synBIOnews No.3

Welcome to the third newsletter edition of the MSCA-ITN project synBIOcarb! We are delighted to provide you with news from our training network activities and to update you on project highlights in the exciting field of synthetic glycobiology! We are happy to keep you posted and we hope that you enjoy reading.

Yours sincerely, synBIOcarb Team

synBIOcarb – Our training network is entering its final phase

The European Training Network synBIOcarb, funded in the frame of the Marie-Skłodowska-Curie program (H2020-MSCA-ITN), is ending in 2022, but the cooperation of the team is going to be continued. Our diverse team of chemists, structural biologists, biophysicists, cell biologists and protein engineers from across Europe provides 15 early stage researchers (ESRs) with advanced scientific training in enabling technologies that underpin the development and exploitation of glycoscience for diagnostics and targeted drug delivery.

The whole team is eager to develop follow-up strategies and design new project ideas from the findings of synBIOcarb. The COVID-19 pandemic is still impacting our daily routine. Whilst some activities are happening in a virtual setting, progress in the lab continues under restricted conditions and travel on secondment to other labs has started become possible again.

Further information on https://synbiocarb.science

LAIA SALTOR NÚÑEZ

UNIVERSITY OF LEEDS

ESR PROJECT TITLE:

ESR2: "Mucin-Like Glycocalyx Modules for Creating Complex Artificial Glycocalyxes"

MY CONTRIBUTION TO SYNBIOCARB AND MEASURES TO MEET THE OBJECTIVES:

The aim of my project is to construct highly glycosylated structures similar to mucin and then use them to construct a model of the glycocalyx. This model will be used to perform binding studies with different proteins, like Cholera Toxin or Shiga Toxin, to have better understanding how these proteins interact with cells.

To achieve this goal, hyaluronan was chemically modified with an alkyne and different oligosaccharides, which were synthesized by enzymes, were derivatized with an azide. A bioorthogonal ligation (CuAAC cycloaddition) was performed between moieties to achieve this complexes structures. Finally, a biotin was attached in one of the ends of the hyaluronan to accomplish mucin-like structures suitable to perform binding studies with Cholera Toxin or Shiga Toxin.

MY PERSONAL EXPERIENCES:

It is being a wonderful pleasure to work in this project. From a career development, I have learned (and I am still learning) several techniques and skills from different fields (biochemistry, polymer chemistry and biophysics). On the other hand, everybody who I meet during these last three years are really lovely people making really easy to work with. Finally, I am planning to make a secondment in the University of Freiburg in the future months (not sure still when, it relies on science!) but I am sure it will be a really nice experience both personal and professional.

MY OPINION ABOUT THE MSCA-ITN PROGRAM:

From my perspective, this program is an excellent opportunity to expand the horizons because it provides plenty of opportunities to learn from other PhD students or PIs. Moreover, it also engages the collaboration between ESRs giving a change to discover what all the research groups are studying nowadays.

On the other hand, I think it has been really useful all the trainings we attended to extend your own knowledge but, as well, to meet all the people of the network and have good time with them.

MY BENEFITS FROM SYNBIOCARB:

I think that one of the best things from synBIOcarb has been the people in the network, PhD students and PIs, which helped and engaged me with the project. Also, all the trainings that were arranged for us were really useful to become better scientists and really nice to learn plenty of new things. Last but not least, I really liked how this network have prepared me as well for the future helping me to guide me in my next steps.

CHUNYUE (SPRING) WANG

UNIVERSITY OF LEEDS

ESR PROJECT TITLE:

ESR3: Lectins on Polymer Scaffolds for Superselective Targeting of Cancer Cells

MY CONTRIBUTION TO SYNBIOCARB AND MEASURES TO MEET THE OBJECTIVES:

In my project, I aim to achieve superselective targeting of tumor cells by multivalent glycan-lectin interactions. A superselective probe was constructed with a hyaluronan scaffold attached with multiple carbohydrate binding domain 40 (CBM40) lectins by a chemical linker. This probe is supposed to specifically bind to melanoma cells with over-expressed ganglioside GM3, which is the target of CBM40. The superselective targeting of the probe over GM3 was determined on cell membrane models monitored by quartz crystal microbalance with dissipation and spectroscopic ellipsometry. In the next step, the superselective targeting of the probe over melanoma cells will be determined using melanoma and melanocyte cell lines.

MY PERSONAL EXPERIENCES:

I have been having a great experience as an ESR in synBIOcarb ITN in the last 2.5 years apart from the pandemic. I joined a really inclusive and lovely team and the work in the lab goes good. I went to University of Freiburg in October last year for my first secondment. It was an impressive experience, where I got the opportunity to connect with different cultures and to learn new techniques. I am enjoying the research I am doing and would like to stay in the field of cancer research in future.

MY OPINION ABOUT THE MSCA-ITN PROGRAM:

It is an excellent program, which benefits young scientists significantly. It provides a multi-culture environment for ESRs to communicate, promoting the development of science internationally. The trainings happened every half year provided a good opportunity for ESRs and PIs to communicate different projects and

also enhance the knowledge of ESRs by the talks given by expert guest. Particularly, the secondment promote the collaborations among ESRs and stimulate

MY BENEFITS FROM SYNBIOCARB:
There were many good suggestions for my project produced from the conversation with other ESRs and PIs and also an important protein for my project is provided by a collaborator in synBIOcarb. The training in synBIOcarb educated me quite a few techniques and software, which were helpful to process my project. It is really nice to have 14 other peers as a team and we can grow together.

SIMONA NOTOVA

CERMAV CNRS

ESR PROJECT TITLE:
ESR6: Engineering of neo-lectins and Janus lectins

MY CONTRIBUTION TO SYNBIOCARB AND MEASURES TO MEET THE OBJECTIVES:
My research is focused on protein engineering. In easy words, we are designing and creating novel proteins with original topology and architecture. Using synthetic biology approach, we can create new lectins with double specificity, regulated valency and reach strong avidity effect. Moreover, the lectins can by immobilized in controlled matter, used for building materials layers by layers or find an application in targeting and drug delivery.Neo-lectins and Janus lectins are therefore adapted for the needs of the other teams in SynBIOcarb network, as tools to characterize the surface of cells or vesicles and associate them by cross-linking.

MY PERSONAL EXPERIENCES:
My host institution, Cermav CNRS, is located in beautiful setting of French Alps and therefore I appreciate the view a lot. I am working in highly dynamic and multicultural environment which gave me the opportunity to meet many interesting people. Since the moment I joined the lab I had the feeling that I belong there and therefore my integration was as smooth as possible. And even though the Covid-19 pandemic stopped us from traveling for a long time, last year I could visit two of our network labs, Slovakia Academy of Science in Bratislava Slovakia and the company enGenes Biotech in Vienna, Austria, where I did short secondments.

MY OPINION ABOUT THE MSCA-ITN PROGRAM:
MSCA-ITN is well-known and prestigious program for young researchers which gives a great opportunity to do science but mostly shows how to collaborate. Moreover, the program is supplemented with international meetings and events, soft skills trainings and science dissemination. Thus I am convinced that MSCA-ITN is one of the best opportunity for those who are searching for an extraordinary PhD journey.

MY BENEFITS FROM SYNBIOCARB:
Definitely networking, and the friendships we established. The original plan included also a lot of travelling which unfortunately did not happen because of worldwide pandemic. Anyway, we replaced the lack of social interaction with soft and transferable skills development.

ILARIA MAINERO ROCCA

DTU BIOENGINEERING

ESR PROJECT TITLE:
ESR9: Glycoengineered Microbiome-based Anti-Infectives and Novel Glycomic Display Systems

MY CONTRIBUTION TO SYNBIOCARB AND MEASURES TO MEET THE OBJECTIVES:
The aim of my PhD is the development of novel non-antibiotic anti-infectives against common food pathogens such as shigella and clostridium difficile. Specific aims are to effectively neutralize the pathogen or their corresponding toxins with high-affinity nanobodies multivalently displayed on a beneficial carrier such as probiotic bacteria. The first task was to investigate how gangliosides can be assembled onto probiotic bacteria and directly neutralize toxins. Secondly, gangliosides are chemically modified to host nanobodies developed to target toxins. A third strategy will be to develop an alternative and more flexible Plug'Nplay strategy based on lipidated modules for assembly onto lipid bilayers. Design features include types of lipidation, multivalency, spatial distribution, and multifunctional properties.

MY PERSONAL EXPERIENCES:
Unfortunately, I haven´t taken part in any secondment within the ITN due to internal university reasons and unforeseen events that made a collaboration within the network difficult.
I have spent half of my PhD in KU, before I relocated with my supervisor in DTU. The change of environment has been accompanied by a drastic change of project and many difficulties related to the new environment. This inconvenient situation gave me the opportunity to build a great ability to adapt my behavior to changing circumstances other than expanding my theoretical and practical knowledge around new topics. Overall, even if this PhD did not go

as expected, I am still glad that I was part of SynBIOcarb because it meant a huge personal growth other than scientific.

MY OPINION ABOUT THE MSCA-ITN PROGRAM:
Being part of MSCA-ITN program is great because it offers the opportunity to build your scientific knowledge both theoretically and practically thanks to the possibility of learning new skills in other labs that are part of the network and then bring the skills back to your own lab. Although a real practical collaboration with the other labs part of the ITN was prevented by unexpected changes of project, I could still benefit from the trainings, seminars and many scientific dissemination opportunities organized by the network.

MY BENEFITS FROM SYNBIOCARB:
Even if I did not experience practical collaboration within the network by doing a secondment, I learned so much from the meetings, seminars and trainings organized by the ITN program. Moreover, meeting and discussing science with people within the ITN has been a great and useful opportunity to create a network and learn how to disseminate your own science.

ANY OTHER COMMENTS:
I would highly recommend an MSCA-ITN as a Ph.D. program. It is highly educational, interdisciplinary, and helpful to build a strong scientific network. Although my personal case represents an extraordinary situation, I can still acknowledge the high quality of this program.

PARAS H. KUNDALIA

SLOVAK ACADEMY OF SCIENCES

ESR PROJECT TITLE:
ESR13: Affinity-based methods for high-throughput determination of glycosylation

MY CONTRIBUTION TO SYNBIOCARB AND MEASURES TO MEET THE OBJECTIVES:
My research project is combination of basic and applied research. It focuses on development of biochip and biosensor-based assays for screening glycosylation status and its changes on proteins and cell surfaces using natural and engineered glycan recognizing elements, mainly lectins. The principal platform adopted for such high-throughput screening will be protein microarray. Along with microarray, the novel aspect of this project is that glycan interactions will be also analyzed by single color reflectometry (SCORE) which is a novel label-free, realtime microfluidics-based platform and surface plasmon resonance. Besides this, immunoassays and glycomic identification of glycans will be employed as well. The worldwide pandemic of covid-19 has exposed the pressing demand for developing high-throughput, accurate and rapid diagnostics. Such a lab-on-chip approach can be a promising tool for detection of glyco-biomarkers of cancer and other diseases, protein glycoprofiling in medicine, biology and biotechnology.

MY PERSONAL EXPERIENCES:
I am based in the Bratislava at the Institute of Chemistry, Slovak Academy of Sciences (ICSAS) which is a premier research institute. It as an integrated research hub spanning diverse fields including chemistry, lifesciences, physics, material sciences, IT, linguistics as well as some spin-offs in the same campus. Being a part of this organization provided me an excellent opportunity to have experts from diverse fields next door to collaborate and have better apprehension of my project. Since my joining I am learning new techniques, gaining skills on hand, and applying research methodologies also beyond the scope of my subject to my project. It also helped me to be an integral part of collaborations from other countries partnered by my supervisor. As a biochemist and surrounded by people from my field as well as other fields has immensely helped me to have better ideas, approach and troubleshoot research problems. I also had the opportunity to engage in various European research dissemination activities and am looking forward to the proposed secondments with my consortium partners to further enhance my research. All of this has collectively contributed in my journey of becoming an independent researcher and overall development as an individual. I am fortunate to have an excellent supervisor and be a part of his team and this institute. I am very thankful to my colleagues.

MY OPINION ABOUT THE MSCA-ITN PROGRAM:
The MSCA-ITN program and having the designation as MSCA-early stage researcher is in itself a recognition in the research fraternity. It is a prestigious European fellowship that helps you to learn and perform cutting-edge research with the some of the best research groups in the respective fields. The overall design of ITN- having academic and industry partners as constituents of the consortium gives a holistic experience of how research progresses right from fundamental research to developing a product in the market. It provides an excellent opportunity to have first-hand experience of academia and industry at the same time. It gives an exposure to people from different ethnicities and thereby working as multinational team. The yearly training events and secondments allows mobility and visit to premier research institutions, collaborations, learning new skills, acquaintance with other academicians and potential recruiters. Besides this the various generic skills training enhances important skills like presentation and scientific writing, team building & management, leadership qualities and overall development as a professional.

MY BENEFITS FROM SYNBIOCARB:
As an ESR in the synBIOcarb consortium I had the chance to meet some of the stalwarts in glycobiology and work with them. I am very fortunate to associated with my supervisor as my mentor and be a part his team and institute. I am acquiring excellent mentoring from my supervisor and learning many other soft skills

like presentation and scientific writing, employability and interview training, team building and working in collaboration, scientific outreach, and project management. The proposed secondments will also help me collaborate with relevant experts in my field which will be an immense value addition to my project. The various scientific and generic skills trainings that we have received during the course has allowed me to visit premier institutes and immensely enhanced my scientific abilities and transferable job skills to emerge as a competent researcher and professional.

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NATALIA DANIELEWICZ

ENGENES BIOTECH

ESR PROJECT TITLE:
ESR 15: Process development for the production of recombinant lectins in *Escherichia coli.*

MY CONTRIBUTION TO SYNBIOCARB AND MEASURES TO MEET THE OBJECTIVES:
My research exploits expression systems engineering, laboratory fed-batch fermentation processes and underlines complementary analytical techniques for quality assessment of the final lectin products. My focus is to integrate the molecular cloning, upstream, downstream processes and analytical techniques for quantitative and qualitative assessment of target lectin with application being justified as a therapeutic, pest control or food additive type product.

MY PERSONAL EXPERIENCES:
I have encountered many pitfalls throughout my research, yet, I could always count on support of colleges and my supervisors. Thanks to synBIOcarb, I was able to further develop my scientific expertise in Bioprocess Engineering. As ESR, I was able to visit different labs across EU and gain more experience in various techniques.

MY OPINION ABOUT THE MSCA-ITN PROGRAM:
MSCA-ITN is an excellent program for those who seek new adventure and are willing to work hard for a new discovery. This program is no small feat with a lot of advantages helpful in future career. It combines diversity, integrity and sense of scientific community.

MY BENEFITS FROM SYNBIOCARB:
The key advantage of synBIOcarb is ability to collaborate freely. We all formed strong relation with one another and supported each other at reaching our scientific goals. Our network clearly represents high European value we all will continue to cherish in our future scientific adventures.

synBIOcarb HIGHLIGHTS

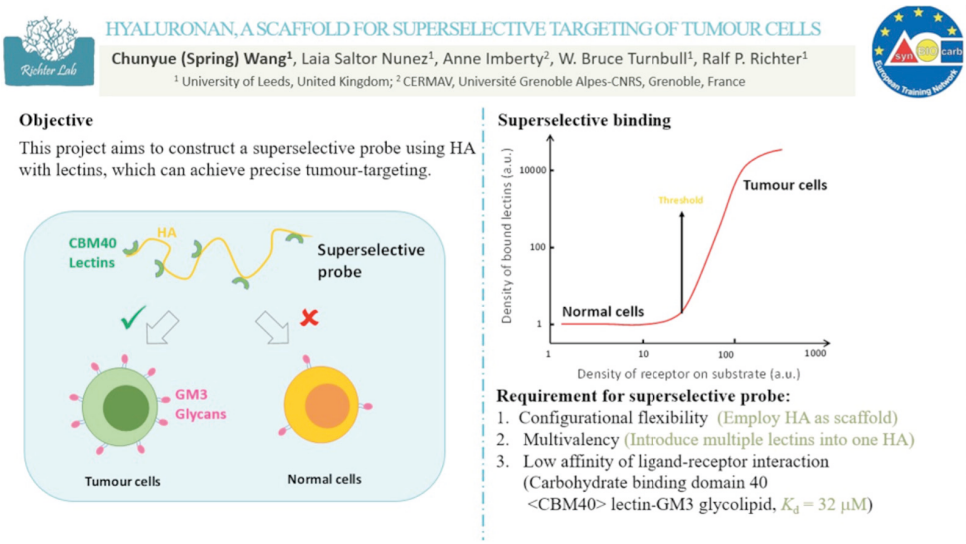
The synBIOcarb team enters its third year and the nice progress is getting more and more visible. With synthetic biology being the new markets of many biotech companies in Europe, our ESRs will have great opportunities in particular in the areas of pharmaceuticals and personalized medicine, food and biomaterials. They study protein-carbohydrate interactions, functionalize complex surfaces with novel lectin components and they develop tools for analytical and diagnostic methods, for cell targeting and drug delivery.

A NUMBER OF PUBLICATIONS UNDERPIN OUR GREAT FINDINGS IN THE FIELD OF SYNTHETIC GLYCOBIOLOGY:

- Involvement of N-glycans in binding of Photorhabdus luminescens Tc toxin
- Structural diversities of lectins binding to the glycosphingolipid Gb3
- The two sweet sides of Janus lectin drive crosslinking of liposomes to cancer cells and material uptake
- Homo- and heterovalent neoglycoproteins as ligands for bacterial lectins
- A pore-forming β-trefoil Lectin with Specificity for the Tumor-related Glycosphingolipid Gb3

Congratulations to the authors!

synBIOcarb ON VIRTUAL NETWORKING TOUR



HYALURONAN 2021,
15TH JUNE 2021, ONLINE EVENT

We proudly announce that our ESR3, Chunyue (Spring) Wang, based in the Faculty of Biological Sciences at the University of Leeds, was awarded the HA 2021 Poster Prize by the International Society for Hyaluronan. Spring received her award on 15th June alongside 5 other poster prize winners selected out of 66 poster submissions at the Hyaluronan 2021 conference.

73RD CONGRESS OF SLOVAK AND CZECH CHEMISTS
6TH – 10TH SEPTEMBER 2021, VYSOKÉ TATRY

Our ESRs Juvissan Aguedo and Paras Kundalia, presented their work about the "glycomic technology for glycotarget discovery" and the "Affinity based high-throughput determination of abberant glycosylation in cancer" during the poster session.

EUROPEAN RESEARCHERS NIGHT "LIFE IS SCIENCE",
24TH SEPTEMBER 2021, GRAZ, AUSTRIA

The ESR videos in the series Diary of a Scientific Researcher were again featured in the 2021 European Researcher Night Life is Science hosted in Austria by ACIB. The evening event Cinema and Science was particularly popular and received hugely positive feedback. An audience of around 200 listened to Prof. Kai-Uwe Fröhlich and Dr. Fritz Treiber from the University of Graz talking about the science in movies like World War Z, Jurassic Park and Contagion.

EUROPEAN RESEARCHERS' NIGHT 2021 life IS science

synBIOcarb ON VIRTUAL NETWORKING TOUR

33RD BIOTECHNOCENTRE CONFERENCE,
OCTOBER 2021, ORLEANS, FRANCE

ESR Federica Vena shared her findings about biotherapeutic glycoproteins at the BTC (BioTechnoCentre) that brings together research and industry organisations from the Center-Val de Loire region of France. 160 delegates attended the event, and it was featured in the French Newspaper La Nouvelle Republic.

4TH GLYCOBASQUE MEETING,
11TH – 12TH NOVEMBER 2021, SAN SEBASTIAN, SPAIN

Federica Vena used an excellent networking opportunity at the Glycobasque Meeting, where she met experts on glycoscience, immunology and carbohydrate chemistry.

synBIOcarb EVENT CALENDAR

INTERNATIONAL CONFERENCE ON SYNTHETIC GLYCOBOLOGY
29TH MAR – 1ST APR
PRAGUE, CZECH REPUBLIC

Theme: Innovative glyconanomaterials for biomedical prognostic and diagnostic devices; Synthesis and application.
This event is organised in collaboration with the COST Action CA18132 GlycoNanoProbes and provides the opportunity for our ESRs to present their project results to a wider audience.

CAFÉ SCIENTIFIQUE
20TH APR
LEEDS, UNITED KINGDOM

SynBIOcarb coordinator, Bruce Turnbull, will present synBIOcarb at the 20th April meetings
www.cafe-sci.org.uk

ESIB 2022
14TH – 16TH NOV
GRAZ, AUSTRIA

The consortium will present the synBIOcarb results at this event that is organized by ACIB. Stakeholders from industrial biotechnology will be represented and the workshop will offer an interdisciplinary discussion about synBIOcarbs replication potential.
www.esib.at

SYNBIONEWS EDITORIAL TEAM

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