (15+5 min) - *B4GALNT2 controls Sda and sLex antigens biosynthesis in healthy and cancer human colon*

11h20-11h40 – Keynote lecture **KL6 –Ramon Hurtado Guerrero** (15+5 min) - *Structural basis for substrate specificity and catalysis of α1,6-fucosyltransferase*

11h40-12h10 – Selected Communications

SC6 - Fumiichiro Yamamoto (8+2 min) - *ABO Blood Groups in Immunology and Cancer*

SC7 - Matjaz Weiss (8+2 min) - *In vitro modulation of protein O-GlcNAcylation and its impact on dendritic cells function*

12h10- 12h30 – Keynote lecturer **KL7- Ruben Ragg** (15+5 min) - *Getting Published in 2020 and Beyond: How to Adapt to a Rapidly Changing Publication Landscape*

12h30 – 12h50 - **Closing session** (Barbara Richichi, Celso A. Reis, Luigi Lay)