DEBCARB 2020

DEBRECEN COLLOQUIUM ON CARBOHYDRATES 2020 IN 2022

Rezső Bognár Memorial Conference on Glycomimetics

August 24-27, 2022

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

UNIVERSITY of DEBRECEN

COST ACTION 18132

GLYCO NANO PROBES

Functional Glyconanomaterials for the Development of Diagnostics and Targeted Therapeutic Probes

2nd Meeting, August 25-26, 2022, Debrecen, Hungary

PROGRAM AND ABSTRACTS

Debrecen Colloquium on Carbohydrates 2020 in 2022

Rezső Bognár Memorial Conference on Glycomimetics

August 24-27, 2022

Debrecen, Hungary

Debrecen Colloquium on Carbohydrates 2020 in 2022

Rezső Bognár Memorial Conference on Glycomimetics

Program and abstracts

Publisher: University of Debrecen

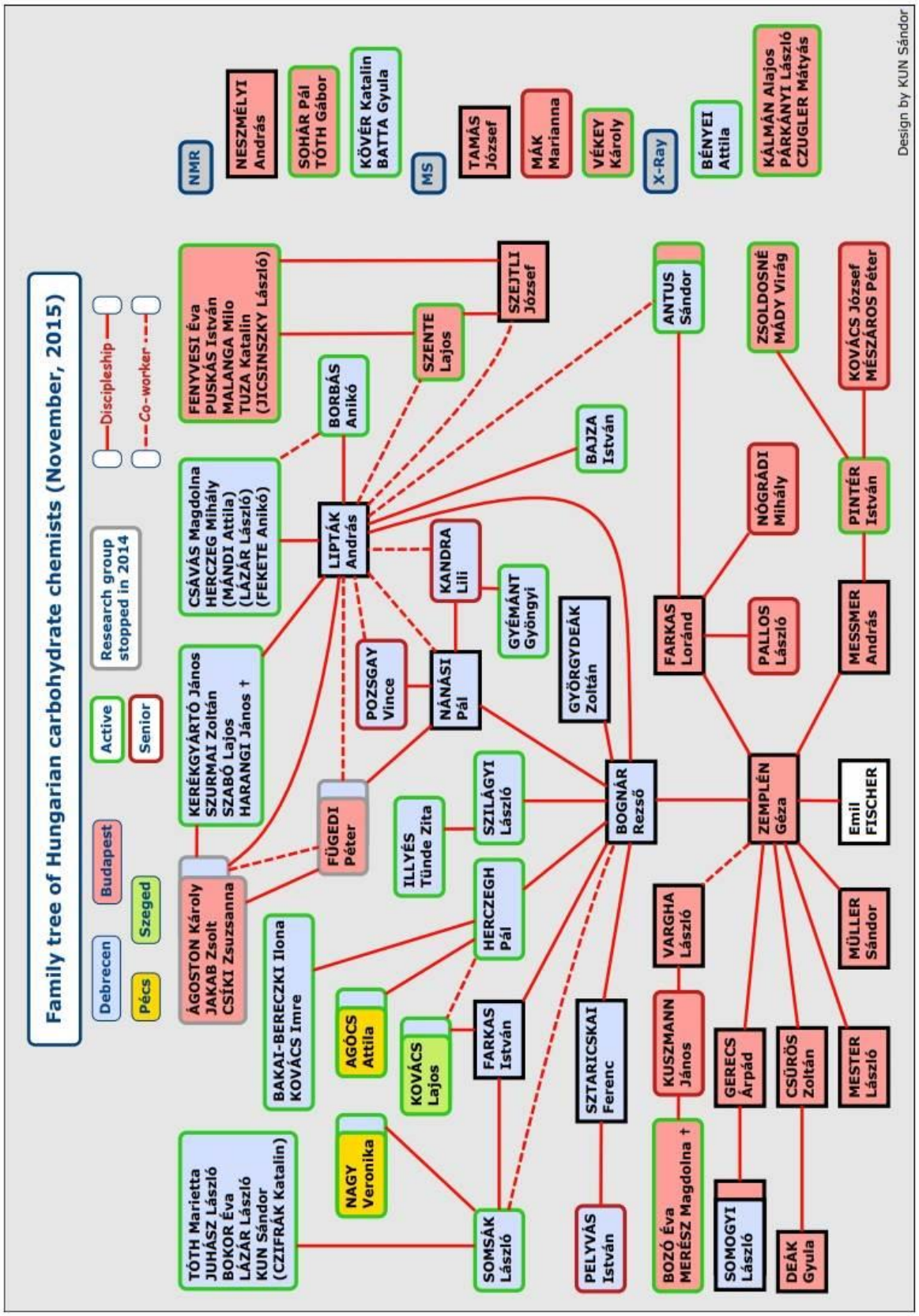
Editor: Mihály Herczeg

Online publication

ISBN 978-963-490-460-1

REZSŐ BOGNÁR

(1913-1990)


Family tree of Hungarian carbohydrate chemists (November, 2015)
Debrecen
Budapest
Pécs
Szeged
Active
Senior
Research group stopped in 2014
Discipleship
Co-worker
Design by KUN Sándor
NMR
NESZMÉLYI András
SOHÁR Pál
TÓTH Gábor
KÖVÉR Katalin
BATTA Gyula
MS
TAMÁS József
MÁK Marianna
VÉKEY Károly
X-Ray
BÉNYEI Attila
KÁLMÁN Alajos
PÁRKÁNYI László
CZUGLER Mátyás
FENYVESI Éva
PUSKÁS István
MALANGA Milo
TUZA Katalin
(JICSINSZKY László)
SZEJTLI József
SZENTE Lajos
BORBÁS Anikó
CSÁVÁS Magdolna
HERCZEG Mihály
(MÁNDI Attila)
(LÁZÁR László)
(FEKETE Anikó)
LIPTÁK András
BAJZA István
ANTUS Sándor
ZSOLDOSNÉ MÁDY Virág
KOVÁCS József
MÉSZÁROS Péter
KERÉKGYÁRTÓ János
SZURMAI Zoltán
SZABÓ Lajos
HARANGI János †
KANDRA Lili
GYÉMÁNT Gyöngyi
NÓGRÁDI Mihály
PINTÉR István
POZSGAY Vince
NÁNÁSI Pál
GYÖRGYDEÁK Zoltán
FARKAS Loránd
PALLOS László
MESSMER András
ÁGOSTON Károly
JAKAB Zsolt
CSÍKI Zsuzsanna
FÜGEDI Péter
ILLYÉS Tünde Zita
SZILÁGYI László
BOGNÁR Rezső
ZEMPLÉN Géza
Emil FISCHER
BAKAI-BERECZKI Ilona
KOVÁCS Imre
HERCZEGH Pál
VARGHA László
MÜLLER Sándor
AGÓCS Attila
KOVÁCS Lajos
FARKAS István
SZTARICSKAI Ferenc
KUSZMANN János
GERECS Árpád
CSÜRÖS Zoltán
MESTER László
TÓTH Marietta
JUHÁSZ László
BOKOR Éva
LÁZÁR László
KUN Sándor
(CZIFRÁK Katalin)
NAGY Veronika
SOMSÁK László
PELYVÁS István
BOZÓ Éva
MERÉSZ Magdolna †
SOMOGYI László
DEÁK Gyula

DEBCARB 2020 in 2022
Rezső Bognár Memorial Conference on Glycomimetics

Dear Colleagues,

The upcoming „Debrecen Colloquium on Carbohydrates 2020 in 2022" (DEBCARB2020/22) is one of the first in person scientific events in the glycoscience field after the COVID-19 pandemic. The conference has also been entitled to be part of the Debrecen University Symposia series.

The conference will host the 2nd Meeting of the COST ACTION 18132 GLYCOnanoPROBES „Functional Glyconanomaterials for the Development of Diagnostics and Targeted Therapeutic Probes".

As it transpires from the name of the conference, this meeting was intended to be organized in 2020 as the „Rezső Bognár Memorial Conference on Glycomimetics" on the occasion of the 30th anniversary of Professor Bognár's (1913-1990) decease. He was a student of Géza Zemplén and became an internationally renowned organic and carbohydrate chemist. He founded carbohydrate chemistry in Debrecen, was member of the Hungarian Academy of Sciences, rector of the University of Debrecen (UD) and head of the Department of Organic Chemistry.

Along with the thematics of the COST Action the conference will be focused on glycomimetics which are at the forefront of current international research. Several drugs have already been approved with glycomimetic active ingredients and, in the near future, their widespread applications can be foreseen, thereby facilitating to achieve new therapeutics with up-to-now unknown targets and mechanism of action.

Beyond reminiscence and discussing cutting edge research topics, our meeting, like any other conference, aims at making aquaintances, exchanging ideas, and visiting new places. We sincerely hope that the blend of foreign scientists from Europe and other continents and the members of the Hungarian carbohydrate community, as well as the atmosphere of the University and the City of Debrecen with the aid of our generous sponsors will provide all of you with an enjoyable and memorable stay in Hungary.

Dr. László Somsák
full professor
UD Department of Organic Chemistry
conference chair

Dr. Magdolna Csávás
senior research fellow
Eötvös Loránd Research Network
conference secretary
DEBCARB

Marietta Vágvölgyiné Dr. Tóth
associate professor
UD Department of Organic Chemistry
conference secretary
DEBCARB and COST

Dr. Mihály Herczeg
assistant professor
UD Department of Pharmaceutical Chemistry
conference secretary
DEBCARB

https://konferencia.unideb.hu/en/node/463

EDITOR

Mihály Herczeg

SPONSORED BY

UNIVERSITY OF DEBRECEN

NATIONAL RESEARCH, DEVELOPMENT AND INNOVATION OFFICE OF HUNGARY

COST

GEDEON RICHTER Plc.

BIOSYNTH/CARBOSYNTH Ltd.

MDPI - MOLECULES

SPRINGER

https://konferencia.unideb.hu/en/node/463

ORGANIZING COMMITTEE

László Somsák

Marietta Vágvölgyiné Tóth

Magdolna Csávás

Mihály Herczeg

SCIENTIFIC COMMITTEE

Anikó Borbás

Attila Agócs

Veronika Nagy

Éva Bokor

Lajos Kovács

Organizing staff Campus Kht.

DISTINGUISHED SPEAKERS AND PARTICIPANTS

Zbigniew J. WITCZAK, Wilkes University, USA

Amélia Pilar RAUTER, Universidade de Lisboa, Portugal

Beat ERNST, University of Basel, Switzerland

Demetres D. LEONIDAS, University of Thessaly, Greece

José M. GARCÍA FERNÁNDEZ, Consejo Superior de Investigaciones Científicas (CSIC), Spain

Vladimír KŘEN, Institute of Microbiology of the Czech Academy of Sciences, Czech Republic

Carmen ORTIZ MELLET, University of Seville, Spain

Michaela WIMMEROVÁ, Masaryk University, Czech Republic

Serge PEREZ, Université Grenoble Alpes, Grenoble, France

Anne IMBERTY, CERMAV-CNRS, Grenoble, France

M. Carmen GALAN, University of Bristol, United Kingdom

Ulf J. NILSSON, Lund University, Sweden

Philippe COMPAIN, Université de Strasbourg, France

Tanja M. WRODNIGG, Graz University of Technology, Austria

Joseph M. HAYES, University of Central Lancashire, United Kingdom

PROGRAM - DEBCARB 2020 in 2022

Aug 24 , Wednesday		Aug 25, Thursday		Aug 26, Friday		Aug 27, Saturday	
		COST WG1		COST WG3			
		9:00-9:30	PL-5 García Fernández	9:00-9:30	PL-11 Imberty	9:30	Excursion to the Tokaj wine region*
		9:30-10:00	PL-6 Křen	9:30-10:00	PL-12 Galan		
		10:00-10:15	OL-1 Russo	10:00-10:15	OL-10 Velasco-Torrijos		Visit in Mád
		10:15-10:30	OL-2 Reis	10:15-10:30	OL-11 Kasemets		
		10:30-11:00	Coffee break	10:30-11:00	Coffee break		
		11:00-11:15	OL-3 Kelemen	11:00-11:30	PL-13 Nilsson	13:30	Lunch
		11:15-11:30	OL-4 Turks				
		11:30-11:45	OL-5 Sodini	11:30-11:45	OL-12 Marcelo		
		11:45-12:30	Guided tour at the main campus of UD	11:45-12:00	OL-13 Kacsir	14:30	Visit in a wine cellar, wine tasting
				12:00-12:15	OL-14 Goldschmidt Gőz		
				12:15-12:30	OL-15 Le		
		12:30-14:00	Lunch	12:30-14:00	Lunch		
			COST WG2				
14:00-15:30	Registration	14:00-14:30	PL-7 Rauter	14:00-14:30	PL-14 Compain		
		14:30-15:00	PL-8 Wimmerová	14:30-15:00	PL-15 Wrodnigg		
15:30-15:45	Opening ceremony	15:00-15:15	OL-6 Visnapuu	15:00-15:15	OL-16 Nicotra		
		15:15-15:30	OL-7 Christensen	15:15-15:30	OL-17 Weber		
15:45-16:00	Bognár memorial lecture - **Herczegh**	15:30-15:45	OL-8 Bokor	15:30-15:45	OL-18 Béni		
		15:45-15:55	**Group photo**	15:45-16:45	Poster session and coffee break	16:30	Departure to Debrecen
16:00-16:30	PL-1 Witczak	15:55-16:45	Poster session and coffee break				
16:30-17:00	PL-2 Ortiz Mellet	16:45-17:15	PL-9 Perez	16:45-17:15	PL-16 Hayes		
17:00-17:30	Coffee break						
	PL-3 Ernst - cancelled	17:15-17:45	PL-10 Borbás	17:15-17:30	OL-19 Jicsinszky		
17:30-18:00	PL-4 Leonidas			17:30-17:45	OL-20 Timári		*Optional, self-financing
18:00-18:30	Commemoration to Rezső Bognár (laying a wreath at his memorial plaque in the Chemistry Building)	17:45-18:00	OL-9 Szakács	17:45-18:00	OL-21 Balogh		
		18:15-19:15	COST CG and MC Meeting		Closing		
18:30-21:00	Welcome reception			19:00-22:00	Conference dinner		

PROGRAM

WEDNESDAY, AUGUST 24, 2022

LEARNING CENTER
LECTURE HALL

14:00-15:30 REGISTRATION

15:30-15:45 OPENING CEREMONY

WELCOME ADDRESSES
LÁSZLÓ SOMSÁK, CHAIR OF DEBCARB 2020 IN 2022
RECTOR OF THE UNIVERSITY OF DEBRECEN
DEAN OF THE FACULTY OF SCIENCE AND TECHNOOGY, UD

SESSION 1. CHAIRPERSON: **LÁSZLÓ SOMSÁK**

15:45-16:00 M-1
PÁL HERCZEGH: REZSŐ BOGNÁR: A PIONEER OF ORGANIC CHEMISTRY RESEARCH IN DEBRECEN
Department of Pharmaceutical Chemistry, University of Debrecen, Debrecen, Hungary

16:00-16:30 PL-1
ZBIGNIEW J. WITCZAK: PREPARATION AND REACTIVITY OF *S*-THIO AND *N*-ADDUCTS TO CONJUGATED SYTEM OF LEVOGLUCOSENONE
Cyclo Nesbitt School of Pharmacy, Department of Pharmaceutical Sciences, Wilkes University, Pennsylvania, USA

16:30-17:00 PL-2
CARMEN ORTIZ MELLET: MIMICKING CARBOHYDRATE CHEMISTRY AND FUNCTIONALITY
Faculty of Chemistry, University of Seville, Seville, Spain

17:00-17:30 COFFEE BREAK

SESSION 2. CHAIRPERSON: ANIKÓ BORBÁS

17:30-18:00 PL-3 (CANCELLED)
BEAT ERNST: FROM sLe^x TO AN ORAL GLYCOMIMETIC
University of Basel, Department of Pharmaceutical Sciences, Basel, Switzerland

17:30-18:00 PL-4
DEMETRES D. LEONIDAS: STRUCTURE DRIVEN CARBOHYDRATE DESIGN AS POTENTIAL DRUGS FOR TYPE 2 DIABETES
Department of Biochemistry and Biotechnology, University of Thessaly, Larissa, Greece

18:30-21:00 WELCOME RECEPTION

(LEARNING CENTER SMART BISTRO)

THURSDAY, AUGUST 25, 2022

LEARNING CENTER
LECTURE HALL

SESSION 3. CHAIRPERSON: **AMÉLIA PILAR RAUTER**

9:00-9:30 PL-5
JOSÉ M. GARCÍA FERNÁNDEZ: CYCLOOLIGOSACCHARIDES FOR GENE DELIVERY
Instituto de Investigaciones Químicas, CSIC, Seville, Spain

9:30-10:00 PL-6
VLADIMÍR KŘEN: RUTINOSIDASE – NOVEL GLYCOSIDASE WITH UNIQUE SYNTHETIC POTENTIAL
Institute of Microbiology of the Czech Academy of Sciences, Laboratory of Biotrans-formation, Vídeňská, Prague, Czech Republic

10:00-10:15 OL-1
LAURA RUSSO: GLYCOCONJUGATE POLYMERS IN MEDICINE: FROM 3D BIOPRINTED *IN VITRO* MODELS TO TISSUE ENGINEERING APPLICATIONS
University of Milano-Bicocca, Department of Biotechnology & Biosciences, Milan, Italy

10:15-10:30 OL-2
CELSO A. REIS: ALTERED GLYCOSYLATION IN CANCER: TARGETING THE MOLECULAR MECHANISMS AND UNDERSTANDING THE CLINICAL IMPLICATIONS
Instituto de Investigação e Inovação em Saúde i3S, Universidade do Porto; Institute of Molecular Pathology and Immunology of the University of Porto; Institute of Biomedical Sciences Abel Salazar of the University of Porto; Faculty of Medicine of the University of Porto, Portugal

10:30-11:00 COFFEE BREAK

SESSION 4. CHAIRPERSON: **ULF J. NILSSON**

11:00-11:15 OL-3
VIKTOR KELEMEN: STEREOSELECTIVE SYNTHESIS OF 1,2-*CIS*-α-THIOGLYCOSIDES BY TWO SEQUENTIAL PHOTOINITIATED THIOL-ENE ADDITIONS
Department of Pharmaceutical Chemistry, University of Debrecen, Debrecen, Hungary

11:15-11:30 OL-4
MĀRIS TURKS: SO_2-ASSISTED GLYCOSIDIC BOND FORMATION
Riga Technical University, Riga, Latvia

11:30-11:45 OL-5
ANDREA SODINI: MUC-1 TnThr MIMETIC ANTIGEN AS TEMPLATE FOR MOLECULARLY IMPRINTED POLYMERS (MIPS)
Department of Chemistry, University of Florence, Sesto, Italy

11:45-12:30 GUIDED TOUR AT THE MAIN CAMPUS OF THE UNIVERSITY OF DEBRECEN

12:30-14:00 LUNCH
(LEARNING CENTER SMART BISTRO)

SESSION 5. CHAIRPERSON: **TANJA M. WRODNIGG**

14:00-14:30 PL-7
AMÉLIA PILAR RAUTER: *C*-GLUCOSYLATION TO INCREASE POLYPHENOL BIOACTIVITY, SELECTIVITY AND BIOAVAILABILITY
Departamento de Química e Bioquímica, Centro de Química Estrutural, Institute of Molecular Sciences, Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal

14:30-15:00 PL-8
MICHAELA WIMMEROVÁ: LECTINS FROM PATHOGENS: FROM STRUCTURE TO FUNCTION AND THEIR INHIBITION
NCBR, Faculty of Science, Masaryk University; CEITEC, Masaryk University; Department of Biochemistry, Faculty of Science, Masaryk University, Brno, Czech Republic

15:00-15:15 OL-6
TRIINU VISNAPUU: ENDO-LEVANASE OF *BACTEROIDES THETAIOTAOMICRON* AS SUITABLE CATALYST FOR BIOACTIVE FRUCTOOLIGOSACCHARIDES PRODUCTION
Institute of Molecular and Cell Biology, University of Tartu, Tartu, Estonia

15:15-15:30 OL-7
BJØRN E. CHRISTENSEN: BLOCK POLYSACCHARIDES
NOBIPOL, Department of Biotechnology and Food Science, NTNU-Norwegian University of Science and Technology, Norway

15:30-15:45 OL-8
ÉVA BOKOR: FIRST SYNTHESIS OF *C*-GLYCOPYRANOSYL 1,2,4,5-TETRAZINES AND THEIR TRANSFORMATIONS IN IEDDA REACTIONS
University of Debrecen, Department of Organic Chemistry, Debrecen, Hungary

15:45 -16:45 POSTER SESSION AND COFFEE BREAK

SESSION 6. CHAIRPERSON: **PHILIPPE COMPAIN**

16:45-17:15 PL-9
SERGE PEREZ: THE ALGORITHMIC BEAUTY OF THE STARCH GRANULE
CERMAV, CNRS, University Grenoble Alpes, Grenoble, France

17:15-17:45 PL-10
ANIKÓ BORBÁS: PHOTOINITIATED THIOL-ENE REACTIONS OF ENOSES – SCOPE AND LIMITATIONS
Department of Pharmaceutical Chemistry, University of Debrecen, Debrecen, Hungary

17:45-18:00 OL-9

BENCE SZAKÁCS: CATALYST-FREE COUPLING REACTIONS OF ANHYDRO-ALDOSE TOSYLHYDRAZONES WITH 1,2,3-1*H*-TRIAZOLES AND 5-BENZYL-2*H*-TETRAZOLES: SYNTHESIS OF *C*-(β-D-GLYCOPYRANOSYL)METHYL-TRIAZOLES AND -TETRAZOLES

Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary

FRIDAY, AUGUST 26, 2022

LEARNING CENTER
LECTURE HALL

SESSION 7. CHAIRPERSON: **DEMETRES D. LEONIDAS**

9:00-9:30 PL-11
ANNE IMBERTY: LECTINS FROM PATHOGENS: FROM STRUCTURAL GLYCOBIOLOGY TO ANTIADHESIVE STRATEGIES
CERMAV, CNRS, University Grenoble Alpes, Grenoble, France

9:30-10:00 PL-12
M. CARMEN GALAN: SYNTHETIC GLYCO-TOOLS FOR EXPLORING AND EXPLOITING THE GLYCOME
School of Chemistry, Cantock's Close, University of Bristol, Bristo, United Kingdom.

10:00-10:15 OL-10
TRINIDAD VELASCO-TORRIJOS: STRUCTURAL OPTIMIZATION OF GLYCOCONJUGATES AS INHIBITORS OF FUNGAL ADHESION
Chemistry Department, Maynooth University, Maynooth, Ireland
The Kathleen Lonsdale Institute for Human Health Research, Maynooth University

10:15-10:30 OL-11
KAJA KASEMETS: ANTIBACTERIAL ACTIVITY OF CHITOSAN-SILVER NANOCOMPOSITES
National Institute of Chemical Physics and Biophysics, Tallinn, Estonia

10:30-11:00 COFFEE BREAK

SESSION 8. CHAIRPERSON: **VLADIMIR KŘEN**

11:00-11:30 PL-13
ULF J. NILSSON: BIOPHYSICAL ASPECTS OF GLYCOMIMETIC-PROTEIN INTERACTIONS
Department of Chemistry, Lund University, Lund, Sweden; Galecto Biotech, Gothenburg, Sweden

11:30-11:45 OL-12
FILIPA MARCELO: UNLOCKING THE FINE SPECIFICITY OF THE ENIGMATIC IMMUNOMODULATORY HUMAN MACROPHAGE GALACTOSE C-TYPE LECTIN
UCIBIO, Associate Laboratory i4HB, Department of Chemistry, NOVA School of Science and Technology, Caparica, Portugal

11:45-12:00 OL-13
ISTVÁN KACSIR: PREPARATION OF HETEROCYCLIC GLUCOSAMINE DERIVATIVES AND THEIR HALF-SANDWICH PLATINUM-GROUP METAL COMPLEXES
Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary

12:00-12:15 OL-14
VIKTÓRIA GOLDSCHMIDT GŐZ: CONFORMER IDENTIFICATION *VIA* CYCLIC ION MOBILITY MASS SPECTROMETRY: HEXOSAMINE EPIMERS ASSIGNED ULTRA-STABILE RING STRUCTURES
MTA-ELTE Protein Modeling Research Group, Eötvös Loránd Research Network, Budapest, Hungary

12:15-12:30 OL-15
SON THAI LE: SYNTHESIS OF GLYCOCONJUGATES AND FLUOROQUINOLONE CARBOXYLIC ACID PRESENTING CHIMERAS
Department of Pharmaceutical Chemistry, University of Debrecen, Debrecen, Hungary

12:30-14:00 LUNCH
(LEARNING CENTER SMART BISTRO)

SESSION 9. CHAIRPERSON: **CARMEN ORTIZ MELLET**

14:00-14:30 PL-14
PHILIPPE COMPAIN: EXPLORING THE LIMITS OF THE INHIBITORY MULTIVALENT EFFECT
Equipe de Synthèse Organique et Molécules Bioactives (SYBIO), Univ. de Strasbourg, Strasbourg, France

14:30-15:00 PL-15
TANJA M. WRODNIGG: GLYCOMIMETICS: USEFUL TOOLS AND POTENTIAL THERAPEUTICS
Institute of Chemistry and Technology of Biobased Systems, Graz University of Technology, Graz, Austria

15:00-15:15 OL-16
FRANCESCO NICOTRA: CHITOSAN BASED NANOPARTICLES FOR MULTIMODAL DETECTION OF PANCREATIC BETA-CELLS
University of Milano-Bicocca, Department of Biotechnology & Biosciences, Milan, Italy

15:15-15:30 OL-17
PATRICK WEBER: *N*-MODIFIED-DIAMINOCYCLOPENTANE SUGAR ANALOGUES AS POWERFUL AND SELECTIVE PROTEIN-*O*-GLCNACASE INHIBITORS
Institute of Chemistry and Technology of Biobased Systems, Graz University of Technology, Graz, Austria

15:30-15:45 OL-18
SZABOLCS BÉNI: CARBOHYDRATE-CARBOHYDRATE INTERACTION REVEALS THE PROTECTING EFFECT OF CATIONIC CYCLODEXTRINS ON THE DESULFATION OF FONDAPARINUX
Semmelweis University, Department of Pharmacognosy, Budapest, Hungary

15:45 -16:45 POSTER SESSION AND COFFEE BREAK

SESSION 10. CHAIRPERSON: ZBIGNIEW J. WITCZAK

16:45-17:15 PL-16
JOSEPH M. HAYES: RECENT DEVELOPMENTS IN THE DESIGN OF GLUCOSE ANALOGUE INHIBITORS OF GLYCOGEN PHOSPHORYLASE MOTIVATED BY COMPUTATION
School of Pharmacy & Biomedical Sciences, University of Central Lancashire, Preston, United Kingdom

17:15-17:30 OL-19
LÁSZLÓ JICSINSZKY: PROPERTIES OF MECHANOCHEMICALLY SYNTHESIZED INSOLUBLE CYCLODEXTRIN POLYMERS. A CHANCE FOR SCALABLE PREPARATION.
Department of Drug Science and Technology, University of Turin, Turin, Italy

17:30-17:45 OL-20
ISTVÁN TIMÁRI: ACCELERATING NMR STRUCTURE ELUCIDATION OF CARBOHYDRATES WITH NOVEL NMR METHODS
Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary

17:45-18:00 OL-21
ÁLEX KÁLMÁN BALOGH: IN SILICO EXPLORATION OF BINDING OF NOVEL SULFUR AND SELENIUM CONTAINING HUMAN GALECTIN-3 LIGANDS
University of Debrecen, Department of Inorganic and Analytical Chemistry, Debrecen, Hungary

CLOSING OF THE CONFERENCE

19:00-22:00 CONFERENCE DINNER
(LEARNING CENTER)

SATURDAY, AUGUST 27, 2022

9:30-16:30	**EXCURSION TO THE TOKAJ WINE REGION***
	VISIT IN MÁD
13.30	LUNCH
14.30	VISIT IN A WINE CELLAR, WINE TASTING

(*OPTIONAL, SELF-FINANCING)

POSTERS

(15:45-16:45 THURSDAY, AUGUST 25, 2022 AND 15:45-16:45 FRIDAY, AUGUST 26, 2022)

P-1: INVESTIGATIONS ON CYTOTOXIC AND ANTIVIRAL EFFECTS OF 1,8-NAPHTHALIMIDE DERIVATIVES

Radostina Alexandrova[a], Hristo Hristov[a], Abedulkadir Abudalleh[a], Desislav Dinev[a], Lora Dyakova[b], Desislava Staneva[c], Kalina Shishkova[d], Awad I. Said[e], Ivo Grabchev[f]
[a]*Institute of Experimental Morphology, Pathology and Anthropology with Museum, Bulgarian Academy of Sciences, Sofia, Bulgaria*
[b]*Institute of Neurobiology, Bulgarian Academy of Sciences, Sofia, Bulgaria*
[c]*University of Chemical Technology and Metallurgy, Sofia, Bulgaria*
[d]*Sofia University "St. Kliment Ohridski", Faculty of Biology, Sofia, Bulgaria*
[e]*Department of Chemistry, Faculty of Science, Assiut University, Assiut, Egypt*
[f]*Sofia University "St. Kliment Ohridski", Faculty of Medicine, Sofia, Bulgaria*

P-2: TRANSGLYCOSYLATION REACTIONS USING ENDO AND EXO GLYCOSIDASES

Teréz Barna[a], Erna Szabó[a], Gyöngyi Gyémánt[b]
[a]*Department of Genetics and Applied Microbiology, University of Debrecen, Debrecen, Hungary*
[b]*Department of Inorganic and Analytical Chemistry, University of Debrecen, Debrecen, Hungary*

P-3: ORATION OF THE CARBOHYDRATE COMPOSITION OF SEEDS FOR THE EXTRACTION OF THERAPEUTIC OLIGOSACCHARIDES

Teréz Barna[a], Róbert Tupicza[a], Miklós Ida[a], Gyöngyi Gyémánt[b]
[a]*Department of Genetics and Applied Microbiology, University of Debrecen, Debrecen, Hungary*
[b]*Department of Inorganic and Analytical Chemistry, University of Debrecen, Debrecen, Hungary*

P-4: THIOL-ENE COUPLING REACTIONS OF NUCLEOSIDES

Miklós Bege[a,b,c], Ilona Bakai-Bereczki[a], Pál Herczegh[a], Anikó Borbás[a]
[a]*Department of Pharmaceutical Chemistry, University of Debrecen, Debrecen, Hungary*
[b]*Institute of Healthcare Industry, University of Debrecen, Debrecen, Hungary*
[c]*MTA-DE Molecular Recognition and Interaction Research Group, University of Debrecen, Debrecen, Hungary*

P-5: AMPHIPHILIC SIALIC ACID DERIVATIVES AGAINST VIRUSES

Ilona Bereczki[a,b,c], Eszter Lőrincz[a,d,e], Anikó Borbás[a,b], Pál Herczegh[a]
[a]*Department of Pharmaceutical Chemistry, University of Debrecen, Debrecen, Hungary*
[b]*National Laboratory of Virology, Szentágothai Research Centre, Pécs, Hungary*
[c]*ELKH-DE Pharmamodul Research Team, Debrecen, Hungary*
[d]*Institute of Healthcare Industry, University of Debrecen, Debrecen, Hungary*
[e]*Doctoral School of Pharmaceutical Sciences, University of Debrecen, Debrecen, Hungary*

P-6: SYNTHESIS OF POTENTIAL GLYCOSYL TRANSFERASE INHIBITORS BY THIO-CLICK REACTIONS

Nóra Debreczeni[a,b,c], Mikós Bege[a,c,d], Anikó Borbás[a]
[a]*Department of Pharmaceutical Chemistry, University of Debrecen, Debrecen, Hungary*
[b]*Doctoral School of Chemistry, University of Debrecen, Debrecen, Hungary*
[c]*Institute of Healthcare Industry, University of Debrecen, Debrecen, Hungary*
[d]*MTA-DE Molecular Recognition and Interaction Research Group, University of Debrecen, Debrecen, Hungary*

P-7: SYNTHESIS OF THE THREE MOST EXPENSIVE L-HEXOSE THIOGLYCOSIDES STARTING FROM D-GLUCOSE

Fruzsina Demeter[a], Attila Bényei[b], Anikó Borbás[a], Mihály Herczeg[a,c]
[a]*University of Debrecen, Department of Pharmaceutical Chemistry, Debrecen, Hungary*
[b]*University of Debrecen, Laboratory for X-ray Diffraction, Department of Physical Chemistry, Debrecen, Hungary*
[c]*Research Group for Oligosaccharide Chemistry of Hungarian Academy of Sciences, ELKH, Debrecen, Hungary*

P-8: STEREOCHEMISTRY OF SUGAR AMINO ACIDS: α/β-ANOMERS OF CHIMERA PEPTIDES AND THEIR INTERCONVERSION

Kim Hoang Yen Duong[a,b], Viktória Goldschmidt Gőz[c], Gitta Schlosser[d], István Pintér[b], András Perczel[b,c]
[a]*Hevesy György PhD School of Chemistry, Institute of Chemistry, ELTE Eötvös Loránd University, Budapest, Hungary*
[b]*Laboratory of Structural Chemistry and Biology, Institute of Chemistry, ELTE Eötvös Loránd University, Budapest, Hungary*
[c]*MTA-ELTE Protein Modeling Research Group, Eötvös Loránd Research Network (ELKH) ELTE Eötvös Loránd University, Budapest, Hungary*
[d]*MTA-ELTE Lendület Ion Mobility Mass Spectrometry Research Group, ELTE Eötvös Loránd University, Budapest, Hungary*

P-9: INVESTIGATION OF THE INTERACTION OF 3-FUCOSYL-LACTOSE DERIVATIVES WITH PSEUDOMONAS AERUGINOSA LECTINS (PA-IL AND PA-IIL) USING SATURATION TRANSFER DIFFERENCE (STD) NMR SPECTROSCOPY

László Bence Farkas[a,b], Magdolna Csávás[b,c], Lenka Malinovská[d], Katalin E. Kövér[a,b]
[a]*Department of Inorganic and Analytical Chemistry, University of Debrecen, Debrecen, Hungary*
[b]*Research Group for Molecular Recognition and Interaction, Eötvös Loránd Research Network, University of Debrecen, Debrecen, Hungary*
[c]*Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Debrecen, Debrecen, Hungary*
[d]*Central European Institute of Technology, Masaryk University, Czech Republic*

P-10: PEPTIDOGLYCAN MONOMER FUNCTIONALIZED GOLD NANOPARTICLES FOR L-DOPA TARGETED DELIVERY AND PROBING OF THEIR INTERACTION WITH WGA LECTIN

Ruža Frkanec[a], Marcela Šišić[a], Nikolina Kalčec[b], Ivana Vinković Vrček[b], Leo Frkanec[c]
[a]*Centre for Research and Knowledge Transfer in Biotechnology, University of Zagreb, Zagreb, Croatia*
[b]*Institute for Medical Research and Occupational Health, Zagreb, Croatia*
[c]*Rudjer Boskovic Institute, Zagreb, Croatia*

P-11: PREPARATION AND ANTICOAGULANT ACTIVITY OF AN IDRAPARINUX ANALOGUE PENTASACCHARIDE CONTAINING L-GULURONIC ACID

Mihály Herczeg[a], Fruzsina Demeter[a], István Timári[b], Katalin E. Kövér[c,d] and Anikó Borbás[a]
[a]*Department of Pharmaceutical Chemistry, University of Debrecen, Debrecen, Hungary*
[b]*Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary*
[c]*Department of Inorganic and Analytical Chemistry, University of Debrecen, Debrecen, Hungary*
[d]*MTA-DE Molecular Recognition and Interaction Research Group, University of Debrecen, Hungary*

P-12: FUNCTIONALIZATION OF 1-C-SUBSTITUTED GLYCAL DERIVATIVES BY ADDITION REACTIONS

Ágnes Homolya, Zsófia Peleskei, Ivett Jedlóczki, László Somsák, Marietta Tóth, László Juhász
Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary

P-13: SYNTHESES OF 2-FLUORO-SELENOGALACTOSIDE DERIVATIVES

László Szilágyi, Fanni Hőgye, Zita Tünde Illyés
Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary

P-14: [2 + 2] TYPE CYCLOADDITION REACTIONS OF PER-*O*-ACYLATED *EXO*-GLYCAL DERIVATIVES WITH CHLOROSULFONYL ISOCYANATE AND DICHLOROKETENE

János József[a], Tünde Zita Illyés[a], Katalin E. Kövér[b], Marietta Tóth[a], László Somsák[a], László Juhász[a]
[a]*Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary*
[b]*Department of Inorganic and Analytical Chemistry, University of Debrecen, Debrecen, Hungary*

P-15: PALLADIUM CATALYSED CROSS-COUPLING REACTIONS OF 2-IODO 1-C-SUBSTITUTED GLYCALS: HECK AND SONOGASHIRA REACTIONS

Ágnes Homolya, Eszter Csomay, Éva Juhász-Tóth, László Somsák, Marietta Tóth, László Juhász
University of Debrecen, Department of Organic Chemistry, Debrecen, Hungary

P-16: "NORMAL" AND CARBONYLATIVE SUZUKI-MIYAURA COUPLING REACTIONS OF 2-IODO 1-*C*-SUBSTITUTED GLYCALS

Éva Juhász-Tóth, Ferenc Dániel Petróczi, Ádám Szilárd Malecz, Marietta Tóth, László Somsák, László Juhász
Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary

P-17: UNIQUE TRANSGLYCOSYLATION OF C-3 FUNCTIONALIZED GALACTOSE YIELDS POTENT GLYCOMIMETICS FOR GALECTIN-3 INHIBITION

Pavla Bojarová[a], Michaela Hovorková[a], Viktoria Heine[a,b], Miluše Vlachová[a], Marcela Filipová[c], Lothar Elling[b], Vladimír Křen[a]
[a]*Institute of Microbiology of the Czech Academy of Sciences, Prague, Czech Republic*
[b]*Institute for Biotechnology and Helmholtz-Institute for Biomedical Engineering, RWTH Aachen University, Aachen, Germany*
[c]*Institute of Macromolecular Chemistry of the Czech Academy of Sciences, Prague, Czech Republic*

P-18: SYNTHETIC STUDIES TOWARD SPIROCYCLIC BIS-C,C-GLYCOSYL DERIVATIVES OF ULOSONIC ACIDS

Sándor Kun, Nándor Kánya, László Somsák
Department of Organic Chemistry, University of Debrecen, 4032, Debrecen, Hungary

P-19: SYNTHESIS OF ANOMERIC SPIRO-MORPHOLINONES FROM GLYCULOSONAMIDES

Nándor Kánya, Sándor Kun, László Somsák
Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary

P-20: QUINIC ACID-GALACTOSE CONJUGATES EQUIPPED WITH LIPOPHILIC SIDE CHAINS AGAINST INFLUENZA VIRUSES

Eszter Boglárka Lőrincz[a,b], Pál Herczegh[a], Anikó Borbás[a], Ilona Bakai-Bereczki[a]
[a]*University of Debrecen, Department of Pharmaceutical Chemistry, Debrecen, Hungary*
[b]*University of Debrecen, Pharmaceutical Sciences Doctoral School, Debrecen, Hungary*

P-21: SEARCHING FOR NEW LECTINS IN MUSHROOMS

Lenka Malinovská[a,b], Kamila Zimová[c], Dominika Pončáková[c], Vojtěch Juza[d], Michaela Wimmerová[a,b,c]
[a]*NCBR, Faculty of Science, Masaryk University, Brno, Czech Republic*
[b]*CEITEC, Masaryk University, Brno, Czech Republic*
[c]*Department of Biochemistry, Faculty of Science, Masaryk University, Brno, Czech Republic*
[d]*Gymnázium Aloise Jiráska v Litomyšli, Litomyšl, Czech Republic*

P-22: SYNTHESIS AND HYDROGENOLYSIS OF DIOXOLANE-TYPE 2,3-*O*-HALOBENZYLIDENE ACETALS OF GLYCOSIDES

Erika Mező, Bayar Boldtumur, Anikó Borbás
University of Debrecen, Department of Pharmaceutical Chemistry, Debrecen, Hungary

P-23: UNEXPECTED REACTIONS OF *N*-(2,3,4,6-TETRA-*O*-ACYL-β-D-GLYCOPYRANOSYL-CARBONYL)-*N*'-TOSYLHYDRAZINES WITH *N*-, *O*-NUCLEOPHILES

Éva Juhász-Tóth, Mariann Kiss, Imre Ignáth, Zwivhuya Phoebe Mudau, László Somsák, Marietta Tóth
Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary

P-24: FIRST SYNTHESIS OF 3-GLYCOPYRANOSYL-1,2,4-TRIAZINES

Éva Bokor, Attila Ferenczi, Mahir Hashimov, Alshimaa Ibrahim Zaki, Éva Juhászné Tóth, László Somsák
University of Debrecen, Department of Organic Chemistry, Debrecen, Hungary

P-25: LECTIN-BASED GLYCOPROTEIN MICROARRAY: HIGH-THROUGHPUT GLYCOMICS TOOL

Jaroslav Katrlík, Lucia Pažitná, Paras Kundalia, Kristína Kianičková
Institute of Chemistry, Slovak Academy of Sciences, Bratislava, Slovakia

P-26: APPLICATION OF ACETYL-GROUP ON PYRANOID β-SAAs TO SYNTHESISE CHIMERA PEPTIDES WITH VARIABLE HYDROFILICITY

István Varga[a], Viktória Goldschmidt Gőz[b], András Perczel[b,c]
[a]*György Hevesy Doctoral School of Chemistry, Eötvös University, Budapest, Hungary*
[b]*MTA-ELTE Protein Modeling Research Group, Eötvös Loránd Research Network (ELKH), Budapest, Hungary*
[c]*Laboratory of Structural Chemistry and Biology, Institute of Chemistry, Eötvös University, Budapest, Hungary*

P-27: *IN SILICO* EXPLORATION OF ANTITROMBIN BINDING OF NOVEL HEPARIN PENTASACCHARIDE DERIVATIVES

Samar Alnukari, Krisztina Fehér
Molecular Recognition and Interaction Research Group, Hungarian Academy of Science, University of Debrecen, Hungary

ABSTRACTS OF PLENARY AND ORAL LECTURES

(LISTED IN THE ORDER OF PRESENTATION)

REZSŐ BOGNÁR: A PIONEER OF ORGANIC CHEMISTRY RESEARCH IN DEBRECEN

Pál Herczegh

Department of Pharmaceutical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary
E-mail: herczegh.pal@pharm.unideb.hu

Rezső Bognár (1913-1990), professor of organic chemistry of University of Debrecen, member of the Hungarian Academy of Sciences founded the organic chemistry research and education in Debrecen. His research interest was wide, covering carbohydrate chemistry, pharmaceutical chemistry, the chemistry of antibiotics, flavonoids and alkaloids.

As one of his latest students and co-workers I will talk about his path of life, achievements in science and cultural policy.

Rezső Bognár (1913-1990)

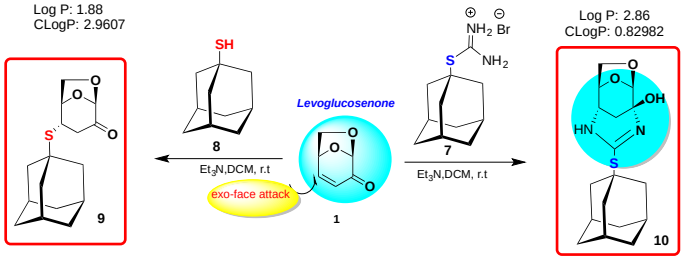
PL-1

PREPARATION AND REACTIVITY OF *S*-THIO AND *N*-ADDUCTS TO CONJUGATED SYTEM OF LEVOGLUCOSENONE

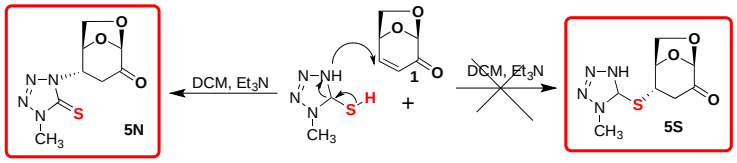
Zbigniew J. Witczak

Nesbitt School of Pharmacy, Department of Pharmaceutical Sciences, Wilkes University, 18766, Wilkes-Barre, Pennsylvania, USA
E-mail: zbigniew.witczak@wilkes.edu

The topics of stereoselective synthesis has witnessed tremendous advances over the past half-century providing access to a very large variety of sophisticated molecular fragments with very high level of diastereo-and enantioselectivity. One of such molecular target is conjugated enone-levoglucosenone (1). Our earlier syntheses[1-3] of
C-4 functionalized Michael adducts *via* base catalyzed stereoselective addition of aromatic thiols containing nitrogen atoms to levoglucosenone resulted in the expected product (9).



Interestingly, triethylamine is a good activator for the conjugate addition of the thiouronium anion to C-4 of levoglucosenone (1), but unfortunately it is not capable of generating a free thiol from its "masked thiol" derivative (7)**.** A two steps process of an addition followed by cyclization with the formation of unusual adduct (10). Similarly, heterocyclic thiols undergoes 1,4-Micheal addition quite easily with the formation of crystalline products in high (75-89%) yield



However, the ^{13}C and ^{1}H NMR spectra of new heterocyclic adducts led us to conclude that they are not *S*-linked, but *N*-aza- linked. The tautomeric forms of heterocyclic thiols are dominant factor for the *N*-aza adducts formation. Moreover, the ^{13}C signal at 198 ppm is indicative of the C=S group. The plausible mechanism is depicted in scheme 1. This lecture will describe our approaches to the formation of *S*- and *N*-adducts to conjugated system of levoglucosenone. Their potential biological activities will be also described.

1. Z. J. Witczak, R. Chhabra, H. Chen, X-Q. Xie, *Carbohydr.Res.30*1, 167-175**, 1997**.
2. Z. J. Witczak, A. Mauger, R. Bielski, D. Mencer, *ARKIVOC*, **2021,** *iv*, 268-279.
3. J. Sarnik, A. Czubatka-Bienkowska, A. Macieja, R. Bielski, Z. J. Witczak, T. Poplawski, *Bioorganic & Med. Chem. Lett.*, **2017,** *27***,** 1215-1219.

PL-2

MIMICKING CARBOHYDRATE CHEMISTRY AND FUNCTIONALITY

Manuel González Cuesta[a], Elena Sánchez-Fernández[a], José M. García Fernández[b], Carmen Ortiz Mellet[a]

[a]*Faculty of Chemistry, University of Seville, 41012, Seville, Spain*
[b]*Instituto de Investigaciones Químicas, CSIC, 41092, Seville, Spain*
E-mail: mellet@us.es

Iminosugars, differing of natural monosaccharides just in the endocyclic heteroatom (amine nitrogen instead of oxygen) are acknowledged as the iconic glycomimetics. Accordingly, they have found broad applications in the regulation of the activity of carbohydrate active enzymes by acting as substrate or transition state analogs. Unfortunately, the intrinsic lability of aminoacetal functionalities handicaps their incorporation into oligosaccharides and glycoconjugates, which hampers their use to interfere in other carbohydrate-mediated molecular recognition processes. In sp^2-iminosugars the endocyclic N is part of a pseudoamide functionality.[1] Consequently, it bears substantial sp^2 hybridation character and can undergo glycosidation-like reactions through an acyliminium intermediate. This remarkable property not only enlarges the opportunities to finally tune their affinity towards enzymes but opens new opportunities to target specific receptors and antibodies that require glycan, glycopeptide or glycolipid partners. Recent examples regard the intervention in neurodegenerative disorders (Tay-Sachs[2] and Alzheimer diseases[3]), tumor-associated carbohydrate antigen recognition[4] and vaccine formulation[5] or the innate immune response.[6]

1. Sánchez-Fernández, E. M.; García Fernández, J. M.; Ortiz Mellet, C. *Chem. Commun.*, **2016**, 52, 5497-5515.
2. González-Cuesta, M.; Herrera-González, I.; García-Moreno, M. I.; Ashmus, R. A.; Vocadlo, D.; García Fernández, J. M.; Nanba, E.; Higaki, K.; Ortiz Mellet, C. *J. Enz. Inh. Med. Chem*. **2022**, *37*, 1364-1374.
3. González-Cuesta, M.; Sidhu, P.; Ashmus, R. A.; Males, A.; Proceviat, C.; Madden, Z.; Rogalski, J. C.; Busmann J. A.; Foster, L. J.; García Fernández, J. M.; Davies, G. J.; Ortiz Mellet, C.; Vocadlo, D. J. *J. Am. Chem. Soc.* **2022**, *144*, 2, 832–844.
4. Guillen-Poza, P.; Sánchez-Fernández, E. M.; Artigas, G.; García Fernández, J. M.; Hinou, H.; Ortiz Mellet, C.; Nishimura, S. -I.; Garcia-Martin, F. *J. Med. Chem.*, **2020**, *63*, 8524-8533.
5. Bermejo, I. A.; Navo, C. D.; Castro-López, J.; Guerreiro, A.; Jiménez-Moreno, E.; Sánchez Fernández, E. M.; García-Martín, F.; Hinou, H.; Nishimura, S.-I.; García Fernández, J. M.; Ortiz Mellet, C.; Avenoza, A.; Busto, J. H.; Bernardes, G. J. L.; Hurtado-Guerrero, R.; Peregrina. J. M.; Corzana, F. *Chem. Sci.*, **2020**, *11*, 3996–4006.
6. Schaeffer, E.; Sánchez Fernández, E. M.; Gonçalves-Pereira, R.; Flacher, V.; Lamon, D.; Duval, M.; Fauny, J.-D.; García Fernández, J. M.; Mueller, G.; Ortiz Mellet, C. *Eur. J. Med. Chem.* **2019**, *169*, 111–120.

PL-3

FROM sLe^x TO AN ORAL GLYCOMIMETIC

Beat Ernst, Xiaohua Jiang, Norbert Varga, Roman P. Jakob, Philipp Daetwyler, Tobias Mühlethaler, Martin Smieško

University of Basel, Dept. of Pharmaceutical Sciences, CH-4056 Basel, Switzerland
E-mail: Beat.Ernst@unibas.ch

Over the last two decades, a wealth of physiological and pathophysiological functions related to carbohydrate-lectin interactions have been uncovered. However, only a fraction of these discoveries have led to new therapeutic concepts. The reasons are manifold: first, carbohydrates are generally regarded as highly demanding lead structures because of their notoriously insufficient pharmacodynamic (PD) properties, as well as their nondrug-like pharmacokinetic (PK) profiles. In addition, lectins typically exhibit solvent-exposed, extended binding sites, and are therefore often considered to be undruggable targets. However, an improved understanding of the principles controlling carbohydrate-lectin interactions have recently led to a number of promising preclinical and clinical candidates, *e.g.* for the therapy of inflammation, cancer, and viral and bacterial infections.

In this lecture, the various pharmacodynamic and pharmacokinetic drawbacks traditionally associated with lectin targets will be discussedon a specific example.

In the second part, solutions to these PK/PD drawbacks will be presented, exemplified by an approach leading to a glycomimetic with nanomolar affinity as well as oral availability.

STRUCTURE DRIVEN CARBOHYDRATE DESIGN AS POTENTIAL DRUGS FOR TYPE 2 DIABETES

Demetres D. Leonidas

Department of Biochemistry and Biotechnology, University of Thessaly, 41500 Larissa, Greece
E-mail: ddleonidas@bio.uth.gr

Glycogen phosphorylase (GP; EC 2.4.1.1) is the key enzyme of glycogen metabolism, catalysing the phosphorolysis of the α-1,4 glycosidic bonds of glycogen to yield glucose-1-phosphate[1]. Glycogen metabolism is a key metabolic process for glucose homeostasis, and GP is a validated pharmaceutical target for the development of novel agents to treat hyperglycaemia in the context of type 2 diabetes. The active site of GP binds the physiological inhibitor α-D-glucose and over the years has been the focus for research efforts to discover potent GP inhibitors, primarily analogues of glucose[2-4].

The crystal structures of GP-ligand complexes[5] have been the driving force for the design and testing of new carbohydrate molecules as potential inhibitors of GP. In the context of the presentation the most recent results on the GP inhibitor discovery efforts will be presented. The multidisciplinary of the approach followed, will be analysed, by presenting enzyme kinetics, cellular biology, X-ray crystallography and metabolomics results[6, 7].

1. Oikonomakos, N.G., *Curr. Protein. Pept. Sci.*, **2002**. 3, 561-86.
2. Somsak, L., *Compt. Rend. Chim.*, **2011**. 14, 211-223.
3. Somsak, L., Czifrak, K., Toth, M., Bokor, E., Chrysina, E.D., Alexacou, K.M., Hayes, J.M., Tiraidis, C., Lazoura, E., Leonidas, D.D., Zographos, S.E., and Oikonomakos, N.G., *Curr. Med. Chem.*, **2008**. 15, 2933-2983.
4. Hayes, J.M., Kantsadi, A.L., and Leonidas, D.D., *Phytochem. Rev.*, **2014**. 13, 471-498.
5. Leonidas, D.D., Zographos, S.E., Tsitsanou, K.E., Skamnaki, V.T., Stravodimos, G., and Kyriakis, E., *Acta Crystallogr.*, **2021**. F77, 303-311.
6. Tsagkarakou, A.S., Chasapi, S.A., Koulas, S.M., Tsialtas, I., Kyriakis, E., Drakou, C.E., Kun, S., Somsák, L., Spyroulias, G.A., Psarra, A.-M.G., and Leonidas, D.D., *Eur. J. Med. Chem. Rep.*, **2021**. 3, 100011.
7. Drakou, C.E., Gardeli, C., Tsialtas, I., Alexopoulos, S., Mallouchos, A., Koulas, S.M., Tsagkarakou, A.S., Asimakopoulos, D., Leonidas, D.D., Psarra, A.G., and Skamnaki, V.T., *J. Agric. Food. Chem.*, **2020**. 68, 10191-10199.

CYCLOOLIGOSACCHARIDES FOR GENE DELIVERY

José López-Fernández[a], Gonzalo Rivero Barbarroja[b], Juan M. Benito[a], José L. Jiménez Blanco[b], Carmen Ortiz Mellet[b], José M. García Fernández,[a]

[a]*Instituto de Investigaciones Químicas, CSIC, 41092, Seville, Spain*
[b]*Faculty of Chemistry, University of Seville, 41012, Seville, Spain*
E-mail: jogarcia@iiq.csic.es

The commercialization of the Moderna and Pfizer-BioNTech mRNA-based vaccines, involving lipid nanoparticle (LNP) carriers, to fight the current Covid-19 pandemics has corroborated the promise of non-viral vectors in gene therapy. Limitations regarding the size of the cargo that can be encapsulated (e.g. self-amplifying RNA), stability (requiring temperatures in the -80 to -25 ºC), or undesired immune response still persist, however. The multicomponent character of LNPs and the fact that some of the constituents have a polydisperse nature and may be immunogenic (e.g. PEG-lipids), represent a main limitation. Molecular vectors with diastereomeric definition and effective in monoformulation represent an attractive alternative made possible by the combination of suitable nanosized platforms (molecular nanoparticles, MNPs) and precision chemistry.[1] Cyclodextrins (CDs), having a well-defined Janus architecture and distinct hydroxyl reactivities, have led the field. Programmed self-assembling can be achieved by the interplay of a range of supramolecular interactions (electrostatics, H-bonding, hydrophobic, aromatic, host-guest), translating into precise properties at the nanoscale and defined tropisms in vivo.[2,3] Lately, cyclotrehalans (CTs) have added to the MNP palette.[4] Interestingly, CTs can break the two-face straitjacket, broadening the chemical space for molecular vector design and virus mimicking.[5] Recent examples put the accent in the opportunities to codify organ targeting information by inducing specific nanoparticle topologies, with no need of biorecognition elements, and implementing stimuli sensitiveness.[6]

1. Jiménez Blanco, J. L.; Benito, J. M.; Ortiz Mellet, C.; Garcia Fernández, J. M. *J. Drug Deliv. Sci. Technol.* **2017**, *42*, 18-37.
2. Gallego-Yerga, L.; Benito, J. M.; Blanco-Fernández, L.; Martínez-Negro, M.; Vélaz, I.; Aicart, E.; Junquera, E.; Ortiz Mellet, C.; Tros de Ilarduya, C.; García Fernández, J. M. *Chem. Eur. J.*, **2018**, *24*, 3825-3835.
3. Manzanares, D.; Pérez-Carrión, M. D.; Jiménez Blanco, J. L.; Ortiz Mellet, C.; García Fernández, J. M.; Ceña, V. *Int. J. Mol. Sci*, **2020**, *21*, 9306
4. Carbajo, A. I.; Rodríguez-Lavado, J.; Jiménez Blanco, J. L.; Benito, J. M.; Di Giorgio, C.; Vélaz, I.; Tros de Ilarduya, C.; Ortiz Mellet, C.; García Fernández, J. M. *Chem. Commun.* **2019,** 55, 8227-8230.
Rivero Barbarroja, G.; Benito Hernández, J. M.; Ortiz Mellet, C.; García Fernández, J. M. *Nanomaterials*, **2020**, *21*, 10, 2517
5. Carbajo-Gordillo, A. I.; González-Cuesta, M.; Jiménez Blanco, J. L.; Benito, J. M.; Santana, M. L.; Carmona, T.; Di Giorgio, C.; Przybylski, C.; Ortiz Mellet, C.; Tros de Ilarduya, C.; Mendicuti, F.; García Fernández, J. M. *Chem. Eur. J.*, **2021**, *27*, 9429–9438.
6. Carbajo-Gordillo, A. I.; López-Fernández, J.; Benito, J. M.; Jiménez Blanco, J. L.; Santana-Armas, M. L.; Marcelo, G.; Di Giorgio, C.; Przybylski, C.; Ortiz Mellet, C.; Tros de Ilarduya, C.; Mendicuti, F.; García Fernández, J. M. *Macromol. Rapid Commun.*, ***2022**, 2200145*.

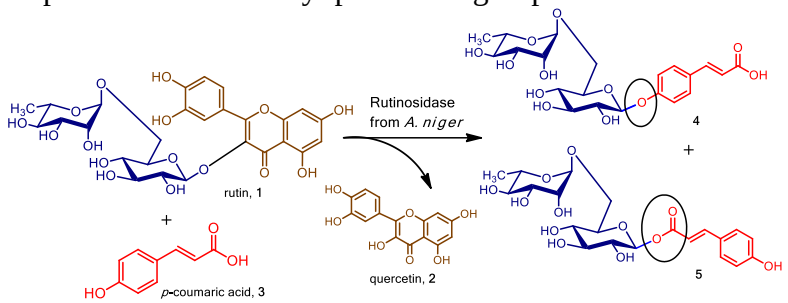
PL-6

RUTINOSIDASE – NOVEL GLYCOSIDASE WITH UNIQUE SYNTHETIC POTENTIAL

Vladimír Křen

Institute of Microbiology of the Czech Academy of Sciences, Laboratory of Biotransformation, Vídeňská 1083, CZ-142 20, Prague 4, Czech Republic
E-mail: kren@biomed.cas.cz

Most phenolic acid glycosides are glycosylated on the aromatic hydroxyls. However, carboxylic glycosides can also be rarely found (glycosyl esters; often β-glucopyranosides). Their chemical synthesis is not trivial and involves inherent problems of high lability of glycosyl ester bond, which is incompatible with most acyl protection groups.



The enzymatic approach mimicking *in vivo* biosynthesis employs glucosyltransferases but this method uses expensive UDP-glucose and the yields are low. We have a new robust diglycosidase rutinosidase from *A. niger*, which can glycosylate various acceptors including phenols[1] in a good yield using cheap rutin (**1**) as a glycosyl donor, which was crystallized.[2] To our great surprise, glycosyl esters were also formed at a reasonable yield. We tested this reaction with a large panel of various phenolic acids and as an example, we demonstrate rutinosylation of *p*-coumaric acid yielding phenolic glycoside (**4**) and respective glycosyl ester (**5**). Rutinosides can be treated *in situ* with α-L-rhamnosidase (*A. terreus*) to yield respective β-glucopyranosides. We describe here probably the first example of glycosylation of a carboxyl group with a glycosidase. Rutinosidase is able to glycosylate inorganic azide to form β-rutinosyl azide and E319A mutant in the active site is able to generate α-rutinosyl azide.[3] The unique ability of this enzyme is most probably caused by a substrate tunnel[4] in the structure of rutinosidase, which explains the unusual catalytic properties of this glycosidase and its specific transglycosylation potential.

1. Šimčíková, D.; Kotik, M.; Weignerová, L.; Halada, P.; Pelantová, H.; Adamcová, K.; Křen V. *Adv. Synth. Catal.* **2015**, *357*, 107-117.
2. Pachl, P.; Kapešová, J.; Brynda, J.; Biedermannová, L.; Pelantová, H.; Bojarová, P.; Křen, V.; Řezáčová, P.; Kotik, M. *FEBS J.* **2020**, *287*, 3315-3327.
3. Kotik, M.; Brodsky, K.; Halada, P.; Javůrková, H.; Pelantová, H.; Konvalinková, D.; Bojarová, P.; Křen V. *Catal. Commun.* **2021**, *149*, 106193.
4. Brodsky, K.; Kutý, M;. Pelantová, H.; Cvačka, J.; Rebroš, M.; Kotik, M.; Kutá Smatanová, I.; Křen, V.; Bojarová P. *Int. J. Mol. Sci.* **2020**, *21*, 5671.

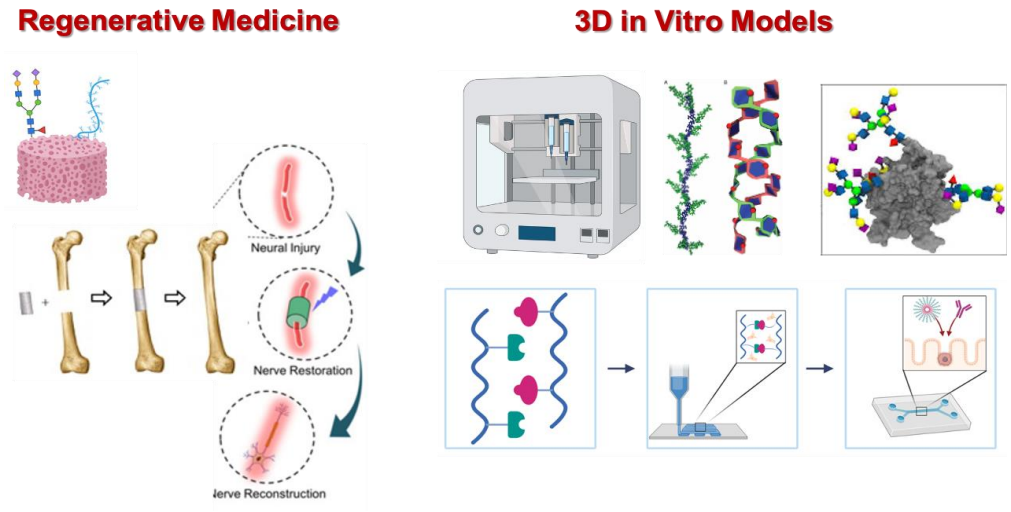
Acknowledgement: Czech Science Foundation grant No. 21-001799S and mobility project LTC 20069 (COST CA18132 GlycoNanoProbes) by the Czech Ministry of Education are gratefully acknowledged.

GLYCOCONJUGATE POLYMERS IN MEDICINE: FROM 3D BIOPRINTED *IN VITRO* MODELS TO TISSUE ENGINEERING APPLICATIONS

Laura Russo[a,b], Federica Barbugian[a], Francesca Cadamuro[a], Francesco Nicotra[a]

[a]*University of Milano-Bicocca, Department of Biotechnology & Biosciences, 20126, Milan, Italy*
[b]*CÚRAM, SFI Research Centre for Medical Devices, National University of Ireland Galway, H91 W2TY, Galway, Ireland*
E-mail: laura.russo@unimib.it

The last advances in 3D bioprinting technologies allows the development of new 3D in vitro tools and models mimicking the biochemical and structural features of cell microenvironment and Extracellular Matrix (ECM) [1]. Glycans are showing a key role in the modulation of cell fate and in the induction of cell differentiation, indispensable processes for the correct functional and structural organs development [2]. With the advancement of 3D bioprinting manufacturing processes, the opportunity to mimic in 3D even the physical features of tissues and organs is leading to new tools to study the impact of glycan-protein interactions. The generation of functional glyco-polymers employable in the design of new organ-like constructs selecting cell populations to mimic at the best the entire tissue microenvironment represents an open challenge in the field. Here in this presentation, the employment of 3D bioprinting and glycans to induce tissue formation in a dish will be presented.



1. J. Nicolas, S. Magli, L. Rabacchin, S. Sampaolesi, F. Nicotra, L. Russo. 3D Extracellular Matrix Mimics: Fundamental Concepts and Role of Materials Chemistry to Influence Stem Cell Fate. *Biomacromolecules* **2020**, *21*, 1968-1994
2. A.L. Rebelo, J. Bizeau, L. Russo, A. Pandit. Glycan-functionalized collagen hydrogels modulate the glycoenvironment of a neuronal primary culture. *Biomacromolecules*. **2020**, *21*, 7, 2681–2694.

ALTERED GLYCOSYLATION IN CANCER: TARGETING THE MOLECULAR MECHANISMS AND UNDERSTANDING THE CLINICAL IMPLICATIONS

Celso A. Reis[a,b,c,d]

[a]*Instituto de Investigação e Inovação em Saúde i3S, Universidade do Porto, Portugal.*
[b]*Institute of Molecular Pathology and Immunology of the University of Porto, Portugal.*
[c]*Institute of Biomedical Sciences Abel Salazar of the University of Porto, Portugal.*
[d]*Faculty of Medicine of the University of Porto, Portugal*
E-mail: celsor@ipatimup.pt

Alterations of glycosylation are common molecular alterations with major biological implications for cancer progression. Cancer is a heterogeneous disease that requires multidisciplinary treatment. Current targeted therapy depends on patient stratification based on molecular features of the tumor.

This presentation will report on the basis of alterations of glycosylation that occur in cancer, particularly our recent results applying glycomic and glycoproteomic strategies in human cancer that provided novel information with major clinical implications [1,2,3]. I will report on the alterations of glycosylation impact the activation of oncogenic receptors in tumour samples, such as HER2 (ErbB2). The glycoproteomic map of the HER2 in gastric cancer cells will be presented[1,4]. These results disclosed a site-specific glycosylation profile of this receptor in gastric cancer cells and how this HER2 glycosylation affects the biology of the receptor and the sensitivity of HER2-dependent gastric cancer cells to the therapeutic humanized monoclonal antibody used in cancer treatment[1,4].

These results highlight the functional aspects of glycosylation modifications occurring in cancer and supports their potential application as biomarkers for patient stratification, personalize medicine and for novel and improved therapeutic applications[5,6].

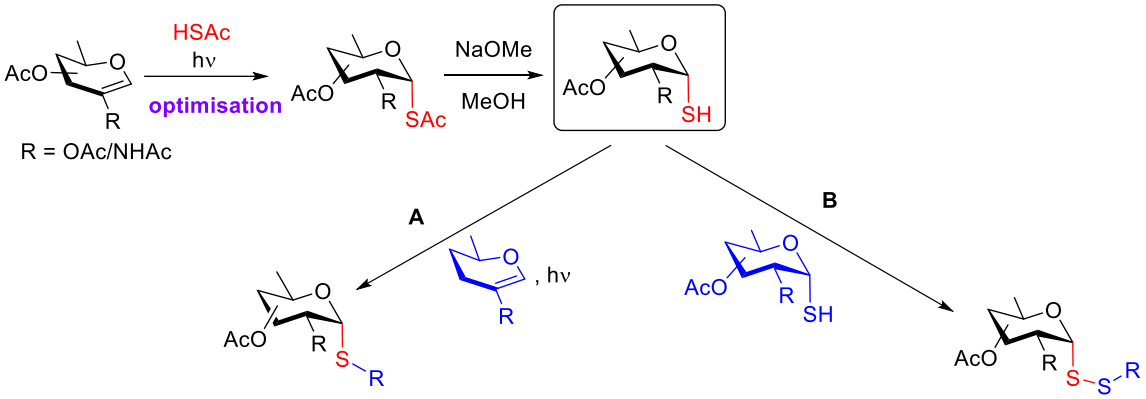
1. Duarte, H. O., Rodrigues, J. G., Gomes, C., Hensbergen, P. J., Ederveen, A., de Ru, A. H., Mereiter, S., Polónia, A., Fernandes, E., Ferreira, J. A., van Veelen, P. A., Santos, L. L., Wuhrer, M., Gomes, J., & Reis, C. A.. ST6Gal1 targets the ectodomain of ErbB2 in a site-specific manner and regulates gastric cancer cell sensitivity to trastuzumab. Oncogene **2021**, 40(21), 3719–3733.
2. Rodrigues, J. G., Duarte, H. O., Gomes, C., Balmaña, M., Martins, Á. M., Hensbergen, P. J., de Ru, A. H., Lima, J., Albergaria, A., van Veelen, P. A., Wuhrer, M., Gomes, J., & Reis, C. A.. Terminal α2,6-sialylation of epidermal growth factor receptor modulates antibody therapy response of colorectal cancer cells. *Cellular oncology (Dordrecht)* **2021**, *44*(4), 835–850.
3. Mereiter, S., Martins, Á. M., Gomes, C., Balmaña, M., Macedo, J. A., Polom, K., Roviello, F., Magalhães, A., & Reis, C. A. (2019). O-glycan truncation enhances cancer-related functions of CD44 in gastric cancer. *FEBS letters* **2019**, *593*(13), 1675–1689.
4. Duarte, H. O., Reis, C. A., & Gomes, J. (2022). Insights on ErbB glycosylation - contributions to precision oncology. *Trends in cancer* **2022**, *8*(6), 448–455.
5. Mereiter, S., Balmaña, M., Campos, D., Gomes, J., & Reis, C. A. (2019). Glycosylation in the Era of Cancer-Targeted Therapy: Where Are We Heading?. *Cancer cell* **2019**, *36*(1), 6–16.
6. Pinho, S. S., & Reis, C. A.. Glycosylation in cancer: mechanisms and clinical implications. *Nature reviews. Cancer* **2015**, *15*(9), 540–555.

STEREOSELECTIVE SYNTHESIS OF 1,2-*CIS*-α-THIOGLYCOSIDES BY TWO SEQUENTIAL PHOTOINITIATED THIOL-ENE ADDITIONS

Viktor Kelemen[a], Nóra Debreczeni[a,b], Miklós Bege[a,b,c], Anikó Borbás[a]

[a]*Department of Pharmaceutical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
[b]*Institute of Healthcare Industry, University of Debrecen, H-4032 Debrecen, Hungary*
[c]*MTA-DE Molecular Recognition and Interaction Research Group, H-4032 Debrecen, Hungary*
E-mail: kelemen.viktor@pharm.unideb.hu

The formation of 1,2-*cis*-α-thiols is a notoriously challenging task, so far, no general method was described. Photoinitiated thiol-ene addition reaction of 2-substituted glycals has already been used by our group to synthesize 1,2-*cis*-α-*S*-linked thioglycosides.[1-3] Here, we present that the addition of thioacetic acid to 2-substituted hexopyranosyl D- and L-glycals results in the selective formation of the desired 1,2-*cis*-α-1-thioacetates, which can then be selectively converted into the corresponding thiols. Those compounds were then used in a second photoinitiated thiol-ene coupling reaction to furnish trehalose-type 1,2-*cis*-α,α-thiodisaccharides (**A**), or in a non-photochemical oxidation reaction to furnish protected or deprotected disulfides (**B**).



Scheme 1. Synthesis of 1,2-*cis*-α carbohydrate thiols and thioconjugates

1. Lázár, L., Csávás, M., Herczeg, M., Herczegh, P., Borbás, A., *Org. Lett.*, **2012**, *14*, 4650-4653.
2. Eszenyi, D., Kelemen, V., Balogh, F., Bege, M., Csávás, M., Herczegh, P., Borbás, A., *Chem. Eur. J.* **2018**, *24*, 4532-4536
3. Kelemen, V., Bege, M., Eszenyi, D., Debreczeni, N., Bényei, A., Stürzer, T., Herczegh, P., Borbás, A., *Chem. Eur. J.*, **2019**, *25*, 14477-14477.

Acknowledgement: The research was supported by the EU and co-financed by the European Regional Development Fund under the project GINOP-2.3.4-15-2020-00080, and by the National Research, Development and Innovation Office of Hungary (OTKA K 132870).

OL-4

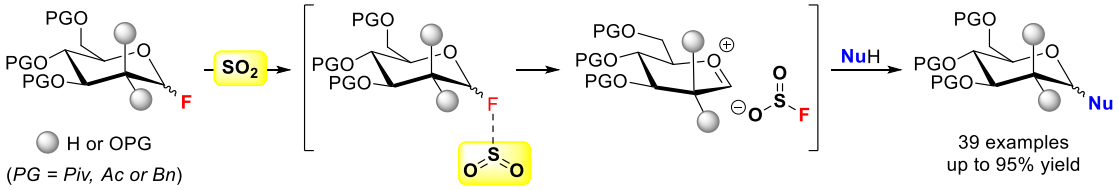
SO_2-ASSISTED GLYCOSIDIC BOND FORMATION

Krista Gulbe[a], Jevgeņija Lugiņina[a], Edijs Jansons[a], Artis Kinēns[b], Māris Turks[a]

[a]*Riga Technical University, LV-1048, Riga, Latvia*
[b]*University of Latvia, LV-1004, Riga, Latvia*
E-mail: maris.turks@rtu.lv

Being one of the few polar solvents that possess Lewis acid properties, liquid SO_2 facilitates Lewis acid promoted and/or carbenium ion mediated chemical transformations.[1] Furthermore, SO_2 has an affinity towards fluoride ion that leads to covalent bonding in the form of fluorosulfite anion.[2]

Based on the aforementioned physico-chemical properties of SO_2, we have developed SO_2-assisted glycosylation with glycosyl fluorides as glycosyl donors in liquid SO_2 without an external promoter.[3] The novel synthetic method was demonstrated with variously protected mannosyl and glucosyl fluorides, and series of *O*-, *S*- and *C*-glycosides were obtained in moderate to excellent yields. The α/β-selectivity of glycosylation was proposed to be substrate-controlled presenting thermodynamic equilibrium. The formation of fluorosulfite species during the glycosylation in the presence of SO_2 was proved by both ^{19}F NMR spectroscopy and DFT calculations.



1. (a) Posevins, D.; Suta, K.; Turks, M. *Eur. J. Org. Chem.* **2016**, 1414. (b) Suta, K.; Turks, M. *ACS Omega* **2018**, *3*, 18065. (c) Leškovskis, K.; Gulbe, K.; Mishnev, A.; Turks, M. *Tetrahedron Lett.* **2020**, *61*, 152528.
2. Eisfeld, W.; Regitz, M. *J. Am. Chem. Soc.* **1996**, *118*, 11918.
3. Gulbe, K.; Lugiņina, J.; Jansons, E.; Kinēns, A.; Turks, M. *Beilstein. J. Org. Chem.* **2021**, *17*, 964.

MUC-1 TnThr MIMETIC ANTIGEN AS TEMPLATE FOR MOLECULARLY IMPRINTED POLYMERS (MIPS)

Andrea Sodini, Maria Minunni, Cristina Nativi, Pasquale Palladino, Francesco Papi, Simona Scarano

Department of Chemistry, University of Florence, 50019 Sesto F.no (FI) - Italy
E-mail: andrea.sodini@stud.unifi.it

Cancer is the second leading cause of death worldwide and an early diagnosis is the key to get a more favorable cancer prognosis and to reduce mortality[1]. Well-established saccharidic cancer biomarkers are seldom used as cancer diagnostics because of false positive/ or and false negative results.[2] Therefore, new cancer biomarkers detectable in body fluids are largely searched.

Abnormal glycoconjugates, known as Tumor Associated Carbohydrate Antigens (TACAs) have distinctly been marked in many tumors and identified as potential biomarkers for cancer diagnosis. Among TACAs, a great attention has been focused on mucin-1 (MUC1) *O*-glycan Tn neoantigen, and on anti-Tn monoclonal antibodies (mAbs).[3] The possiblility to replace the use of anti-Tn mAbs with a new class of Molecularly Imprinted Polymers (MIPs), as a diagnostic tools will be presented.

New poly-norepinephrine (PNE) based MIPs template were obtained using: a) monovalent TnThr mimetic **1** and *N*-acetylated natural TnThr **2** (as control) or b) mimetic **1** and native **2** conjugated to MUC1 hexapeptide domain AlaProAspThrArgPro (**Figure. 1**).

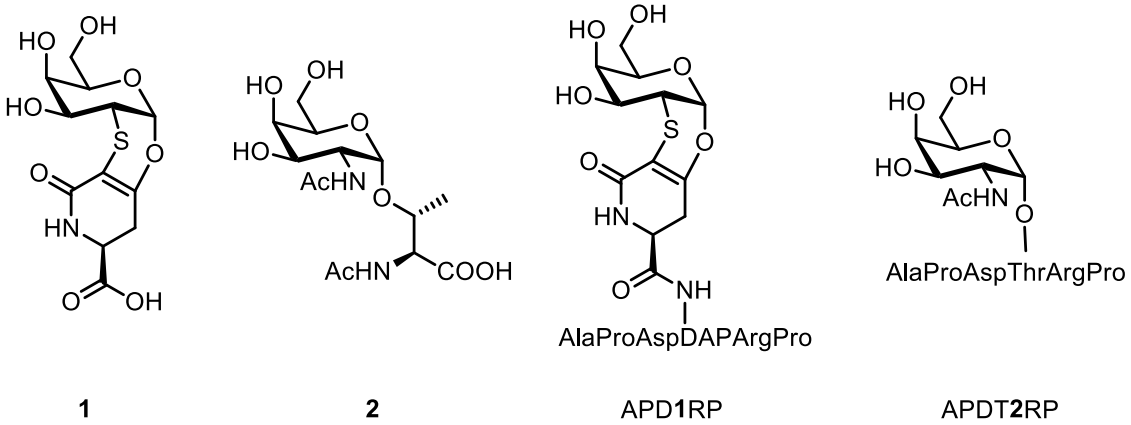


Figure 1. Structure of the TnThr mimetic 1, N-acetylated natural TnThr 2, hexapeptides AlaProAspDAP(1)ArgPro (APD1RP) and AlaProAspThr(2)ArgPro (APDT2RP).

1. J. D. Cohen, L. Li, Y. Wang, C. Thoburn, B. Afsari, L. Danilova, C. Douville, A. A. Javed, F. Wong, A. Mattox, et al., Science (80-.). **2018**, 359, 926–930.
2. J. Tkac, T. Bertok, M. Hires, E. Jane, L. Lorencova, P. Kasak, *Expert Rev. Proteomics* **2019**, *16*, 65–76.
3. A. Tsuchiya, M. Kanno, T. Kawaguchi, Y. Endo, G.-J. Zhang, T. Ohtake, I. Kimijima, *Breast Cancer* **1999**, *6*, 175–180.

C-GLUCOSYLATION TO INCREASE POLYPHENOL BIOACTIVITY, SELECTIVITY AND BIOAVAILABILITY

Amélia Pilar Rauter

Departamento de Química e Bioquímica, Centro de Química Estrutural, Institute of Molecular Sciences, Faculdade de Ciências, Universidade de Lisboa, 1749-016 Lisboa, Portugal
E-mail: aprauter@fc.ul.pt

The health benefits of natural polyphenols are well-known, namely the protection against cardiovascular and neurodegenerative diseases, diabetes and cancer.[1] Nonetheless these compounds have usually low bioavailability, thus preventing their clinical use. To overcome the polyphenol low bioavailability/high bioactivity paradox, we have investigated polyphenol *C*-glucosylation. We have found that this synthetic methodology is a chemical tool not only effective in increasing bioavailability but also in increasing bioactivity and selectivity. We illustrate now our findings through the *C*-glucosylation of polyphenol structures, starting with *C*-glucosyl dihydrochalcones, which inhibit sodium glucose co-transporter proteins (SGLTs), a very efficient strategy used in the clinic for the treatment of type 2 diabetes. These *C*-glucosides are highly selective for SGLT2 over SGLT1, which is critical for minimizing adverse side effects. Their bioactivity is 1000 times higher than that of their non-selective *O*-glucoside and aglycone analogues.

New neuroprotective treatments able to rescue neurons from cell injury to prevent neurodegenerative disease progression are, indeed, quite urgent. We have synthesized and explored a library of flavones and their *C*-glucosyl derivatives and discovered non-toxic *C*-glucosyl flavones fully rescuing human neuroblastoma cells against both hydrogen peroxide and β-amyloid (A_β**)** induced cell death.

In the absence of effective Alzheimer's disease treatments, the leading cause of dementia which affects 50-70% of dementia cases,[2] drug discovery to fight disease is indeed important. In this context, we have generated multitarget non-toxic *C*-glucosyl polyphenols blocking A_β-induced Fyn kinase activation and decreasing derived Tau hyperphosphorylation, with pharmacokinetic properties ideal for further developments.

In light of the finding that cellular prion protein (PrP^C) is a key player in Aβ oligomer(Aβo)-induced neurodegeneration, we investigated *C*-glucosyl flavones and aglycones against Aβ-promoted toxicity and their ability to disrupt PrP^C-Aβo interactions. Their synthesis, pharmacokinetic properties, water solubility and potential as protein-protein interaction inhibitors able to tackle PrP^C-Aβo will be presented and discussed.

By highlighting the multitarget nature of *C*-glucosyl polyphenols, their fine structural tuning capacity, and their high therapeutic potential in the context of metabolic (diabetes) and neurodegenerative disorders, we reveal the unique role of *C*-glycosylation for polyphenol health purposes, with the hope of inspiring further developments in the area.

1. Luca, S. V.; Macovei, I.; Bujor, A.; Miron, A.; Krystyna Skalicka-Wozniak, K.; Aprotosoaie, A. C.; Trifan, A.; *Crit Rev Food Sci Nutr.*, **2019**, 1-34.
2. Zhang, X. X.; Tian, Y.; Wang, Z. T.; Y. H. Ma; Tan, L.; Yu, J. T.; *J. Prev Alzheimers Dis.*, **2021**, *8*, 313-321.

PL-8

LECTINS FROM PATHOGENS: FROM STRUCTURE TO FUNCTION AND THEIR INHIBITION

Michaela Wimmerová

NCBR, Faculty of Science, Masaryk University, 61137, Brno, Czech Republic
CEITEC, Masaryk University, 62500, Brno, Czech Republic
Department of Biochemistry, Faculty of Science, Masaryk University, 62500, Brno, Czech Republic
E-mail: michaw@chemi.muni.cz

Lectins are carbohydrate-binding proteins of non-immune origin. Some of them participate in immune system processes but they are not products of primary immune response. Also, these proteins do not display catalytic activity towards their ligands. Microbial lectins can recognize carbohydrates on host cells (glycoproteins or glycolipids) and mediate adhesion to host cells or mucosal surfaces. Therefore, these proteins are significant virulence factors.

Our long-term aim is an identification, isolation and characterization of lectins from microbes, especially from pathogens including human pathogens associated with cystic fibrosis (*P. aeruginosa, B. cenocepacia, A. fumigatus*), animal (*M. canis*), plant (*R. solanacearum*) or insect pathogens (*Photorhabdus* spp.).

Although lectins may possess intriguing and useful properties, lectins from human pathogens are mainly studied for a purpose of *interfering* with their functions. Blocking of lectins with suitable inhibitors could prevent disease development or facilitate treatment. Our work therefore includes testing of carbohydrate-based inhibitors of lectins from human pathogens using different methodologies, ranging from simple yet robust (hem)agglutination assays to complex biophysical approaches (calorimetry, surface plasmon resonance biosensors, analytical ultracentrifugation) and testing on cell level.

As a demonstration of an importance of lectin research, several examples of lectins discovered and characterized in our group will be presented. Their structure, biological significance and potential utilization will be discussed.

Acknowledgement: This work is supported by Grant Agency of Czech Republic (GA21-29622S).

ENDO-LEVANASE OF *BACTEROIDES THETAIOTAOMICRON* AS SUITABLE CATALYST FOR BIOACTIVE FRUCTOOLIGOSACCHARIDES PRODUCTION

Triinu Visnapuu[a], Luiza Tolokonnikova[a], Karin Ernits[b], Wim Van den Ende[c], Tiina Alamäe[a]

[a]*Institute of Molecular and Cell Biology, University of Tartu, 51010, Tartu, Estonia*
[b]*Department of Experimental Medical Science, Lund University, 22184, Lund, Sweden*
[c]*Laboratory of Molecular Plant Biology, KU Leuven Plant Institute, KU Leuven, 3001, Leuven, Belgium*
E-mail: triinu.visnapuu@ut.ee

A bacterial β-2,6-linked polyfructan, levan, is a versatile biopolymer with various potential applications, e.g. gut microbiota modulator, cell-protecting and hydrating agent and as metal nanoparticle stabilizing and dispersing agent. Levan and respective levan-type fructooligosaccharides (L-FOS) are considered as candidate prebiotics with potential beneficial health effects to the host.[1-3] In addition, recently it was revealed that L-FOS mixture acts as protective agent for plants against grey mold[4] and could potentially be applied as immune system stimulator for variety of organisms.

L-FOS can be produced from a high-molecular levan with acid-assisted chemical hydrolysis or enzymatically by levanases and also synthesized by levansucrase from sucrose. Still, separation of the components from the mixtures with a high monosaccharide content is tedious.[3]

We have shown that the levanase BT1760 from a human gut commensal *Bacteroides thetaiotaomicron* efficiently degrades levan of bacterial and plant origin into L-FOS. Levan conversion to L-FOS with degree of polymerization 2–12 reached up to 91% at optimal reaction conditions.[5] The structure of the enzyme and the binding mode of levan to the active site has been characterized.[6] Enzymatically synthesized L-FOS were found to significantly diminish *Botrytis cinerea* infection on agronomically important plants when priming was applied.

We expressed the BT1760 endo-levanase with a lectin tag that binds to a commercial agarose resin enabling immobilization of the enzyme. The fusion enzyme was purified and further biochemically characterized. The tagged catalyst degraded levans into L-FOS with a high catalytic efficiency, maintaining activity and stability for longer times at 37°C. It was confirmed that the tag did not interfere with the catalysis. The immobilized catalyst was used in numerous consecutive cycles without significant decrease of L-FOS formation.

In conclusion, endo-levanase from *B. thetaiotaomicron* is a valuable tool to valorize levan by degrading it to prebiotic and plant-protective fructooligosaccharides.

1. Marx, S.P.; Winkler, S.; Hartmeier W. *FEMS Microbiol. Lett* **2000**, *182*, 163−9.
2. Visnapuu, T.; Mardo, K.; Alamäe, T. *New Biotechnol.* **2015**, 32, 597−605.
3. Adamberg, K.; Adamberg, S.; Ernits, K.; *et al*. *Anaerobe* **2018**, 52, 100−10.
4. Versluys, M.; Van den Ende, W. *Biomolecules* **2022**, 12, 370.
5. Mardo, K.; Visnapuu, T.; Vija, H.; Aasamets, A.; Viigand, K.; Alamäe, T. *PLOS ONE* **2017**, 12, e0169989.
6. Ernits, K.; Eek, P.; Lukk, T.; Visnapuu, T.; Alamäe, T. *Sci. Rep*. **2019**, 9, 8443.

BLOCK POLYSACCHARIDES

A. Solberg[a], M. Fauquignon[b], C. Schatz[b], B. E. Christensen[a]

[a]*NOBIPOL, Department of Biotechnology and Food Science, NTNU-Norwegian University of Science and Technology, Norway*
[b]*Laboratoire de Chimie des Polymères Organiques (LCPO), Université de Bordeaux, France*
E-mail: bjorn.e.christensen@ntnu.no

The conjugation at chain termini of two different polysaccharides provides diblock polysaccharides, a new class of precisely engineered polysaccharides. This architecture provides on one hand new solution and stimuli-responsive self-assembly properties, while retaining key properties such as biodegradability on the other.

The first part of the presentation will focus on the preparation of blocks through dioxyamine linkers. The second part will focus on diblocks containing Ca-reactive oligoguluronates (derived from alginates) and their Ca-induced self-assembly studied by static and dynamic light scattering, SANS and SAXS.

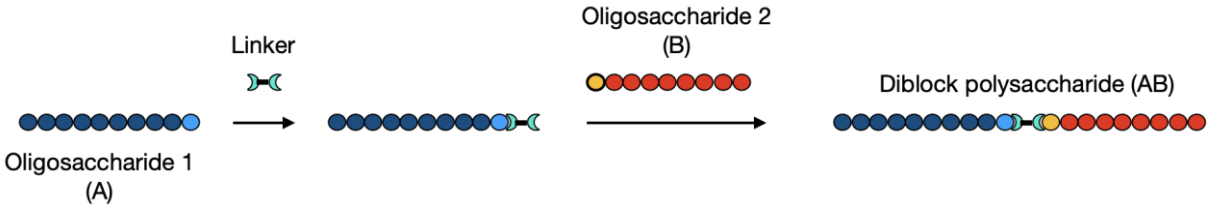


Figure 1.: General scheme for preparing diblock polysaccharides

FIRST SYNTHESIS OF *C*-GLYCOPYRANOSYL 1,2,4,5-TETRAZINES AND THEIR TRANSFORMATIONS IN IEDDA REACTIONS

Éva Bokor, Eszter Kardos, Dóra T. Kecskés, Alexandra Fehér, Ferenc Gombás, Zsófia Vonza, Akram Dabian, Eszter Szennyes, László Lázár, László Somsák

University of Debrecen, Department of Organic Chemistry, H-4032, Debrecen, Hungary
E-mail: bokor.eva@science.unideb.hu

1,2,4,5-Tetrazines are widely used as azadienes, whose [4+1] and [4+2] cycloadditions provide access to further N-heterocycles such as pyrazoles, 1,2,4-triazines and pyridazines.[1]

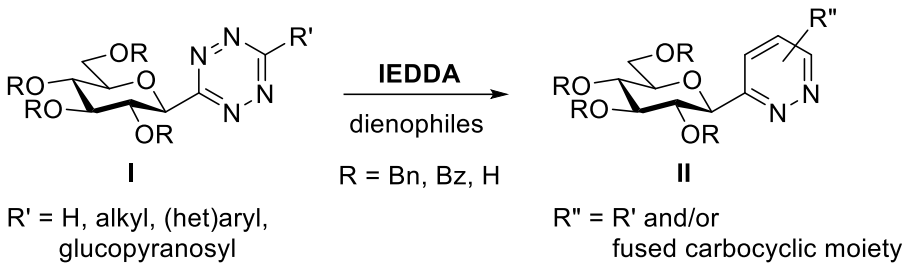
A special type of [4+2] cycloadditions, the strain-promoted variant of the inverse electron-demand Diels-Alder reactions (IEDDA) of 1,2,4,5-tetrazines has received the greatest attention in recent years. Such transformations have emerged as the most robust bioorthogonal reactions and appear to be reliable tools for labeling of biomolecules.[2]

Despite the growing interest in variously functionalized *s*-tetrazines, there is no example in the literature for the preparation of *C*-glycosyl-1,2,4,5-tetrazines. Therefore, we set out to investigate the possibilities for the synthesis of this hitherto unknown compound class.

The synthesis of a set 3-(β-D-glucopyranosyl)-5-substituted-1,2,4,5-tetrazines (Scheme 1, **I**) has already been carried out.

In addition, ring-transformations of **I** into 3-*C*-glucopyranosyl pyridazines **II**, also barely represented in the literature,[3] are under investigation.

This study also involves the IEDDA reactions of **I** with strained cyclic dienophiles, in order to test the potential use of *C*-glycosyl-1,2,4,5-tetrazines as sugar-based bioorthogonal labeling agents.



Scheme 1.

In the presentation the synthetic details of the aforementioned *C*-glucopyranosyl azines **I** and **II** will be reported.

1. Neunhoeffer, H. Tetrazines and Pentazines. In *Comprehensive Heterocyclic Chemistry*, Katritzky, A. R.; Rees, C. V., Eds. Pergamon: Oxford, **1984**; Vol. 3, pp 531-572.
2. Oliveira, B. L.; Guo, Z.; Bernardes, G. J. L. *Chem. Soc. Rev.* **2017**, 46, 4895-4950.
3. Kang, S. Y.; Song, K. S.; Lee, J.; Lee, S. H.; Lee, J. *Bioorg. Med. Chem.* **2010**, 18, 6069-6079.

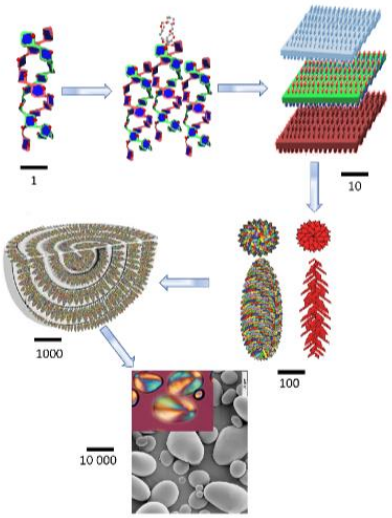
PL-9

THE ALGORITHMIC BEAUTY OF THE STARCH GRANULE

Serge Perez

CERMAV, CNRS, Univ. Grenoble Alpes, Grenoble, France
E-mail: Serge.perez@cermav.cnrs.fr /spsergeperez@gmail.com

The starch granule is Nature's favourite material to store energy in green plants over long periods. Irrespective of their botanical origin and their great diversity, it is remarkable that the internal structures of starch granules share universal features. Starches display distinct structural features that are the fingerprints of levels of organization over six orders of magnitude (1). Understanding such a puzzling organization has escaped all investigations taken from chemistry or biological approaches. We took a more physics-based approach to elucidate the general rules that govern the establishment of such organizations independent of the botanical origin. In doing so, we hypothesized that Nature retains hierarchical material structures at all levels and that some general rules control the morphogenesis of these structures.



We considered the occurrence of « phyllotaxis » like features that would develop at scales ranging from nano to micrometres and developed a novel geometric model capable of building complex structures from simple components. We applied it to elucidate one of the most intriguing and elusive structural elements: the 'blocklet". From the convergence between the experimental findings and the theoretical construction, we suggest that the « phyllotactic » model of the "blocklet" represents an amylopectin macromolecule with a high molecular weight. Our results offer a new vision to some previous models of starch. They clearly describe the levels of organization over four orders of magnitude of the starch granule (2) and illustrate the algorithmic beauty underlying the construction of the starch granule.

Figure. 1.: Starch: from granules to glucosyl units. The bar scale (in nm) is approximate to give an impression of the size dimensions. (Creative Common Attribution)

1. Perez, S., Bertoft, E., Starch-Stärke, 2010, 62, 389-420.
2. Spinozzi, F., et al., Sci. Rep., 2020, 10, 1-16.

PL-10

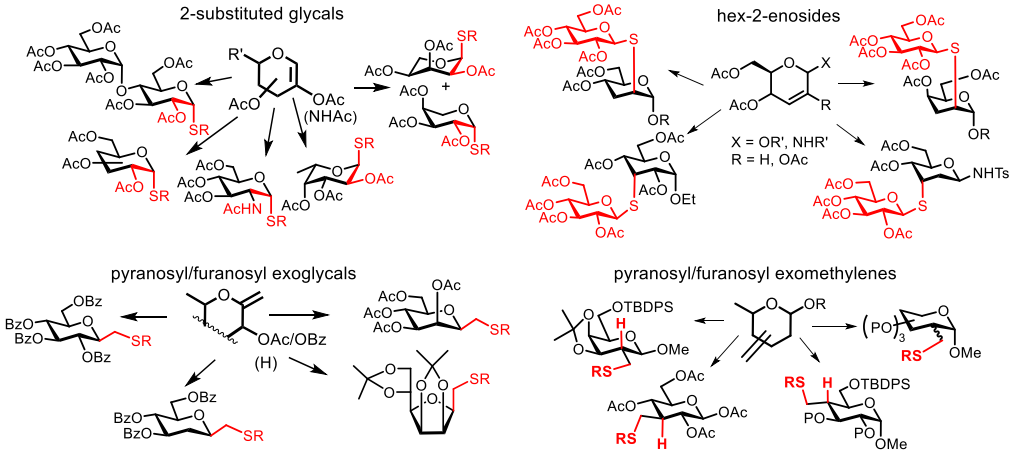
PHOTOINITIATED THIOL-ENE REACTIONS OF ENOSES – SCOPE AND LIMITATIONS

Anikó Borbás

Department of Pharmaceutical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary
E-mail: borbas.aniko@pharm.unideb.hu

The development of efficient strategies for the synthesis of stable analogs of biorelevant glycans and glycoconjugates for biomedical applications is a particularly important research area in carbohydrate chemistry.

We have shown that UV-induced radical-mediated addition of thiols to the endo- or exocyclic double bond of unsaturated sugars is a powerful tool for the stereoselective synthesis of a wide range of stable glycomimetics, including 1,2-cis-α-*S*-glycosides and new types of *C*-*S*-bridged glycoside analogs.[1-6]



Scheme 1. Examples for glycomimetics obtained by hydrothiolation of different glycals

We found that although the thiol-ene coupling of enoses is characterized by excellent or complete stereoselectivity, the reactions often proceed with low conversion. During our optimization studies, we observed that the temperature of the reaction plays a crucial role in the efficiency: heating inhibits, while cooling promotes the thiol-ene coupling reaction of enoses.

In my presentation, I will discuss the unique temperature dependence of the reaction, as well as analyze how the structure of the enoses, the nature of the thiols, the method of initiation, and the solvent affect the efficiency of the hydrothiolation reactions of unsaturated sugars.

1. L. Lázár, M. Csávás, M. Herczeg, P. Herczegh, A. Borbás, *Org. Lett*. **2012**, *14*, 4650−4653.
2. L. Lázár *et*. al., *Org. Biomol. Chem*. **2013**, *11*, 5339−5350.
3. V. Kelemen *et* al., *Chem. Asian. J*. **2020**, *15*, 876 –891.
4. M. Csávás, *et* al., *Int. J. Mol. Sci.* **2020**, *21*, 573
5. D. Eszenyi *et* al., *Chem. Eur. J*. **2018**, *24*, 4532-4536.
6. V. Kelemen *et* al., *Chem. Eur. J*. **2019**, *25*, 14477-14477.

CATALYST-FREE COUPLING REACTIONS OF ANHYDRO-ALDOSE TOSYLHYDRAZONES WITH 1,2,3-1*H*-TRIAZOLES AND 5-BENZYL-2*H*-TETRAZOLES: SYNTHESIS OF *C*-(β-D-GLYCOPYRANOSYL)METHYL-TRIAZOLES AND -TETRAZOLES

Bence Szakács, Tímea Kaszás, Éva Juhász-Tóth, Ivett Cservenyák, Tamara Kovács, István Timári, László Juhász, László Somsák, Marietta Tóth

Department of Organic Chemistry, University of Debrecen, Debrecen, Hungary
E-mail: szakacs.bence@science.unideb.hu

In the past ~15 years *N*-tosylhydrazones emerged as partners in metal-catalyzed and in metal-free coupling reactions. *N*-tosylhydrazones are readily available and stable compounds, from which carbenes *in situ* can be generated.[1,2] On contrary, anhydro-aldose tosylhydrazones **1** are not so easy to access, but our research group has elaborated an easy synthetic route to get such type of compounds.[3]

Based on these preliminaries we have started an intensive, systematic investigation of the application of anhydro-aldose tosylhydrazones **1**[3] in coupling reactions. In these reactions carbon-carbon[4-6] and carbon-heteroatom bonds[7-9] such as C-N bonds with 5-subtituted tetrazoles were formed[9]. These C-N coupling reactions have been extended to 2*H*-1,2,3-triazoles and 5-benzyl-2*H*-tetrazoles to form biologically active, potential SGLT and galectin inhibitors. In this presentation we disclose our results.

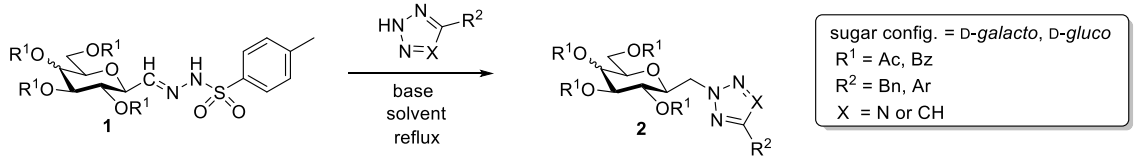


Figure 1. Catalyst-free coupling of anhydro-aldose tosylhydrazones with 2*H*-1,2,3-triazoles and 5-benzyl-2*H*-tetrazoles

1. Qiu, D.; Mo, F.; Zhang, Y.; Wang, J. in *Advances in Organometallic Chemistry* (Ed: P.J. Pérez), Academic Press: Cambridge, MA, USA, **2017**, *Vol. 67*, pp. 151–219.
2. Wang, H.; Deng, Y.-H.; Shao, Z. *Synthesis* **2018**, *50*, 2281–2306.
3. Tóth, M.; E. Kövér, K.; Bényei, A.; Somsák, L. *Org. Biomol. Chem*. **2003**, *1*, 4039–4046.
4. Kaszás, T.; Ivanov, A.; Tóth, M.; Ehlers, P.; Langer, P.; Somsák, L. *Carbohydr. Res.* **2018**, *466*, 30–38.
5. Kaszás, T.; Tóth, M.; Langer, P.; Somsák, L. *Adv. Synth. Catal.* **2019**, *361*, 105–117.
6. Kaszás, T.; Baráth, B. Á.; Balázs, B.; Blága, T.; Juhász, L.; Somsák, L.; Tóth, M. *Molecules* **2022**, *27*, 1795–1827.
7. Kaszás, T.; Tóth, M.; Kun, S.; Somsák, L. *RSC Adv.* **2017**, *7*, 10454–10462.
8. Kaszás, T.; Tóth, M.; Somsák, L. *New J. Chem.* **2017**, *41*, 13871–13880.
9. Kaszás, T.; Cservenyák, I.; Juhász-Tóth, É.; Kulcsár, A. E.; Granatino, P.; Nilsson, U. J.; Somsák, L.; Tóth, M. *Org. Biomol. Chem.* **2021**, *19*, 605–618.

Acknowledgement: The research was supported by the National Research, Development and Innovation Office under the project FK128766 and the ÚNKP-21-3-I-DE-424 New National Excellence Program of the Ministry for Innovation and Technology from the Source of the National Research, Development and Innovation Fund.

PL-11

LECTINS FROM PATHOGENS: FROM STRUCTURAL GLYCOBIOLOGY TO ANTIADHESIVE STRATEGIES

Anne Imberty

CERMAV, CNRS, Univ. Grenoble Alpes, Grenoble, France
E-mail: anne.imberty@cermav.cnrs.fr

A large number of pathogenic microorganisms display receptors for specific recognition and adhesion to the glycoconjugates present on human tissues. In addition to membrane-bound adhesins, soluble lectins are involved in lung infections caused by the bacteria *Pseudomonas aeruginosa* and *Burkholderia cepacia* and by the fungus *Aspergillus fumigatus* that are responsible for hospital-acquired diseases. The multivalency of lectin is proposed to play a role in their strong avidity for glycosylated cell surfaces, their specific binding to targeted human tissues, and also in their ability to affect membrane dynamics by clustering glycosphingolipids, resulting in some cases in internalization of intracellular pathogens.

Accumulated knowledge about the structures of the lectins and the interactions with host glycoconjugates has led to the design of powerful glyco-derived inhibitors that can serve as antimicrobial therapeutic agents, as a complement to or an alternative to antibiotic therapy. Several strategies are developed with development of glycoderivatives and/or multivalent glycostructures. The structural role of calcium present in the binding site of fucose and galactose specific lectins has been investigated through x-ray and neutron crystallography.[1] Novel inhibition strategy with non-carbohydrate glycomimetics is now proposed.[1]

1. Gajdos, L.; Blakeley, M.P.; Haertlein, M.; Forsyth, V. T.; Devos, J. M.: Imberty, A. *Nature Comm.* **2022,** *13*, 194.
2. Kuhaudomlar, S.; Siebs, E.; Shanina, E.; Topin, J.; Joachim, I.; da Silva Figueiredo Celestino Gomes, P.; Varrot, A.; Rognan, D.; Rademacher, C.; Imberty, A.; Titz, A.; *Angew. Chem. Int. Ed.* **2021,** *60*, 2-13.

PL-12

SYNTHETIC GLYCO-TOOLS FOR EXPLORING AND EXPLOITING THE GLYCOME

M. Carmen Galan

School of Chemistry, Cantock's Close, University of Bristol, Bristol BS8 1TS., United Kingdom
E-mail: m.c.galan@bris.ac.uk

The stereoselective synthesis of glycosides remains one of the biggest challenges in carbohydrate chemistry.[1] The chemical synthesis of complex carbohydrates generally involves the coupling of a fully protected glycosyl donor bearing a leaving group at its anomeric centre, with a suitably protected glycosyl acceptor (R-OH). In many instances, these reactions lead to a mixture of two stereoisomers.

Towards this goal, our group has endeavoured to develop catalytic and stereoselective methods to address this important synthetic challenge.[2] Recent years have seen a steady increase in the application of transition metal catalysis applied to oligosaccharide synthesis,[3] since the reaction conditions are mild and the careful choice of catalyst can offer significant improvements over traditional methods in terms of atom economy, high yields and control of anomeric selectivity.

Herein, we will discuss the application of transition metal catalysis in the stereoselective synthesis of deoxy glycosides, including the α,α-stereoselective synthesis of trehalose derivates and their application as probes of mycobacterium tuberculosis (*Mtb)* detection. Moreover, I will also disclose the development of imidazolium-based labels and their applications to expedite oligosaccharide synthesis and in glycobiology.[4]

1. R. Williams and M. C. Galan, *Eur. J. Org. Chem.* **2017**, 6247
2. C. S. Bennett; M. C. Galan, *Chem. Rev.*, **2018**, *118***,** 7931–7985.
3. a) A. Sau and M. C. Galan, *Org. Lett.*,**2017**, 19, 2857; b) A. Sau, R. Williams, C. Palo-Nieto, A. Franconetti, S. Medina and M. C. Galan, *Angew. Chem. Int. Ed.*, **2017**, 56, 640; c) C. Palo-Nieto, A. Sau and M. C. Galan, *J. Am. Chem. Soc.* **2017**, 139, 14041; d) C. Palo-Nieto, A. Sau, R. Jeanneret, P.-A. Payard, M. Braga Martins-Teixeira, I. Carvalho and L. Grimaud M. C. Galan, *Org. Lett*. **2020**, 22, 5, 1991-1996.
4. a) K. Huang, M.C. Galan, W. B. Turnbull, F. Parmeggiani and S. L. Flitsch *et al. Org. Biomol. Chem.*, **2020**, 18, 3142 – 3148 and *Org. Biomol. Chem.* **2019**, 17, 5920-5924; b) M. Ghirardello, R. Shyam and M. C. Galan, *Chem. Commun*. **2022**, 58, 5522-5525.

STRUCTURAL OPTIMIZATION OF GLYCOCONJUGATES AS INHIBITORS OF FUNGAL ADHESION

Trinidad Velasco-Torrijos[a,b]

[a]*Chemistry Department, Maynooth University, Maynooth, Co. Kildare, Ireland*
[b]*The Kathleen Lonsdale Institute for Human Health Research, Maynooth University*
E-mail: trinidad.velascotorrijos@mu.ie

Chronic fungal infections affect over 150 million individuals. These infections can have a huge impact on people's lives and, in certain circumstances, can also be fatal. The yeast *C albicans*. is an opportunistic fungal pathogen which induces superficial and systemic infections in immunocompromised patients. Adherence to host tissue is critical to its ability to colonise and infect the host. We have evaluated anti-adhesion glycomimetics grafted onto several multivalent scaffolds as inhibitors of *C. albicans* adherence to buccal epithelial cells (BECs, **Figure 1.**), The results showed that scaffold valency and structure strongly influence anti-adhesion activity, with the best performing glycoconjugate capable of inhibiting over 60% of yeast adhesion to the BECs. We then proceeded to explore multivalent presentations of the lead compound, along with Structural-Activity Relationship studies to identify structural features for optimal antifungal activity.

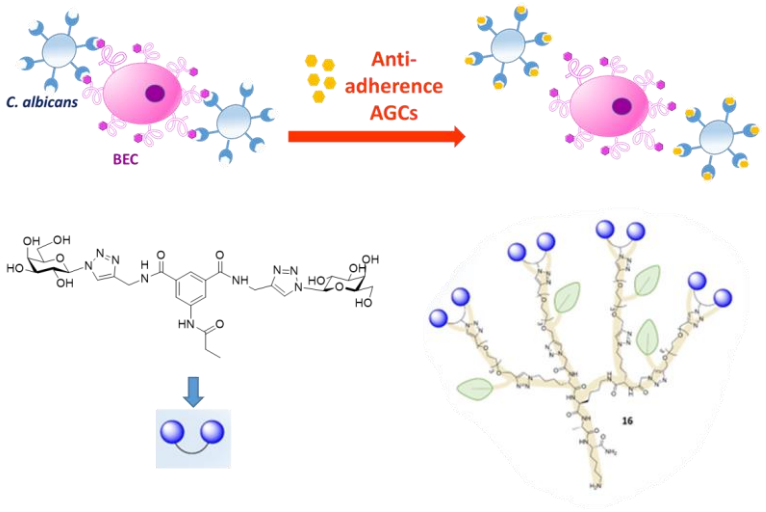


Figure 1.: Schematic representation of glycomimetics as inhibitors of fungal adhesion.

1. Martin H; Kavanagh K; Velasco-Torrijos T; (2021) Future Med. Chem. 13: 313-334.
2. Martin H; Mc Govern M; Abbey L; Gilroy A; Mullins S; Howell S; Kavanagh K; Velasco-Torrijos T; (2018) Eur. J. Med. Chem. 160: 82-93.
3. Martin H; Goyard D; Margalit A; Doherty K; Renaudet O; Kavanagh K; Velasco-Torrijos T; (2021) Bioconjugate Chem. 32: 971-982. DOI: 10.1021/acs.bioconjchem.1c00115
4. Martin H; Masterson H; Kavanagh K; Velasco-Torrijos T; (2021) Pathogens 10: 572.

OL-11

ANTIBACTERIAL ACTIVITY OF CHITOSAN-SILVER NANOCOMPOSITES

Kaja Kasemets[a], Jüri Laanoja[a,b], Anne Kahru[a]

[a]*National Institute of Chemical Physics and Biophysics, 12618, Tallinn, Estonia*
[b]*Tallinn University of Technology, 19086, Tallinn, Estonia*
E-mail: kaja.kasemets@kbfi.ee

Hospital-acquired infections and the development of antimicrobial resistance (AMR) have become challenging medical problems worldwide. Novel compounds for the treatment of infections, especially those caused by AMR microbes are urgently needed.

Nanotechnology holds great promise for the design of novel effective antimicrobials for biomedical applications. Silver, copper and zinc oxide nanoparticles are effective against pathogenic bacteria and yeasts and could be promising for medical use.[1]

Combining the antimicrobial nanoparticles with biologically active polymers, e.g. chitosan, may enhance their efficacy and specificity. Chitosan is a biocompatible, biodegradable, antimicrobial and immune-modulating polymer and is already used for wound treatments. Crosslinking of chitosan with antimicrobial nanoparticles can be a promising design for novel antimicrobials having both biocidal and immune-modulating effects.

In this study, silver-chitosan nanocomposites (nAgCS) were synthesized reducing silver nitrate by trisodium citrate. The low molecular weight chitosan (50–190 kDa, Sigma Aldrich) was used and the silver-chitosan weight ratio in the nanocomposites was 1:0.3, 1:1 and 1:3. The antibacterial activity was assessed against medically important pathogenic model bacteria *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* using a cell viability test (Spot test) where the exposure to nAgCS was performed in deionized water.[2] Particle-cell interactions were evaluated by the flow-cytometer and laser-scanning confocal microscopy (CLSM).

Results showed that the nAgCS with a weight ratio of 1:3 were most effective against the studied bacteria acting already at 0.08, 0.31 and 0.50 mg Ag/L levels to *E. coli*, *P. aeruginosa* and *S. aureus*, respectively. Flow cytometer and CLSM studies revealed the attachment of the nAgCS onto the surface of all the studied bacteria.

1. Bondarenko, O.; Juganson, K.; Ivask, A.; Kasemets, K.; Mortimer, M. and Kahru, A. Toxicity of Ag, CuO and ZnO nanoparticles to selected environmentally relevant test organisms and mammalian cells in vitro: a critical review. *Archives of Toxicology* **2013**, 87, 1181–1200.
2. Suppi S.; Kasemets K.; Ivask A.; Künnis-Beres K.; Sihtmäe M.; Kurvet I.: Aruoja V.: Kahru A. A novel method for comparison of biocidal properties of nanomaterials to bacteria, yeasts and algae. *Journal of Hazardous Materials* **2016**, 286, 75−84.

Acknowledgement: This work was supported by the Estonian Research Council project PRG749 and ERDF projects NAMUR+ and TK-134.

PL-13

BIOPHYSICAL ASPECTS OF GLYCOMIMETIC-PROTEIN INTERACTIONS

Ulf J. Nilsson

Department of Chemistry, Lund University, Lund, Sweden
Galecto Biotech, Gothenburg, Sweden
E-mail: ulf.nilsson@chem.lu.se

Glycan-recognizing proteins are receiving increasing attention as drug targets as they play key roles in many pathological processes. However, these proteins often display shallow and polyamphiphilic binding sites and natural ligands and initial leads often show comparatively weak affinity. Hence, glycomimetic drug design remains an inspiring challenge for medicinal chemists.

Galectins are glycoconjugate-binding proteins that bind galactose-containing glycans to affect *e.g.* glycoprotein trafficking and localization, which in turn may influence glycoprotein functions in *e.g.* inflammatory processes and tumor immune evasion.[1] This has fueled an increasing interest in developing galectin inhibitors. Parallel to efforts towards discovery and development of galectin-inhibiting compounds,[2,3] studies aiming at improved understanding of biophysical aspects of protein-glycomimetic interactions[4,5] are imperative for accelerating glycomimetic discovery. Here, we present recent studies on galectin-glycomimetic interactions with emphasis on entropy-entropy compensation and halogen bond-solvation thermodynamics.

1. Johannes, L., Jacob, R. & Leffler, H., *J. Cell. Sci.* **131**, doi:10.1242/jcs.208884 (2018).
2. Delaine, T. *et al. ChemBioChem* **17**, 1759-1770, doi:10.1002/cbic.201600285 (2016).
3. Zetterberg, F. R. *et al. ChemMedChem* **27**, 133-137, doi/10.1002/cmdc.201700744 (2018).
4. Verteramo, M. L. *et al*. *J. Am. Chem. Soc.* **141**, 2012-2026, doi/10.1021/jacs.8b11099 (2019).
5. Wallerstein, J. *et al. JACS Au* **1**, 484-500, doi:10.1021/jacsau.0c00094 (2021).

OL-12

UNLOCKING THE FINE SPECIFICITY OF THE ENIGMATIC IMMUNOMODULATORY HUMAN MACROPHAGE GALACTOSE C-TYPE LECTIN

AnaAna Diniz[a], Carlos D. L. Lima[a], Helena Coelho[a], Jorge S. Dias[a], Marta G. Lete[d], Ulrika Westerlind[c], Eurico J. Cabrita[a], Jesús Jiménez-Barbero[d], F. Javier Cañada[e], Francisco Corzana[b], Filipa Marcelo[a]

[a]*UCIBIO, Associate Laboratory i4HB, Department of Chemistry, NOVA School of Science and Technology, 2829-516 Caparica, Portugal*
[b]*Departamento de Química, Centro de Investigación en Síntesis Química, Universidad de La Rioja, E-26006 Logroño Spain*
[c]*Department of Chemistry, Umeå University, 901 87 Umeå, Sweden*
[d]*CIC bioGUNE, Basque Research and Technology Alliance, 48170 Derio, Spain*
[e]*Centro de Investigaciones Biológicas Margarita Salas, CSIC, Ramiro de Maetzu 9, 28040 Madrid, Spain*
E-mail: filipa.marcelo@fct.unl.pt

Glycans have an important role on immune modulation.[1] The human macrophage galactose C-type lectin (MGL) is the only C-type lectin present on immune cells with a marked sugar specificity for N-acetylgalactosamine (α- or β-GalNAc) [2]. MGL recognizes GalNAc containing structures that can be present in pathogens, self-glycoproteins, and tumour cells, which makes of MGL a modulator of distinct immune cell responses. Herein, our latest advances in unlocking the structural and dynamic features behind the fine specificity and recognition of MGL will be described.

By following an integrative and multidisciplinary approach, which combines glycopeptide synthesis and molecular biology protocols, with biophysical and structural techniques with special focus on nuclear magnetic resonance spectroscopy (NMR), we revealed that the structure of the carbohydrate recognition domain (CRD) of MGL is highly dynamic and is strongly dependent of the structure and presentation of the precise GalNAc-containing antigen [3-5]. This plasticity of MGL-CRD perfectly agrees with the ability of MGL-CRD to accommodate different GalNAc-containing ligands and might explain the capacity of MGL to produce distinct immune responses (tolerance vs immunity) depending on the nature of the GalNAc-containing structure. Furthermore, the molecular recognition of distinct mucin-1 tumour-associated carbohydrate antigens, common in several tumours, by MGL was also investigated, and our data also pinpoints the ability of MGL to discriminate different tumour-associated antigens.

1. Baum L. G.; Cobb A., *Glycobiology*, **2017**, *27*, 619-624.
2. Marcelo F. *et* al., *J. Biol. Chem.*, **2019**, *294*, 1300-1311.
3. Diniz A. *et* al., *Chem. Eur. J.*, **2019**, *25*, 13945-13955.
4. Gabba A.*et* al., *Biochemistry* **2020**, *60*, 1327-1336.
5. Lima C. D. L., *et* al., *Chem. Eur. J.* **2021**, *29*, 7951-7958.

Acknowledgement: The authors acknowledge FCT-Portugal for funding projects: IF/00780/2015, PTDC/QUI-OUT/2586/2020, UCIBIO project UIDP/04378/2020 and UIDB/04378/2020 and Associate Laboratory Institute for Health and Bioeconomy - i4HB project LA/P/0140/2020). FM and H.C. thanks FCT for the CEEC contract 2020.00233.CEECIND and 2020.03261.CEECIND, respectively. A.D. acknowledges the PhD grant PD/BD/142847/2018 under the PTNMRPhD Program (PD00065/2013). The NMR spectrometers are part of the National NMR Facility supported by FCT-Portugal (ROTEIRO/0031/2013- PINFRA/22161/2016, cofinanced by FEDER through COMPETE 2020, POCI and PORL and FCT through PIDDAC). F.M. and J.J.B. acknowledge the COST Action GLYCONanoProbes (CA18132).

PREPARATION OF HETEROCYCLIC GLUCOSAMINE DERIVATIVES AND THEIR HALF-SANDWICH PLATINUM-GROUP METAL COMPLEXES

István Kacsir[a], Adrienn Sipos[b], Péter Buglyó[c], Péter Bai[b], László Somsák[a], Éva Bokor[a]

[a]*Department of Organic Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
[b]*Department of Medical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
[c]*Department of Inorganic and Analytical Chemistry, University of Debrecen, H-4032, Debrecen, Hungary*
E-mail: kacsir.istvan@science.unideb.hu, bokor.eva@science.unideb.hu

The square planar platinum(II) complexes, such as cisplatin, oxaliplatin and carboplatin are common chemotherapeutics worldwide.[1] However, because of their insufficient selectivity towards tumor cells[1] there is a continuing effort to find other metal complex-based drug candidates with better anticancer properties. In this direction, the half-sandwich type complexes of other platinum-group metal ions (e.g. Ru(II), Os(II), Ir(III) and Rh(III)) have recieved a great attention in recent years.[2]

We have recently synthesized a series of half-sandwich complexes of the above metal ions with β-D-glycopyranosyl azole type *N,N*-bidentate ligands (Figure 1, **I**), some of which (e.g. **II**) displayed (sub)micromolar cytostatic activity against different cancer cells[3,4] and also showed antibacterial effect against multiresistant Gram positive bacteria.[5]

As a continuation of our studies, the syntheses of new glucosaminyl heterocycles and their incorporation as *N,N*-chelators into the coordination sphere of such organometallics were envisaged (**III**).

In the presentation the synthetic details of the new glycosyl heterocycles and their complexes as well as the biological results will be reported.

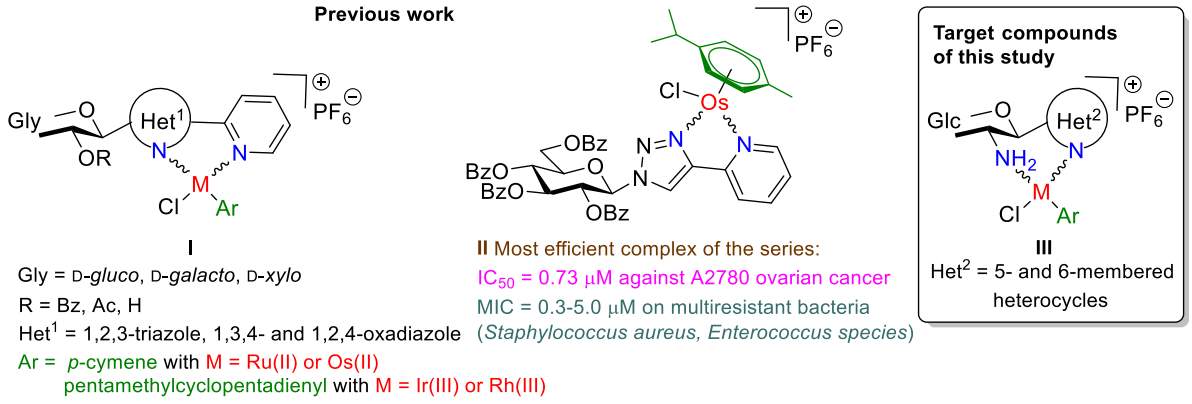


Figure 1.

1. Kenny, R. G.; Marmion, C. J. *Chem. Rev.* **2019**, *119*, 1058-1137.
2. Štarha, P.; Trávníček, Z. *Coord. Chem. Rev.* **2019**, *395*, 130-145.
3. Kacsir, I.; Sipos, A.; Ujlaki, G.; Buglyó, P.; Somsák, L.; Bai, P.; Bokor, É. *Int. J. Mol. Sci.* **2021**, *22*, 454.
4. Kacsir, I.; Sipos, A.; Bényei, A.; Janka, E.; Buglyó, P.; Somsák, L.; Bai, P.; Bokor, É. *Int. J. Mol. Sci.* **2022**, *23*, 813.
5. Balázs, B.; Tóth, Z.; Kacsir, I.; Sipos, A.; Buglyó, P.; Somsák, L.; Bokor, É.; Kardos, G.; Bai, P. *Front. Chem.* **2022,** *10*, 868234.

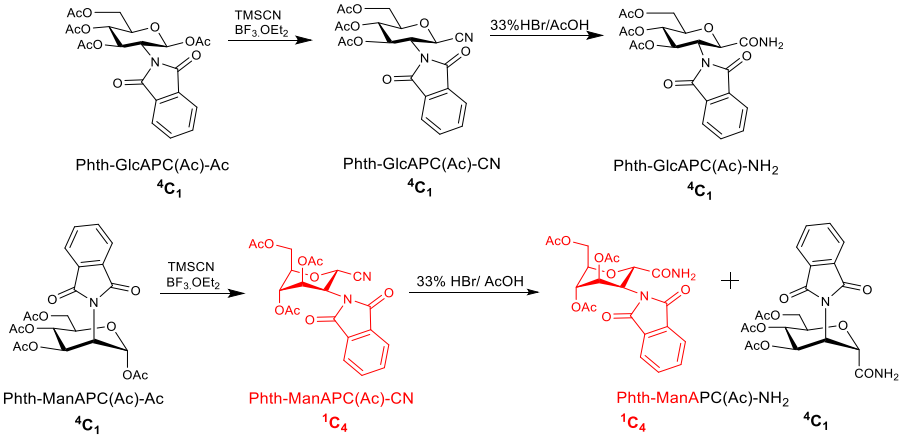
OL-14

CONFORMER IDENTIFICATION *VIA* CYCLIC ION MOBILITY MASS SPECTROMETRY: HEXOSAMINE EPIMERS ASSIGNED ULTRA-STABILE RING STRUCTURES

Viktória Goldschmidt Gőz[a], István Varga[b,c], Imre Jákli[a], Zsolt Dürvanger[b,c], Veronika Harmat[a,c], István Pintér[c], Gitta Schlosser[d] and András Perczel[a,c]

[a]*MTA-ELTE Protein Modeling Research Group, Eötvös Loránd Research Network, H-1117 Budapest, Hungary*
[b]*Hevesy György PhD School of Chemistry, Institute of Chemistry, Eötvös Loránd University, H-1117 Budapest, Hungary*
[c]*Laboratory of Structural Chemistry and Biology, Institute of Chemistry, Eötvös Loránd University, H-1117 Budapest, Hungary*
[d]*MTA-ELTE Lendület Ion Mobility Mass Spectrometry Research Group, ELTE Eötvös Loránd University, H-1117 Budapest, Hungary*
E-mail: viktoria.goz@ttk.elte.hu, andras.perczel@ttk.elte.hu,

Fast and accurate characterization of the ring conformers of carbohydrates in oligosaccharides, glycoproteins, foldamers and other sugar-containing molecules remains a challenge.[1] A state-of-the-art, fine-tuned, cyclic ion mobility mass spectrometry[2] method is presented, to determine ring conformers of sugar moieties, in µg-ng scale, without purification. $^4C_1$ and $^1C_4$ ring conformers of D-glucosamine and D-mannosamine derivatives - nitriles,[3] amides and carboxylic acids- some of unusual thermodynamic stabilities were characterized and used as reference for cyclic-IM experiments, based on their collisional cross section differences: Δ*CCS*. The comprehensive analysis shows that DFT based predicted CCS values allow for the assignment of $^1C_4/^4C_1$ ring conformers *via* multipass cyclic-IM-MS experiments even without isolating rotamers, conformers or isomers. Thus, sugar ring conformers can now be identified in natural products, carbohydrate decorated epitopes or proteins, antibodies *etc.* with confidence.



1. Pronker, M. F. etc. *Nat. Commun.* **2016**, *7*, 13584
2. Giles, K. etc. *Anal. Chem.* **2019**, *91*,8564-8573.
3. Myers, R. W.; Lee, Y. C. *Carbohydr. Res.* **1986**, *152*, 143-158.

OL-15

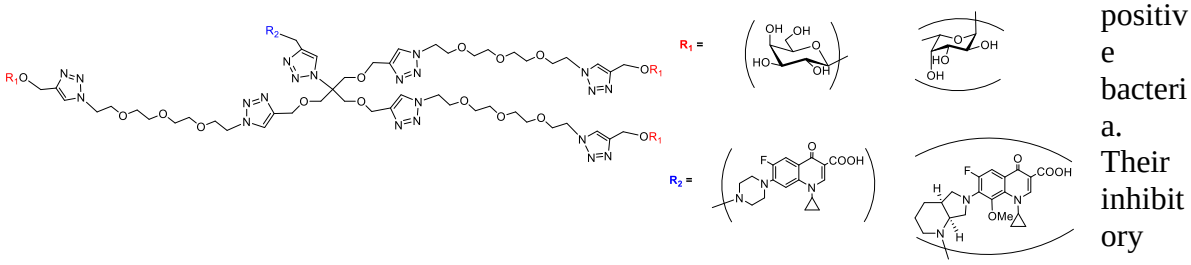
SYNTHESIS OF GLYCOCONJUGATES AND FLUOROQUINOLONE CARBOXYLIC ACID PRESENTING CHIMERAS

Son Thai Le[a], Lenka Malinovská[b], Michaela Wimmerová[b], Eszter Ostorházi[c], Anikó Borbás[a], Pál Herczegh[a], Magdolna Csávás[d]

[a]*Department of Pharmaceutical Chemistry, University of Debrecen, H-4032, Debrecen, Hungary*
[b]*Central European Institute of Technology, Masaryk University, 625 00, Brno, Czech Republic*
[c]*Department of Medical Microbiology, Semmelweis University, H-1085, Budapest, Hungary*
[d]*Molecular Recognition and Interaction Research Group, Eötvös Loránd Research Network, H-4032, Debrecen, Hungary*
E-mail: le.thai.son@pharm.unideb.hu

Antibiotic resistance is a global health-concerned problem with increasing number of deaths every year. In order to tackle this problem, we proposed chimeric strategy which provides an effective tool against multi-drug resistant bacteria. Herewith, we report the synthesis of carbohydrate-antibiotic chimeras: α-L-fucopyranoside- and β-D-galactopyranoside-containing trivalent glycoclusters coupled with fluoroquinolone carboxylic acid derivatives were synthesized. Functionalized Tris was chosen as multivalent scaffold, and the glycoclusters were built by coupling tetraethylene-glycol bridges with peracetylated propargyl α-L-fucosides or β-D-galactosides using Cu(I)-catalysed azide-alkyne cycloaddition. Ciprofloxacin and moxifloxacin were converted into propargyl-moieties and coupled to the glycoclusters.

The antibacterial properties were investigated on a panel of Gram-negative and Gram-positive bacteria. Their inhibitory potential against fucose-specific *Pseudomonas aeruginosa* lectin II (PA-IIL) was also tested and the possibility of utilization of chimeric compounds in treatment of *Pseudomonas aeruginosa* infections was discussed.



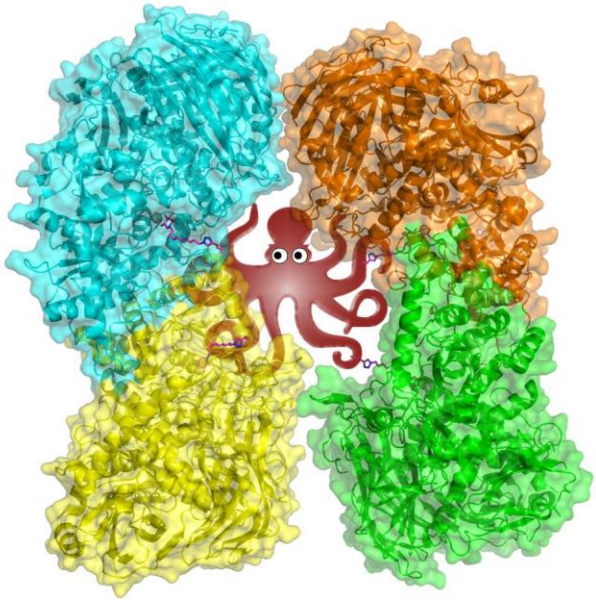
PL-14

EXPLORING THE LIMITS OF THE INHIBITORY MULTIVALENT EFFECT

Philippe Compain

Equipe de Synthèse Organique et Molécules Bioactives (SYBIO), Univ. de Strasbourg | CNRS | LIMA (UMR 7042), ECPM, 67087 Strasbourg, France
E-mail: philippe.compain@unistra.fr

The field of multimeric glycosidase inhibitors has experienced a major take-off in the last decade[1] with the disclosing of impressive valency-corrected multivalent effects exceeding three orders of magnitude,[2] and even four orders of magnitude for polymeric inhibitors.[3] Given the importance of glycosidase inhibition in biology, these results not only open a new field of research but also further highlight the interest of multivalent design.



Intensive studies have been pursued to understand how glycosidases and multimeric inhibitors interact to provide outstanding affinity enhancements. A number of binding models have been proposed and involved large aggregates, discrete cross-linked complexes or higher local concentration effects favoring bind-and-recapture of the cluster's reversible inhibitor heads.[1,4] Our efforts towards the optimization and rationalization of the multivalent inhibitory effect will be presented and discussed.

1. For a recent review see: Compain, P. *Chem. Rec*. **2020,** *20*, 10–22.
2. Lepage, M. L. ; Schneider, J. P. ; Bodlenner, A.; Meli, A.; De Riccardis, F.; Schmitt, M.; Tarnus, C.; Nguyen-Huynh, N.-T.; Francois, Y.-N.; Leize-Wagner, E.; Birck, C.; Cousido-Siah, A.; Podjarny, A.; Izzo, I.; Compain, P. *Chem. Eur. J.* **2016**, *22*, 5151–5155.
3. Assailly, C.; Bridot, C.; Saumonneau, A.; Lottin, P.; Roubinet, B.; Krammer, E.-M.; François, F.; Vena, F.; Landemarre, L.; Alvarez Dorta, D.; Deniaud, D.; Grandjean, C.; Tellier, C.; Pascual, S.; Montembault, V.; Fontaine, L.; Daligault, F.; Bouckaert, J.; Gouin, S. G. *Chem. Eur. J.* **2021**, *27*, 3142–3150.
4. Howard, E.; Cousido-Siah, A.; Lepage, M. L.; Schneider, J. P.; Bodlenner, A.; Mitschler, A.; Meli, A.; Izzo, I.; Alvarez, A.; Podjarny, A.; Compain, P. *Angew.Chem. Int. Ed.* **2018**, *57*, 8002 –8006.

PL-15

GLYCOMIMETICS: USEFUL TOOLS AND POTENTIAL THERAPEUTICS

Tanja M. Wrodnigg

Institute of Chemistry and Technology of Biobased Systems, Graz University of Technology, 8010 Graz, Austria
E-mail: t.wrodnigg@tugraz.ar

Glycomimetics are modified carbohydrate structures which have altered physical and/or biological properties, compared to their corresponding parent compounds, due to respective modifications. The modifications can be tailored towards certain biological, medicinal or technological applications. Paradigmatic examples are Tamiflu®, Miglustat or AZT.

We are interested in glycomimetic structures such as iminoalditols **1** and **2**,[1] carbacycles **3**[2] and *C*-glycosyl type glycoconjugates **4**[3] as well as C-glycosides **5**.[4] These glycomimetics we apply as inhibitors for glycoprocessing enzymes, as pharmacological chaperone for the treatment of lysosomal storage diseases, as ligands for *manno*-spezific lectins such as FimH of 1-fimbriated bacteria and as probes for ligand directed chemistry profiling of glycoprocessing enzymes. Recently, we became also interested in synthesising polysaccharidic glycomimetics by modification of polysaccharides such as cellulose.[5]

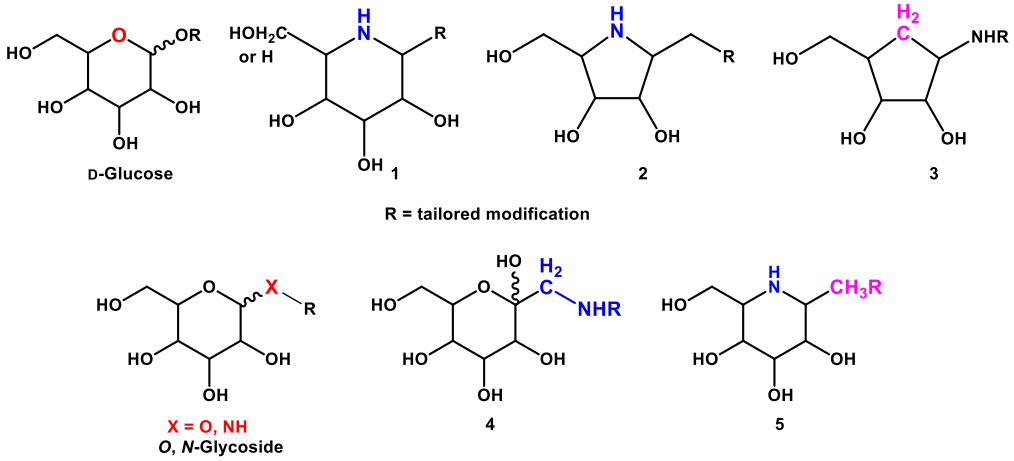


Figure 1.: Structures of glycomimetics **1** – **5**.

Details on synthetic approaches as well as biological evaluation of assorted glycomimetics from recent studies will be presented.

1.Wolfsgruber, A.; Thonhofer, M.; Weber, P.; Nasseri, S. A.; Fischer, R.; Schalli, M.; Stütz, A. E.; Withers, S. G.; Wrodnigg, T. M. *Molecules* **2020**, *25(20)*, 4618.
2. Weber, P.; Fischer, R. C.; Nasseri, S.; Stütz, A. E.; Thonhofer, M.; Withers, S. G.; Wolfsgruber, A.; Wrodnigg, T. M. *RCS Advances* **2021**, *11*, 15943 – 15951.
3. Hojnik, C.; Müller, A.; Gloe, T-E.; Lindhorst, T. K.; Wrodnigg, T. M. *EJOC* **2016**, *25*, 4328 - 4337.
4. Prasch, H.; Hojnik, C.; Lindhorst T. K.; Didak, B.; Landemarre, L.; Wrodnigg T. M. *Carbohydr. Res.* **2019**, *475*, 65 – 68.
5. Koschella, A.; Chien, C-Y.; Tadahisa, I.; Heinze, T.; Thonhofer, M. S.; Wrodnigg T. M. *J. Macromol. Chem. Phys.* **2019**, *221(1)*, 1900343 (1-8).

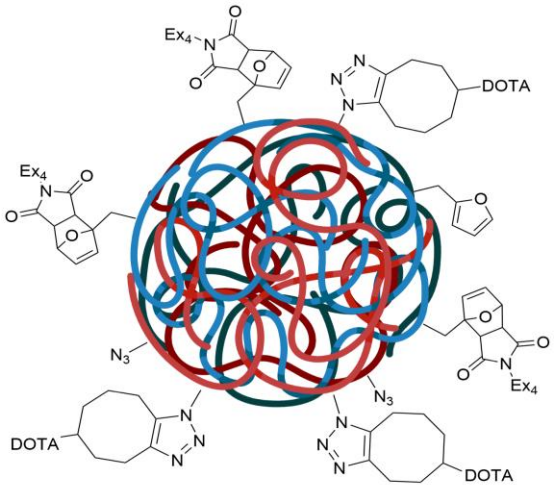
OL-16

CHITOSAN BASED NANOPARTICLES FOR MULTIMODAL DETECTION OF PANCREATIC BETA-CELLS

Laura Russo[a,b], Francesco Nicotra[a]

[a]*University of Milano-Bicocca, Department of Biotechnology & Biosciences, 20126, Milan, Italy*
[b]*CÚRAM, SFI Research Centre for Medical Devices, National University of Ireland Galway, H91 W2TY, Galway, Ireland*
E-mail: francesco.nicotra@unimib.it

In a project (H2020-NMBP-15-2017- GA-76098, iNanoBIT) aiming to develop an implantable medical device containing porcine pancreatic beta-cells able to provide insulin to diabetic patients[1], we exploited chitosan to develop nanoparticle for beta-cells multimodal detection. Nanoparticles of around 150 nm were generated combining Chitosan and Polyglutammic acid (PGA). The nanoparticles were functionalized at the surface with: i) Exendin-4, a FDA approved ligand of GLP1-receprors, to target the beta-cells; ii) DOTA, a chelator of Gd, Ga-68, Tc-99 or Cu-64 for detection by MRI, PET or SPECT; iii) IRDye® 800CW Infrared Dye for detection by Multispectral Ostoacustic Tomography (MSOT). The multiple functionalization of the nanoparticles, preserving their integrity, required different and orthogonal chemoselective click chemistry approaches. To this purpose Chitosan and PGA were functionalized with thiol, azido and furan groups, to allow chemoselective reactions with Exendin-4 containing a linker with a maleimido group, DOTA containing a linker with a dibenzylcyclooctine, and the IR dye with an NHS-linker. The multifunctionalized nanoparticles showed significant affinity to beta-cells in in vitro experiments. Labelling with Ga-68 and administration to mice resulted in the detection of beta-cells in pancreas by PET. MSOT preliminary experiments indicate the detectability of the nanoparticles in the IR region of 700-800 nm.



1. Dinnyes A, Schnur A, Muenthaisong S, Bartenstein P, Burcez C-T, Burton N, Cyran C, Gianello P, Kemter E, Nemeth G, Nicotra F, Prepost E, Qiu Y, Russo L, Wirth A, Wolf E, Ziegler S, Kobolak, *Cell Proliferation*, **2020**, 1-9, DOI: 10.1111/cpr.12785.

N-MODIFIED-DIAMINOCYCLOPENTANE SUGAR ANALOGUES AS POWERFUL AND SELECTIVE PROTEIN-*O*-GLCNACASE INHIBITORS

Patrick Weber[a], Zuzana Mészáros[b], Pavla Bojarová[b], Vladimír Křen[b], Kristýna Slámová[b], Arnold E. Stütz[a], Martin Thonhofer[a], Tanja M. Wrodnigg[a]

[a]*Institute of Chemistry and Technology of Biobased Systems, Graz University of Technology, A-8010, Graz, Austria*
[b]*Laboratory of Biotransformation, Institute of Microbiology of the Czech Academy of Sciences, CZ-14220, Praha, Czech Republic*
E-mail: patrick.weber@tugraz.at

The neurodegenerative Alzheimer's disease is characterized by a decline of cognitive functions, accompanied by loss of memory, attention, reasoning and language.[1] Potential treatments are scarce and have practically no significant efficacy. One of the first hallmarks of Alzheimer's is an unusual structure and accumulation of tau proteins. This pathological progress is caused by an abnormal hyperphosphorylation of hydroxyl groups of serine or threonine residues from tau proteins.[2] This pathological hyperphosphorylation can be reduced by inhibition of the enzyme *O*-GlcNAcase to prevent the deglycosylation step of the tau protein and consequently the subsequent phosphorylation reaction.[3]

Recently, many efficient carbohydrate-based *O*-GlcNAcase inhibitors, which mimic the oxazoline transition state, have been reported. Contemporarily, we are interested in a new type of 'non-transition state' like inhibitors will be presented. (Figure 1) Details of synthetic strategies and biological evaluation of novel carbohydrate-based *O*-GlcNAcase inhibitors will be presented.

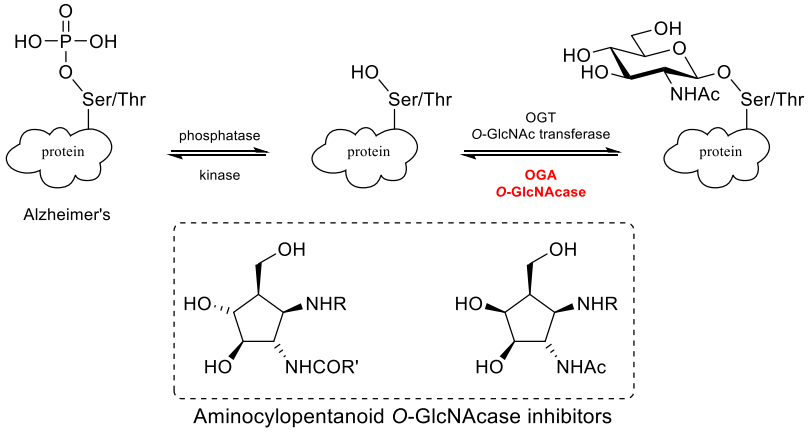


Figure 1: Synthesized *O*-GlcNAcase and hexosaminidase inhibitors.

1. Castellani, R. J.; Perry, G. *J. Alzheimer's Dis.* **2019**, *67*, 447-467.
2. Iqbal, K.; Liu, F.; Gong, C.-X. *Nat. Rev. Neurol.* **2016**, *12*, 15-27.
3. Hastings, N. B.; Wang, X.; Song, L.; Butts, B. D.; Grotz, D.; Hargreaves, R.; Fred Hess, J.; Hong, K.-L. K.; Huang, C. R.-R.; Hyde, L.; Laverty, M.; Lee, J.; Levitan, D.; Lu, S. X.; Maguire, M.; Mahadomrongkul, V.; McEachern, E. J.; Quyang, X.; Rosahl, T. W.; Selnick, H.; Stanton, M.; Terracina, G.; Vocadlo, D. J.; Wang, G.; Duffy, J. L.; Parker, E. M.; Zhang, L. *Mol. Neurodegener.* **2017**, *12*, 39.

OL-18

CARBOHYDRATE-CARBOHYDRATE INTERACTION REVEALS THE PROTECTING EFFECT OF CATIONIC CYCLODEXTRINS ON THE DESULFATION OF FONDAPARINUX

Szabolcs Béni[a], Bianka Várnai[a], Tamás Sohajda[b], Milo Malanga[b]

[a]*Semmelweis University, Department of Pharmacognosy, H-1085, Budapest, Hungary*
[b]*CarboHyde Inc., H-1045, Budapest, Hungary*
E-mail: beniszabi@gmail.com

The highly anionic synthetic pentasaccharide fondaparinux (FDPX) – representing the antithrombin binding sequence of heparin – is in clinical use as a potent anticoagulant[1]. Contrary to the unfractionated heparin, FDPX lacks potent antidote completely reversing its anticoagulant activity, therefore it is of great importance to identify new structures exhibiting strong intermolecular interactions towards FDPX. In this study, several polycationic cyclodextrins were used as potential interacting partners to mimic the electrostatic-driven interactions between the oppositely charged oligosaccharides. Among the cyclodextrins, the heptakis(6-amino-6-deoxy)-beta-cyclodextrin (NH_2-β-CD) were chosen for extensive nuclear magnetic resonance (NMR) spectroscopic and nano-electrospray ionization mass spectrometric (nESI-MS) studies to understand the molecular-level interactions in the FDPX - NH_2-β-CD systems.

NMR experiments were performed at pD 7.4 and 2.0 in order to modulate the number of charged moieties on each compound. Job's method of continuous variation and ^{1}H NMR titration experiments suggested the formation of FDPX·NH_2-β-CD complex at pD 7.4, while the presence of multiple complexes was assumed at pD 2.0. Stability constants were determined by separate ^{1}H NMR titrations, yielding log β_{11}=3.65 ± 0.02 at pD 7.4, while log $\beta_{11} \geq 4.9$ value suggested a high-affinity system at pD 2.0. 2D NOESY NMR studies indicated spatial proximities between the anomeric resonance α-L-iduronic acid residue and the cyclodextrin's methylene unit in the proximity of the cationic amino function.[2]

The desulfation of glycosaminoglycans under various environmental conditions has not been fully described yet. The acidic degradation of FDPX was also investigated by 2D NMR and MS for the first time in detail confirming that desulfation occurs involving the hydrolytic cleavages of one to two sulfate moieties. Based on our experimental results, the structure of the major acidic degradant of FDPX was proposed. Moreover, it was also observed, that the desulfation of FDPX can be inhibited by the cationic cyclodextrin in the case of equimolar ratio at pD 2.0. This is the first report on the stabilizing effect of cyclodextrin complexation on the sulfate loss of glycosaminoglycan FDPX under acidic condition.

1. Gray, E.; Mulloy, B.; Barrowcliffe, T. W.; *Thromb. Haemost.* **2008**, *99*, 807-818.
2. Várnai, B.; Grabarics, M.; Szakács, Z.; Pagel, K.; Malanga, M.; Sohajda, T.; Béni S.; *J. Pharm. Biomed. Anal.* **2021**, *197*, 113947-113956.

PL-16

RECENT DEVELOPMENTS IN THE DESIGN OF GLUCOSE ANALOGUE INHIBITORS OF GLYCOGEN PHOSPHORYLASE MOTIVATED BY COMPUTATION

Joseph M. Hayes[a]

[a]*School of Pharmacy & Biomedical Sciences, University of Central Lancashire, PR1 2HE, Preston, United Kingdom*
E-mail: jhayes@uclan.ac.uk

Regulation of the glycogen metabolism is a therapeutic strategy for type 2 diabetes,[1] but also has potential in terms of development of novel anti-cancer agents, including against glioblastoma.[2] Glycogen phosphorylase (GP) is the rate-determining enzyme in the glycogenolysis pathway, hence GP is an important target for the discovery of these compounds. GP is an allosteric enzyme with six different binding sites discovered to date. The majority of inhibitor design efforts have focused on the catalytic site and in particular the design of glucose analogue inhibitors, but other natural product analogues such as flavonoids and pentacyclic triterpenes have revealed considerable potential.[3,4] A multidisciplinary approach of computation, synthesis, crystallography, *in vitro* and *ex-vivo* studies has proved particularly effective, with a number of glucose analogues now demonstrating inhibition in the sub-micromolar range.[5,6] Recent examples of *in silico* motivated discovery of GP inhibitors will be presented, including the effects of the best compounds in cellular models of disease.

1. Oikonomakos, N. G. Glycogen phosphorylase as a molecular target for type 2 diabetes therapy. *Curr. Prot. Peptide Sci.* **2002**, *3*, 561–586.
2. Favaro, E.; Bensaad, K.; Chong, M. G.; Tennant D. A.; Ferguson, D. J. P.; Snell, C.; Steers, G.; Turley, H.; Li, J.-L.; Gunther, U. L.; Buffa, F. M.; McIntyre A.; Harris, A. L. Glucose Utilization via Glycogen Phosphorylase Sustains Proliferation and Prevents Premature Senescence in Cancer Cells. *Cell Metabol*. **2012**, *16*, 751–764.
3. Chetter, B. A.; Kyriakis, E.; Barr, D.;, Karra, A. G.; Katsidou, E.;, Koulas, A. M.; Skamnaki, V. T.; Snape, T. J., Psarra, A. M. G.; Leonidas, D. D.; Hayes, J. M. Synthetic flavonoid derivatives targeting the glycogen phosphorylase inhibitor site: QM/MM-PBSA motivated synthesis of substituted 5,7-dihydroxyflavones, crystallography, *in vitro* kinetics and *ex-vivo* cellular experiments reveal novel potent inhibitors. *Biorg. Chem*. **2020**, *102*, 104003.
4. Stravodimos, G. A.; Chetter, B. A.; Kyriakis, E.; Kantsadi, A. L.; Chatzileontiadou, D. S. M.; Skamnaki, V. T.; Kato, A.; Hayes, J. M.; Leonidas, D. D. Phytogenic polyphenols as glycogen phosphorylase inhibitors: the potential of triterpenes and flavonoids for the treatment and management of type 2 diabetes. *Curr. Med. Chem*. **2017**, *4*, 384-403.
5. Barr, D.; Szennyes, E.; Bokor, E., Al-Oanzi, Z. H.; Moffatt, C.; Kun, S.; Docsa, T.; Sipos, A.; Davies, M. P.; Mathomes. R. T.; Snape, T. J.; Agius, L.; Somsák, L.; Hayes, J. M. Identification of C-β-D-glucopyranosyl azole type inhibitors of glycogen phosphorylase that reduce glycogenolysis in hepatocytes: in silico design, synthesis, *in vitro* kinetics and *ex-vivo* studies. *ACS Chem. Biol.* **2019**, *14*, 1460-1470.
6. Kun, S.; Begum, J.; Kyriakis, E.; Stamati, E. C. V.; Barkas, T. A.; Szennyes, E.; Bokor, E.; Szabó, K. E.; Stravodimos, G. A.; Sipos, A.; Docsa, T.; Gergely, P.; Moffatt, C.; Patraskaki, M. S.; Kokolaki, M. C.; Gkerdi, A.; Skamnaki, V. T.; Leonidas, D. D.; Somsák, L.; Hayes, J. M. A multidisciplinary study of 3-(β-D-glucopyranosyl)-5-substituted-1,2,4-triazole derivatives as glycogen phosphorylase inhibitors: computation, synthesis, crystallography and kinetics reveal new potent inhibitors. *Eur. J. Med. Chem*. **2018**, *147*, 266-278.

OL-19

PROPERTIES OF MECHANOCHEMICALLY SYNTHESIZED INSOLUBLE CYCLODEXTRIN POLYMERS. A CHANCE FOR SCALABLE PREPARATION.

László Jicsinszky, Fabio Bucciol, Giancarlo Cravotto

Department of Drug Science and Technology, University of Turin, 10125 Turin, Italy
E-mail: laszlo.jicsinszky@unito.it

Cyclodextrin (CD) derivatization dominantly uses high boiling solvents, which removals are energy-consuming processes. These solvents are often toxic, making their elimination and regeneration challenging too. Water is a safe solvent, nevertheless usually not inert, and significantly influences the reagent ratios. Since polymerization reactions require at least two suitably reactive functional groups, side reactions such as hydrolysis can reduce the yields and significantly affect the uniformity of the product, regardless of the chemical bonds formed in the polymer network.

Although insoluble cyclodextrin polymers were patented almost 70 years ago, their use is still not widespread due to the synthetic and analytical difficulties. However, this has not discouraged synthetic chemists from trying again and again to prepare new and newer CD polymers. An insoluble CD polymer (CDPIS) is indeed insoluble in non-destructive solvents. Though, in theory, they are easy to separate from the reaction mixture, the uncontrolled particle size makes residual reagents and solvents a crucial drawback.

In recent decades, advances in materials technology have made it possible to produce more efficient mills in which organic chemical transformations can harness mechanical energy. Now it is possible to prepare several kilograms at reasonable investment costs. The mechanochemical methods can significantly reduce the disadvantages of working in a solution. Although the transfer of syntheses in these so-called high-energy ball mills to conventional mills is not always straightforward, the absence of the unwanted solvent effects removes at least one efficiency factor. It is also true, however, that a mechanochemical reaction alone does not mean that one or more reactants cannot be a liquid, so solubility issues can also play an important role in synthesis.

The commercially available CD bead polymer has good complexing properties, which have not changed significantly even after its powder conversion. The preparation of CDPIS in a ball mill resulted in small particle size (hydrodynamic diameter, based on photon correlation spectroscopy) with an irregular section. As shown previously, the reagent recovery of the milling technology was significantly higher than that of the solution method. The use of an identical CD/epichlorohydrin molar ratio, unlike the classical synthesis, resulted in an insoluble polymer. Although the adsorption properties of the synthesized CDPIS were similar to those of the bead polymer, we found adsorption efficiency differences in some cases. By examining a wide range of organic molecules, we have not found any explanation so far for the different complexation behavior of the bead and CDPIS using identical guest molecules. Crosslinking the randomly methylated βCD (RAMEB) with epichlorohydrin was ineffective under classical reaction conditions, but the grinding technology resulted in RAMEB CDPIS with excellent yield. Polymerization scale-up experiments (3 g =>100 g) resulted in only minimal changes in the physicochemical properties of the synthesized CDPIS.

The polymers produced effectively removed the traces of organic dyes and pharmaceutical residuals in artificial wastewater by both batches and flow techniques. Preparative scale experiments in isolation of caffeine from green coffee bean extracts have also demonstrated the broad applicability of CDPIS.

OL-20

ACCELERATING NMR STRUCTURE ELUCIDATION OF CARBOHYDRATES WITH NOVEL NMR METHODS

István Timári[a], Tamás Milán Nagy[b], Tamás Gyöngyösi[b], Mihály Herczeg[c], Anikó Borbás[c], Ole W. Sørensen[d], Katalin E. Kövér[b,e]

[a]*Department of Organic Chemistry, University of Debrecen, H-4032, Debrecen, Hungary*
[b]*ELKH-DE Molecular Recognition and Interaction Research Group, H-4032, Debrecen, Hungary*
[c]*Department of Pharmaceutical Chemistry, University of Debrecen, H-4032, Debrecen, Hungary*
[d]*Copenhagen, Denmark*
[e]*Department of Inorganic and Analytical Chemistry, University of Debrecen, H-4032, Debrecen, Hungary*
E-mail: timari.istvan@science.unideb.hu

Nuclear magnetic resonance (NMR) spectroscopy is proven to be a central technique to characterize the structure of carbohydrates. However, the complete structure elucidation of carbohydrates (especially oligosaccharides) based on classic 1D and 2D NMR experiments is not a trivial task due to serious spectral crowding caused by closely resonating proton signals of sugar rings.

To take advantage of the resolving power of a heteronucleus, we have recently developed multiple $^{1}H–^{13}C$ HSQC-CLIP-COSY experiments,[1,2] which combine the valuable one-bond heteronuclear, multiple-bond proton-proton correlations and optionally the ^{13}C multiplicity information into a single 2D spectrum. However, traditional acquisition of multidimensional NMR experiments often requires long measurement times. A few years ago, the idea of sequentially exploiting two different pools of magnetization in a concatenated experiment was proposed for saving spectrometer time since the two pools can relax simultaneously in a single delay.[3]

More recently, we have demonstrated that it was possible to completely discard the relaxation delay using the NORD (NO Relaxation Delay) strategy.[4] NORD experiments offer to relax one of the magnetization pools, while the other is being used and vice versa, and to save magnetization in individual modules for succeeding scans in accordance with the Ernst angle concept. A typical set of experiments in carbohydrate NMR ($^{1}H–^{13}C$ HSQC or H2OBC, $^{1}H–^{13}C$ HMBC and $^{1}H–^{1}H$ TOCSY) is combined in novel NORD sequences.[5] The result is a significant reduction of the NMR measurement and analysis time needed for structure elucidation. It will be presented that the NORD strategy in combination with the concatenation of two or three 2D NMR experiments delivers complete hetero- and homonuclear correlation maps within minutes for oligosaccharides in moderate concentration.

1. Gyöngyösi, T.; Timári, I.; Haller, J.; Koos, M. R. M.; Luy, B.; Kövér, K. E. *ChemPlusChem* **2018**, *83*, 53.
2. Gyöngyösi, T.; Timári, I.; Sinnaeve, D.; Luy, B.; Kövér, K. E. *Anal. Chem.* **2021**, *93*, 3096.
3. Kupče, Ē.; Claridge, T. D. W. *Angew. Chem. Int. Ed.* **2017**, *56*, 11779.
4. Nagy, T. M.; Kövér, K. E.; Sørensen, O. W. *Angew. Chem. Int. Ed.* **2021**, *60*, 13587.
5. Timári, I.; Nagy, T. M.; Kövér, K. E.; Sørensen, O. W. *Chem. Commun.* **2022**, *58*, 2516.

OL-21

IN SILICO EXPLORATION OF BINDING OF NOVEL SULFUR AND SELENIUM CONTAINING HUMAN GALECTIN-3 LIGANDS

Fanni Hőgye[a], Álex Kálmán Balogh[b,c], Tünde Zita Illyés[a,c], István Timári[a,c], László Szilágyi[a,c], Katalin E. Kövér[b,c], Krisztina Fehér[b,c]

[a]*Department of Organic Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
[b]*Department of Inorganic and Analytical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
[c]*Molecular Recognition and Interaction Research Group, Hungarian Academy of Science, University of Debrecen, H-4032 Debrecen, Hungary*
E-mail: balogh.alex@science.unideb.hu

Human Galectin-3 has a variety of biological functions and thus is implicated in wide range of disease pathologies. As a result, targeting *h*Gal-3 for clinical applications has become an intense area of research. As a step towards development of novel hGal-3 inhibitors, we describe an in silico study of the binding of novel sulfur and selenium containing hGal-3 ligands. The ligands are modifications of well-known inhibitors thiodigalactoside (TDG) and di(β-D-galactopyranosyl) selenide (SeDG) [1] by aromatic substitutions added either symmetrically or asymmetrically at the 3-3' or 6 positions using groups of differing sizes and electron richness through a methylene group and hetero atom. Docking these ligands to hGal3 has provided promising docking scores and poses that reproduced canonical binding modes of TDG and SeDG. The docking poses feature a stacking interaction of the galactose apolar side to the aromatic ring of W181 and a general H-bonding pattern that is similar to that of the binding mode observed for TDG and SeDG. We have found π–π stacking between aromatics substituents and W181 in a T-shaped conformation.

1. Raics, M.; Balogh, Á.K.; Kishor, C.; Timári, I.; Medrano, F.J.; Romero, A.; Go, R.M.; Blanchard, H.; Szilágyi, L.; E. Kövér, K.; Fehér, K.; Int. J. Mol. Sci. **2022**, 23, 2494.

ABSTRACTS OF POSTER PRESENTATIONS

INVESTIGATIONS ON CYTOTOXIC AND ANTIVIRAL EFFECTS OF 1,8-NAPHTHALIMIDE DERIVATIVES

Radostina Alexandrova[a], Hristo Hristov[a], Abedulkadir Abudalleh[a], Desislav Dinev[a], Lora Dyakova[b], Desislava Staneva[c], Kalina Shishkova[d], Awad I. Said[e], Ivo Grabchev[f]

[a]Institute of Experimental Morphology, Pathology and Anthropology with Museum, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria
[b]Institute of Neurobiology, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria;
[c]University of Chemical Technology and Metallurgy, 1756 Sofia, Bulgaria
[d]Sofia University "St. Kliment Ohridski", Faculty of Biology, 1164 Sofia, Bulgaria
[e]Department of Chemistry, Faculty of Science, Assiut University, 71511 Assiut, Egypt
[f]Sofia University "St. Kliment Ohridski", Faculty of Medicine, 1407 Sofia, Bulgaria
E-mail: rialexandrova@hotmail.com

The aim of this study was to evaluate the cytotoxic / antitumour and antiviral activities of first generation polypropylene imine dendrimer modified with 1,8-naphthalimide and chitosan modified with 4-amino-1,8-naphthalimide.

The following cell lines were used as model systems: MDA-MB-231 (human triple negative breast cancer), MCF-7 (human luminal type A breast cancer), Lep-3 (non-tumor human embryonic cells) and MDBK (bovine kidney). The effect of the compounds on cell viability and proliferation was studied by: i) short-term experiments (treatment period is 24-72h, performed with monolayer – 2D cell cultures) carried out by MTT test, neutral red uptake cytotoxicity assay, crystal violet staining and double staining with acridine orange and propidium iodide); ii) long term experiments – the influence of 1,8-naphthalimide derivatives on viability and 3D growth of cancer cells was assessed during 26-28 days by 3D colony-forming technique. The effect of the compounds on the replication of Herpes simplex virus type 1 (HSV-1, strain F) and hype 2 (HSV-2, Strain BA) was investigated in MDBK cells by the method of Reed and Muench.

The results obtained revealed that modified chitosan has more pronounced cytotoxic activity than the first generation polypropylene imine dendrimer modified with 1,8-naphthalimide and non-modified chitosan. Non-tumor Lep-3 human cells are less sensitive to the cytotoxic effect of the compounds examined as compared to MDA-MB-231 and MCF-7 breast cancer cells. The 1,8-naphthalimide derivatives do not affect significantly the replication of HSV-1 (strain F) and HSV-2 (strain BA).

Acknowledgement: supported by Grant №КП-06-КОСТ/16 from 16.12.2020, National Science Fund, Bulgarian Ministry of Education and Science; COST Action CA18132.

P-2

TRANSGLYCOSYLATION REACTIONS USING ENDO AND EXO GLYCOSIDASES

Teréz Barna[a], Erna Szabó[a], Gyöngyi Gyémánt[b]

[a]*Department of Genetics and Applied Microbiology, University of Debrecen, H-4032 Debrecen, Hungary*
[b]*Department of Inorganic and Analytical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
E-mail:gyemant@science.unideb.hu, barna.terez@science.unideb.hu

The reversible nature of a glycoside hydrolase catalysed hydrolytic cleavage makes feasible to transglycosylate different carbohydrate substrates in controlled conditions. Both the endo- and exo-glycosidase-catalyzed transglycosylation has emerged as a powerful method for making complex oligosaccharides, polysaccharides, and glycoconjugates.

A unique feature of transfer reaction by endo-acting enzymes is the block transfer of an entire oligosaccharide moiety in a given step. α-Amylase, the endo-acting enzyme from the gut of *Leptinotarsa decemlineata* (LDAmy) catalysed the hydrolysis and transglycosylation of the both-end-protected substrate 4,6-O-benzylidene-4-nitrophenyl β-maltoheptaoside in parallel reactions. Shorter and longer both end-protected products with degree of polymerization 4-10 were formed. Ratio of transglycosylation to hydrolysis reached 0.5 in presence of 20 % acetonitrile as organic solvent. Lack of a mobile loop and at the same time the presence of several aromatic residues in a close approximation of the active site may be the reason for the enhanced transfer activity of LDAmy.

In a different approach, transglycosylation can be achieved by generating glycosynthases, the mutants of wild-type glycoside hydrolases that are devoid of product hydrolysis activity but capable of taking an appropriate activated substrate for glycosyl transfer. A stable mannosynthase created from the *exo*-acting β-D-mannosidase of *Thermobifida fusca* efficiently catalyses the formation of tri- and tetraoligosaccharides linked by β-mannosidic bond using α-D-mannosyl fluoride as donor and a wide range of acceptor sugars. The recognition of versatile acceptor sugar moieties assumes extreme plasticity not only for the active site but for the global enzyme structure. Kinetic studies also revealed a cooperative binding behavior of the substrates upon increasing donor sugar concentration with an estimated dimer and tetramer formation of the enzyme molecules. This specific self-association into oligomeric enzyme complexes induced by the sugar substrates warns the importance of elucidating the regulatory mechanisms in this type of catalysis, which can limit the effectivity of the transglycosylation.

In future, the combination of applying exo- and endo-acting glycoside hydrolase/gycosynthase actions in a regulated order can lead for building up predetermined, complex and structurally well-defined glycans, oligosaccharides, and glycoconjugates, which are highly valuable for functional glycomics studies and for biomedical applications as well.

P-3

EXPLORATION OF THE CARBOHYDRATE COMPOSITION OF SEEDS FOR THE EXTRACTION OF THERAPEUTIC OLIGOSACCHARIDES

Teréz Barna[a], Róbert Tupicza[a], Miklós Ida[a], Gyöngyi Gyémánt[b]

[a]*Department of Genetics and Applied Microbiology, University of Debrecen, H-4032 Debrecen, Hungary*
[b]*Department of Inorganic and Analytical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
E-mail: gyemant@science.unideb.hu, barna.terez@science.unideb.hu

Dietary fibers are mainly those carbohydrate components in all plant foods that are resistant to digestion in the upper gastrointestinal tract and arrive intact to the colon where they selectively stimulate the microbial growth with a health benefit to human organism. Analysis of carbohydrate composition of plant materials to support the selection of breeding lines of plant cultivars with high nutritious value, including the functional fiber content, requires a complex approach. Here, we sought to develop a novel workflow applying enzymatic steps in addition to analytical methods elucidating the carbohydrate composition of grain crops. An important aspect of this method is the successful liberation of the soluble and insoluble polysaccharide component associated tightly to the complex matrix of the plant tissue.

In addition, the functionality of some isolated plant polysaccharides and oligosaccharides derived from the enzymatic digests of these polysaccharides were tested on probiotic *Lactobacillus and Bifidobacterium strains* in an *in vitro* assay.

THIOL-ENE COUPLING REACTIONS OF NUCLEOSIDES

Miklós Bege[a,b,c], Ilona Bakai-Bereczki[a], Pál Herczegh[a], Anikó Borbás[a]

[a]*Department of Pharmaceutical Chemistry, University of Debrecen, H-4032, Debrecen, Hungary*
[b]*Institute of Healthcare Industry, University of Debrecen, H-4032, Debrecen, Hungary*
[c] *MTA-DE Molecular Recognition and Interaction Research Group, University of Debrecen, H-4032, Debrecen, Hungary*
E-mail: bege.miklos@euipar.unideb.hu

Thiol-ene coupling (TEC) or thio-click reaction is a widely used method in synthetic chemistry due to its advantageous properties such as mild conditions, good yields and simple execution.[1-2] The radical mediated thiol-ene reaction is intensively exploited in carbohydrate chemistry.[3-6] Our research group was the first to perform radical-mediated thiol addition on unsaturated nucleoside derivatives, obtaining a large library of 2'-, 3'- and 4'-modified nucleoside analogues.[7-8]

Uridine, ribothymidine and adenosine were included into our experiments, using thiosugars, alkyl-mercaptans and amino-acid derivatives as thiol partners. We investigated the effect of different conditions, such as temperature, protecting groups, solvent, initiation method and nucleobase, on the yield and stereoselectivity of the reaction. Generally, the lower temperature improved the selectivity, by increasing the ratio of one of the 2 possible diastereisomers of the product, however, in some cases the structure of the thiol also affected the stereochemical outcome of the reaction, especially in the case of 1-thiosugars. In most cases, hydrothiolation of 4'-exomethylene derivatives of nucleosides resulted in the corresponding *ribo* isomer as the main product, while in the case of 3'-exomethylenes, the *xylo* was the major isomer formed, and in the reactions of 2'-exomethylene derivatives, predominantly the *arabino* isomer was obtained. The synthetized compounds were subjected to various biological tests, including antiviral, antimalarial and cytotoxicity assays, which showed interesting results.[8-9]

1. Dénes, F.; Pichowicz, M.; Povie, G.; Renaud, P.; *Chem Rev* **2014**, 114, 2587-2693.
2. Hoyle, C.E.; Bowman C.N.; *Angew Chem Int Ed* **2010**, 49, 1540-1573.
3. Dondoni, A.; *Angew Chem Int Ed* **2008**, 47, 8995-8997.
4. Kelemen, V.*et* al., *Chem Asian J*, **2020**, 15, 876-891.
5. Kelemen, V. *et* al., *Chem Eur J*, **2019**, 25, 14555-14574.
6. Eszenyi, D. *et* al., *Chem Eur J*, **2018**, 24, 4532-4537.
7.Bege, M.; Bereczki, I.; Herczeg, M.; Kicsák, M.; Eszenyi, D.; Herczegh, P.; Borbás, A.; *Org. Biomol. Chem.* **2017**, 15, 9226-9233.
8. Bege, M. *et* al., *Molecules*, **2019**, 24, 2173-2196.
9. Kiss, A.; Baksa, V.; Bege, M.; Tálas, L.; Borbás, A.; Bereczki, I.; Bánfalvi, G.; Szemán-Nagy, G.; *Anticancer Res*, **2021**, 41, 137-149.

Acknowledgement: The authors gratefully acknowledge financial support from the National Research, Development and Innovation Office of Hungary (NKFIH/OTKA K 132870). This work was also supported by the EU and co-financed by the European Regional Development Fund under the projects GINOP-2.3.4-15-2020-00008.

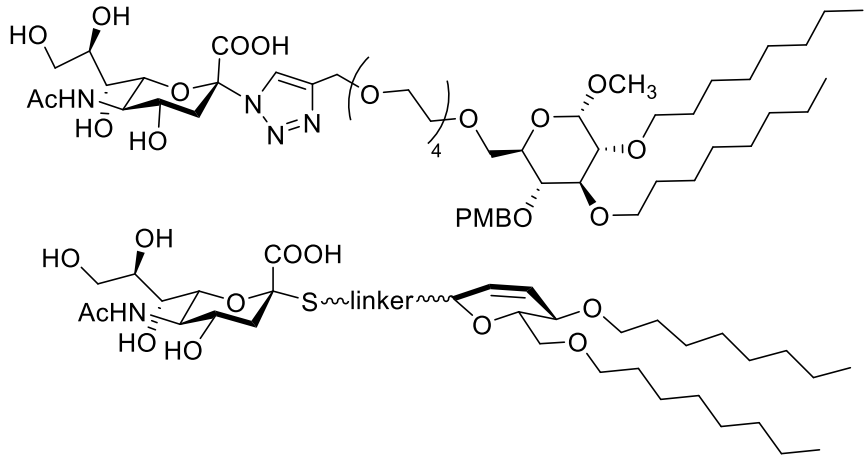
AMPHIPHILIC SIALIC ACID DERIVATIVES AGAINST VIRUSES

Ilona Bereczki[a,b,c], Eszter Lőrincz[a,d,e], Anikó Borbás[a,b], Pál Herczegh[a]

[a]*Department of Pharmaceutical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
[b]*National Laboratory of Virology, Szentágothai Research Centre, H-7624 Pécs, Hungary*
[c]*ELKH-DE Pharmamodul Research Team, H-4032 Debrecen, Hungary*
[d]*Institute of Healthcare Industry, University of Debrecen, H-4032, Debrecen, Hungary*
[e]*Doctoral School of Pharmaceutical Sciences, University of Debrecen, H-4032 Debrecen, Hungary*
E-mail: bereczki.ilona@pharm.unideb.hu

In the middle of the SARS-CoV-2 pandemic, influenza seems to be an innocent virus, but it is not true. Many scientists believe that an influenza pandemic is one of the greatest threats to the global public health nowadays. During the Spanish flu a third of the global population was infected and up to 50 million people died worldwide within a year. A new and even more dangerous flu epidemic could break out at any time. Moreover, the virus can develop resistance against medications so quickly, as it happened in the 2008-2009 season, when a totally oseltamivir resistant strain caused pandemic around the world. Although nowadays medicines are available against influenza, these medications are not effective enough. According to the WHO, there is an urgent need for better tools to prevent, detect, control and treat influenza, including more effective vaccines and antiviral drugs.

Influenza hemagglutinin recognizes and attaches to neuraminic acid receptor endings on the surface of the host cells. Therefore, we designed and synthesized neuraminic acid derivatives equipped with lipophilic tails in order to produce amphiphilic molecules capable of aggregation. In this way in aqeous medium the surface of the aggregates is covered with sialic acid molecules mimicking the surface of the host cells to trap the virus and inhibit infection. Hindering the viral attachment and infection is a very promising antiviral strategy.



P-6

SYNTHESIS OF POTENTIAL GLYCOSYL TRANSFERASE INHIBITORS BY THIO-CLICK REACTIONS

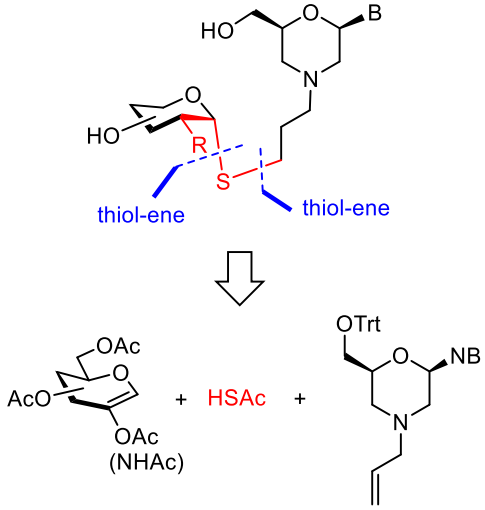
Nóra Debreczeni[a,b,c], Mikós Bege[a,c,d], Anikó Borbás[a]

[a]*Department of Pharmaceutical Chemistry, University of Debrecen, H-4032, Debrecen, Hungary*
[b]*Doctoral School of Chemistry, University of Debrecen, H-4032, Debrecen, Hungary*
[c]*Institute of Healthcare Industry, University of Debrecen, H-4032, Debrecen, Hungary*
[d]*MTA-DE Molecular Recognition and Interaction Research Group, University of Debrecen, H-4032, Debrecen, Hungary*
E-mail: debreczeni.nora@science.unideb.hu

Glycosyltransferases (GTs) play a central role in the biosynthesis of glycans and glycoconjugates by catalyzing the transfer of a mono- or oligosaccharide from a glycosyl donor to a carbohydrate or protein acceptor.[1] Biological glycosylation and the glycosylated products are involved in many fundamental processes of living systems, including inflammation, cancer and bacterial virulence, making glycosyltransferases potential drug targets, therefore, the design and synthesis of their inhibitors is an important area in medicinal chemistry.[2]

The donor substrates of Leloir glycosyltransferases are nucleotide-sugars such as UDP-glucose, UDP-galactose, UDP-GlcNAc, GDP-mannose, CMP-sialic acid, etc. Neutral analogues of these donor substrates, as potential inhibitors of Leloir glycosyltransferases, are of prime importance.

Our aim was to develop *S*-linked sugar-morpholino analogues by replacing the pyrophosphate bridge with an electroneutral thioether linker. These morpholino type mimetics of UDP-, GDP- and CMP-sugars were constructed by photoinitiated additions of α-1-thiosugars (Glc, GlcNAc, Gal, Man) and 2-thio-Neu5Ac onto *N*-allyl morpholinos.



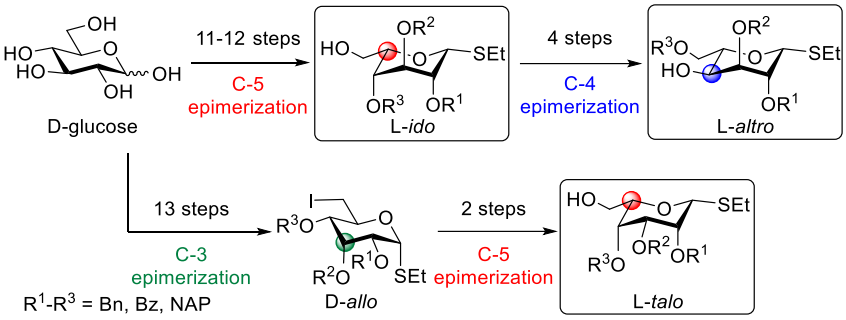
1. Palcic, M. M.; Glycosyltransferases as biocatalysts, *Curr. Opin. Chem. Biol.* **2011**, *15*, 226-233.
2. Tedaldi, L. Wagner, G. K.; Beyond substrate analogues: new inhibitor chemotypes for glycosyltransferases, *Med. Chem. Commun.* **2014**, *5*, 1106-1125.

SYNTHESIS OF THE THREE MOST EXPENSIVE L-HEXOSE THIOGLYCOSIDES STARTING FROM D-GLUCOSE

Fruzsina Demeter[a], Attila Bényei[b], Anikó Borbás[a], Mihály Herczeg[a,c]

[a]*University of Debrecen, Department of Pharmaceutical Chemistry, H-4032, Debrecen, Hungary*
[b]*University of Debrecen, Laboratory for X-ray Diffraction, Department of Physical Chemistry, H-4032, Debrecen, Hungary*
[c]*Research Group for Oligosaccharide Chemistry of Hungarian Academy of Sciences, ELKH, H-4032, Debrecen, Hungary*
E-mail: demeter.fruzsina@science.unideb.hu

The rare L-hexoses play important roles in nature and they are part of many biologically active molecules.[1,2] They cannot be obtained from natural sources or can only be extracted very costly. Due to the complexity of their synthesis, their commercially available derivatives are also very expensive.[2] In our work, one of the cheapest D-hexoses, D-glucose was used as starting material and a method was developed in which the three most expensive, L-hexoses (L-idose, L-altrose and L-talose) were successfully prepared in orthogonally protected thioglycoside form, ready for glycosylation using inexpensive, readily available chemicals.



Scheme 1.: Synthetic plan of the three L-hexose thioglycosides

The L-*ido* and L-*talo* derivatives were obtained by C-5 epimerization *via* the corresponding 5,6-unsaturated thioglycosides using the hydroboration-oxidation method. Then, orthogonally protected L-altrose thioglycosides were synthesized by C-4 epimerization of the prepared L-*ido* derivatives. We were the first to systematically investigate the preparation of the key intermediate, the 5,6-unsaturated derivatives, on thioglycosides using various protecting groups (ether and ester).

1. De Lederkremer, R. M.; Gallo-Rodriguez C.; *Adv. Carbohydr. Chem. Biochem*. **2004**, *59*, 9-67.
2. Frihed, T. G.; Bols, M.; Pedersen, C. M.; *Chem. Rev.* **2015**, *115*, (9), 3615-3676.

Acknowledgement: The synthetic work was supported by the Premium Postdoctoral Program of HAS (PPD 461038, M. H.), National Research, Development and Innovation Office of Hungary (FK 137924 M. H.), and from the EU and co-financed by the European Regional Development Fund under the project GINOP-2.3.4-15-2020-00008.

P-8

STEREOCHEMISTRY OF SUGAR AMINO ACIDS: α/β-ANOMERS OF CHIMERA PEPTIDES AND THEIR INTERCONVERSION

Kim Hoang Yen Duong[a,b], Viktória Goldschmidt Gőz[c], Gitta Schlosser[d], István Pintér[b], András Perczel[b,c]

[a]*Hevesy György PhD School of Chemistry, Institute of Chemistry, ELTE Eötvös Loránd University, H-1117 Budapest, Hungary*
[b]*Laboratory of Structural Chemistry and Biology, Institute of Chemistry, ELTE Eötvös Loránd University, H-1117 Budapest, Hungary*
[c]*MTA-ELTE Protein Modeling Research Group, Eötvös Loránd Research Network (ELKH) ELTE Eötvös Loránd University, H-1117 Budapest, Hungary*
[d]*MTA-ELTE Lendület Ion Mobility Mass Spectrometry Research Group, ELTE Eötvös Loránd University, H-1117 Budapest, Hungary*
E-mail: dkhy.yen@gmail.com, perczel.andras@ttk.elte.hu

Carbohydrates are biopolymers playing a vital role in living organisms as well as building blocks of macromolecules such as RNA, DNA and ATP. The structural diversity of carbohydrates presents a significant number of chemical compounds, differing in the stereochemistry at carbon atoms, linkage position or stereocenter.[1,2] Our research focused on β-sugar amino acids (β-SAAs) as building blocks of chimera peptides in the presence of anomers. Various small and biologically relevant chimeras were prepared by manual and flow-based solid phase peptide synthesis. The modified 50% TFA protocol was applied to remove 1,2-*O*-isopropylidene protection from β-SAA (Fmoc-RibAFU(ip)-OH) which increased the hydrophilicity of the sugar moieties.[3,4] We achieved fully unprotected OHs of chimera peptides containing the -RibAFU(α/β)- building block. Such α- and β-anomers in aqueous solution were in equilibrium, they were inseparable from each other. Cyclic ion mobility-mass spectrometry is appropriate and effective in distinguishing carbohydrates having the same mass but different structures as conformers or anomers.[5,6] We realized the applicability of this approach in a comprehensive analysis of our anomeric chimeras containing -RibAFU(α/β)- and in the reveal of their mutarotation at equilibrium.

1. Hofmann, J.; Pagel, K. *Angew. Chem. Int. Ed.* **2017**, *56*, 8342-8349.
2. Gray, C.J.; Migas, L. G.; Barran, P. E.; Pagel, K.; Seeberger, P. H.; Eyers, C. E.; Boons, G.-J.; Pohl, N. L. B.; Compagnon, I.; Widmalm, G.; Flitsch, S. L. *J. Am. Chem. Soc.* **2019**, *141*, 14463-14479.
3. Duong, K. H. Y.; Goldschmidt Gőz, V.; Pintér, I.; Perczel, A. *Amino Acids* **2021**, *53*, 281-294.
4. Goldschmidt Gőz, V.; Duong, K. H. Y.; Horváth, D.; Ferentzi, K.; Farkas, V.; Perczel, A. *Eur. J. Org. Chem.* **2021**, *44*, 6071-6083.
5. Giles, K.; Ujma, J.; Wildgoose, J.; Pringle, S.; Richardson, K.; Langridge, D.; Green, M. *Anal. Chem.* **2019**, *91*, 8564-8573.
6. Ujma, J.; Ropartz, D.; Giles, K.; Richardson, K.; Langridge, D.; Wildgoose, J.; Green, M.; Pringle, S. *J. Am. Soc. Mass Spectrom.* **2019**, *30*, 1028-1037.

P-9

INVESTIGATION OF THE INTERACTION OF 3-FUCOSYL-LACTOSE DERIVATIVES WITH *PSEUDOMONAS AERUGINOSA* LECTINS (PA-IL AND PA-IIL) USING SATURATION TRANSFER DIFFERENCE (STD) NMR SPECTROSCOPY

László Bence Farkas[a,b], Magdolna Csávás[b,c], Lenka Malinovská[d], Katalin E. Kövér[a,b]

[a]*Department of Inorganic and Analytical Chemistry, University of Debrecen, H-4032, Debrecen, Hungary*
[b]*Research Group for Molecular Recognition and Interaction, Eötvös Loránd Research Network, University of Debrecen, H-4032, Debrecen, Hungary*
[c]*Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Debrecen, H-4032, Debrecen, Hungary*
[d]*Central European Institute of Technology, Masaryk University, 625 00 Brno, Czech Republic*
E-mail: farkasbence1104@gmail.com

Pseudomonas aeruginosa (PA) is an opportunistic human pathogen, a potential cause of particularly serious nosocomial infections especially in the case of cystic fibrosis.[1]

Due to the rapid development of the disease and the emerging resistance of PA to antibiotics, novel therapies based on the inhibition of adhesion and the elimination of biofilms have become an important target of research. Two lectins were investigated by our research group, the galactophilic PA-IL and the L-fucose-specific PA-IIL, which are produced in the cytoplasm of the bacterium and play an important role in the communication between the bacterium and the host cell, thus in the colonization of the pathogen and in the formation of biofilm.[2] The aim of our studies was to investigate the interactions of 3-fucosyl-lactose glycoconjugates containing terminal D-galactose and L-fucose units, suitable for anti-adhesion therapy and synthesized for the purpose of inhibiting biofilm formation with lectins using the ligand-based saturation transfer difference (STD)[3] NMR spectroscopy.

In the present study, our strategy for the assignment of the NMR signals is presented firstly, since in order to evaluate the STD NMR spectra obtained during the interaction tests, the ^{1}H-signal assignment of the investigated ligands should be performed in advance.[4] The STD experiments were accomplished competitively, the essence of which was to displace the selected reference ligand from the carbohydrate-binding site of the lectin with the competitor monovalent or tetravalent ligand. The drop of the STD-NMR signal of the reference ligand unambiguously confirms the presence of competitive binding in the investigated lectin systems. Moreover, the tetravalent ligand tends to link the lectin molecules into non-soluble aggregates through possible cross-links. In this case, the degree of aggregation was also monitored regularly.

1. Bhagirath, A.Y.; Li, Y.; Somayajula, D.; Dadashi, M.; Badr, S.; Duan, K. *BMC Pulm. Med*. **2016**, *16*, 174–196.
2. Imberty, A.; Wimmerová, M.; Mitchell, EP.; Gilboa-Garber, N. *Microbes Infect.* **2004**, 6(2), 221-228.
3. Di Carluccio, C.; Forgione, M. C.; Martini, S.; Berti, F.; Molinaro, A.; Marchetti, R. & Silipo, A. *Carbohydr. Res.*, **2021**, *503*, 108313.
4. Gyöngyösi T.; Timári I.; Sinnaeve D.; Luy B.; Kövér K.E.; *Anal Chem.* **2021**, 93(6), 3096-3102.

P-10

PEPTIDOGLYCAN MONOMER FUNCTIONALIZED GOLD NANOPARTICLES FOR L-DOPA TARGETED DELIVERY AND PROBING OF THEIR INTERACTION WITH WGA LECTIN

Ruža Frkanec[a], Marcela Šišić[a], Nikolina Kalčec[b], Ivana Vinković Vrček[b], Leo Frkanec[c]

[a]*Centre for Research and Knowledge Transfer in Biotechnology, University of Zagreb, 10000, Zagreb, Croatia*
[b]*Institute for Medical Research and Occupational Health, 10000 Zagreb, Croatia*
[c]*Rudjer Boskovic Institute, 10 000 Zagreb, Croatia*
E-mail: rfrkanec@unizg.hr

The aim of the present study was to synthesize gold nanoparticles (AuNPs-PGM) modified with peptidoglycan monomer (GlcNAc-MurNAc-L-Ala-D-isoGln-mesoDAP(εNH2)-D-Ala-D-Ala) and probe their interaction with model WGA lectin which specifically recognized N-acetylglucosamine (GlcNAc). Our previous study investigates the ability of novel gold nanoparticles to be used as delivery systems for L-DOPA or dopamine by considering the binding capabilities of L-DOPA to the AuNPs-PGM. The results indicate that AuNPs functionalized with PGM enables a significantly higher L-DOPA binding compared to citrate stabilized AuNPs vesicles.[1] Now, AuNPs-PGM were treated with the WGA lectin in order to investigate the spatial arrangement of PGM on the AuNPs surface and find out how bound L-DOPA affects the availability of the peptidoglycan and the interaction with lectin. Agglutination is one of the early methods to monitor sugar-receptor interactions, so the WGA lectin is added to the AuNPs-PGM and the hydrodynamic volumes of the resulting aggregates were measured by DLS.

Preliminary results demonstrated that WGA lectin successfully recognize and bind to AuNPs-PGM as well as that the particle size grew immediately after WGA lectin is added to the AuNPs-PGM. The increase of size of AuNPs-PGM-L-DOPA was lower in comparison with AuNPs-PGM themselves, but still it is significant. The interaction of lectin and AuNPs-PGM confirmed availability of glycan part of PGM molecule to recognize the lectin receptors on the cell surface and promising potential of prepared nanoparticles to become efficient drug delivery system for Parkinson's disease.

1. Kalčec, N.; Peranić, N.; Barbir, R.; Hall, C.R.; Smith, T.A.; Sani, M.A.; Frkanec, R.; Separovic, F.; Vinković Vrček, I. *Spectrochim. Acta A Mol. Biomol. Spectrosc*. **2022**, *268*, 120707, 13.

Acknowledgment: We acknowledge the financial support of the Croatian Science Foundation (Projects: IP-2018-01-6910; PZS-2019-02-4323).

PREPARATION AND ANTICOAGULANT ACTIVITY OF AN IDRAPARINUX ANALOGUE PENTASACCHARIDE CONTAINING L-GULURONIC ACID

Mihály Herczeg[a], Fruzsina Demeter[a], István Timári[b], Katalin E. Kövér[c,d] and Anikó Borbás[a]

[a]*Department of Pharmaceutical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
[b]*Department of Organic Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
[c]*Department of Inorganic and Analytical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
[d]*MTA-DE Molecular Recognition and Interaction Research Group, University of Debrecen, H-4032 Debrecen, Hungary*
E-mail: herczeg.mihaly@pharm.unideb.hu

One of the most problematic parts of the synthesis of heparinoid anticoagulants is the preparation of the L-iduronic acid unit.[1] In the case of idraparinux, a heparin-related anticoagulant pentasaccharide, we demonstrated that L-iduronic acid can be replaced by an easier-to-produce L-sugar without significant change in biological activity. From the inexpensive D-mannose, through a highly functionalized phenylthio-mannoside, L-gulose donor was prepared by C-5 epimerization[2] in 10 steps. This unit was incorporated into the pentasaccharide by α-selective glycosylation and oxidized to L-guluronic acid. The complete synthesis required only 36 steps. The guluronate-containing pentasaccharide was able to inhibit coagulation factor Xa with high potency, indicating that L-iduronic acid is interchangeable without loss of bioactivity.

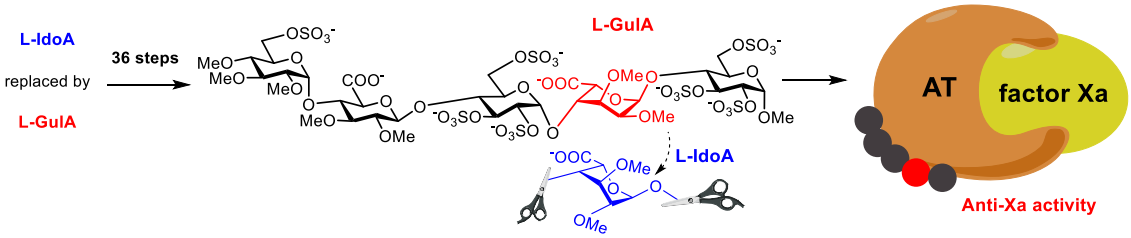


Figure 1. The structure of the L-guluronic acid containing pentasaccharide

1. Mohamed, S.; Ferro, V., *Adv. Carbohydr. Chem. Biochem.* **2015**, *72*, 21-61.
2. Demeter, F.; Veres, F.; Herczeg M. and Borbás, A., *Eur. J. Org. Chem*. **2018**, *48*, 6901-6912.

Acknowledgement: The synthetic work was supported by the National Research and Development and Innovation Office of Hungary (K 132870, A. B.; FK 137924 M. H.), Premium Postdoctoral Program of HAS (PPD 461038, M. H.) and the EU and co-financed by the European Regional Development Fund under the project GINOP-2.3.4-15-2020-00008.

P-12

FUNCTIONALIZATION OF 1-C-SUBSTITUTED GLYCAL DERIVATIVES BY ADDITION REACTIONS

Ágnes Homolya, Zsófia Peleskei, Ivett Jedlóczki, László Somsák, Marietta Tóth, László Juhász

Department of Organic Chemistry, University of Debrecen, H-4032 Debrecen, Hungary
E-mail: homolya.agnes@sceince.unideb.hu

Saccharides are important building blocks of the living organism,[1,2] playing a crucial role in the recognition processes on the cell surface.[3] Glycals are sugar enol ethers having a double bond between the C-1 and C-2 carbon atoms.[4] This endocyclic double bond defines the reactivity of these derivatives, which is characterized by electrophilic ionic and radical additions to the electron rich double bond.

Reactivity of 1-C-substituted glycals is much less studied at least in part due to the not easy accessability of such compounds,[5,6] but our research group has elaborated an effective synthetic route for these glycals from anhydro-aldonic acid and (ulosylbromide)onic acid derivatives,[7] which made it possible to study the reactions of these compounds.[8-10]

The aminosugar molecules contain one or more amino group instead of the hydroxy groups, which are an important class of the biologically active compounds. They can be found in naturally occurring antibiotics and glycoproteins, and the biologically importance of these biomolecules is connected to the aminosugar moiety.[11]

In our work, we investigated in detail the haloazidation and hydroxyazidation reactions of the 1-C-substituted glycals to prepare some azide derivatives, which can be the precursors of the aminosugars.

1. Varki, A.; *Glycobiology* **1993**, *3*, 97.
2. Dwek, R. A.; *Chem. Rev.* **1996**, *96*(2), 683.
3. H. J. Gabius; Ed. The Sugar Code - Fundamentals of Glycosciences; Wiley-VCH: Weinheim, 2009.
4. Priebe, W.; Grynkiewicz, G. in *Glycoscience: Chemistry and Chemical Biology I-III*, ed. by Fraser, B. O.; Tatsuta, R. K.; Thiem, J.; Springer-Verlag, Berlin Heidelberg **2001**, 7492.
5. Somsák, L. *Chem. Rev.*; **2001,** *101*, 81.
6. Gómez, A. N.; Cristóbal López, J.; in *Carbohydrate Chemistry*; The Royal Society of Chemistry, **2009**; Vol. 35, pp 289.
7. Kun, S.; Deák, S.; Czifrák, K.; Apelt, O.; Juhász, L.; Somsák, L. in *Carbohydrate Chemistry: Proven Synthetic Methods*, Vol.4, ed. by Vogel, C.; Murphy, P.; Chapter 10, **2017**, CRC Press, ISBN: 978-1-4987-2691-7.
8. Lázár, L.; Juhász L.; Batta, Gy.; Borbás, A.; Somsák, L. *New J. Chem.*, **2017,** ***41***, 1284.
9. Homolya, L.; Juhász, L.; Somsák, L.; *Carbohydr. Res.*, **2021**, *504*, 108292.
10. Homolya, L.; Antal, D.; Nagy, M.; Juhász-Tóth, É.; Tóth, M.; Bényei, A.; Somsák, L.; Juhász, L.; *Carbohydr. Res.*, **2022**, *519*, 1085828.
11. Mirabella, S.; Cardona, F.; Goti, A.; *Org. Biomol. Chem.* **2016**, *14*, 5186.

Acknowledgement: This work was financially supported by the Hungarian National Research, Development, and Innovation Office (Grant: FK 128766). Ágnes Homolya thanks the Gedeon Richter Talentum Foundation for supporting her PhD studies.

P-13

SYNTHESES OF 2-FLUORO-SELENOGALACTOSIDE DERIVATIVES

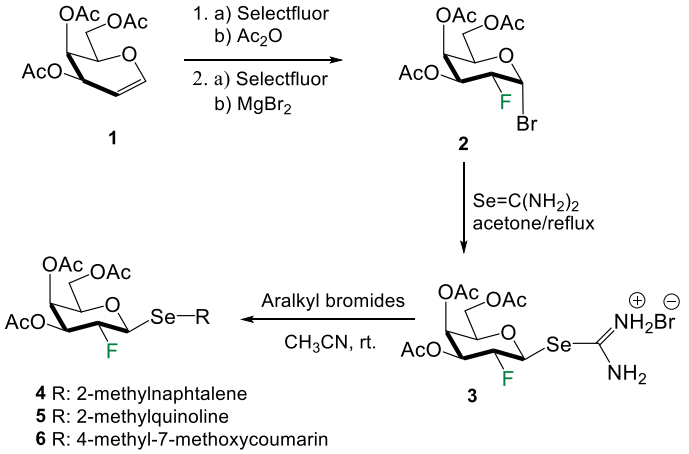
László Szilágyi, Fanni Hőgye, Zita Tünde Illyés

Department of Organic Chemistry, University of Debrecen, H-4032 Debrecen, Hungary
E-mail: lszilagyi@unideb.hu, illyestz@unideb.hu, hogye.fanni@science.unideb.hu

Lectin–glycan interactions are involved in cellular processes such as adhesion, intercellular communication, growth and differentiation, cell cycle, and apoptosis.

Selenoglycosides play an important role in synthetic carbohydrate chemistry and are useful in structural and biochemical investigations of pysiologically relevant interactions with proteins, such as lectins as hydrolytically stable inhibitors. ^{77}Se NMR spectroscopy is useful for monitoring the binding of selenoglycosides to galectins. Fluorine containing molecules are extensively used in bioorganic and medicinal chemistry; fluoro sugar derivatives are useful as probes for studying glycan-protein interactions by ^{19}F NMR.

The aim of this work is the synthesis of fluorine- and selenium-containing carbohydrate derivatives. New 2-fluoro-selenogalactoside derivatives were synthesized by reacting 2-fluoro-3,4,6-tri-O-acetyl-β-D-Se-galactopyranosyl-isoselenuronium salt[1,2] with aralkyl halides under mild conditions. The new compounds will be considered as probes in lectin binding assays by ^{77}Se and ^{19}F NMR.



1. Giguère, D. et. al. *HAL Open Science*, **2020**, 25 (17), *4478-4490.*
2. Kumar, A. A et al. *Carbohydr. Res.*, **2012**, 360, *8–18.*

[2 + 2] TYPE CYCLOADDITION REACTIONS OF PER-*O*-ACYLATED *EXO*-GLYCAL DERIVATIVES WITH CHLOROSULFONYL ISOCYANATE AND DICHLOROKETENE

János József[a], Tünde Zita Illyés[a], Katalin E. Kövér[b], Marietta Tóth[a], László Somsák[a], László Juhász[a]

[a]*Department of Organic Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
[b]*Department of Inorganic and Analytical Chemistry, University of Debrecen, H-4032 Debrecen, Hungary*
E-mail: jozsef.janos@science.unideb.hu

Carbohydrates play a key role in many physiological and pathological processes. Nowadays one of the most important aims of glycobiological research is to map the relationships between the structure and function of carbohydrates. Glycomimetics, synthetically produced compounds that mimic the structure and/or biological function of natural derivatives, but have more favorable chemical and enzymatic properties, are often used for these investigations. The structural modifications are sometimes associated with more favorable metabolic and pharmacological properties, so these compounds can also be used as lead structures in drug design.[1,2]

Exo-glycals – the carbohydrate derivatives possessing a reactive exocyclic double bond on the anomeric carbon atom – can be easily transformed into various glycomimetics.

Based on the similar transformations performed in the case of *endo*-glycal,[3-7] the [2+2]-type cycloaddition reaction of *exo*-glycals with dichloroketene and chlorosulfonyl isocyanate can be a suitable method for the preparation of carbohydrate derivatives containing spiro-cyclobutanone and spiro-β-lactam structural units. In the case of spiro-cyclobutanones, ring expansion is also possible, they can be converted into γ-lactams through the corresponding oxime, while γ-lactones can be produced by Baeyer-Villiger oxidation. These derivatives can be useful synthetic intermediates, since their ring opening reactions with nucleophilic reagents can provide the new types of *C*-glycosyl compounds and amino acid conjugates.

1. Hevey, R. *Pharmaceuticals* **2019,** *12* (2), 55.
2. Ernst, B.; Magnani, J. L. *Nat. Rev. Drug Discov.* **2009,** *8* (8), 661.
3. Chmielewski, M.; Kałuża, Z.; Furman, B. *Chem. Commun.* **1996,** (24), 2689.
4. Chmielewski, M.; Kaluża, Z.; Grodner, J.; Urbański, R. *Cycloaddition Reactions in Carbohydrate Chemistry*, American Chemical Society: 1992; Vol. 494, pp 50.
5. Oh, J.; Lee, C.-R.; Chun, K. H. *Synth. Commun.* **2002,** *32* (15), 2349.
6. Umbreen, S.; Linker, T. *Chem. Eur. J.* **2015,** *21* (20), 7340.
7. Oh, J. *Tetrahedron Lett.* **1997,** *38* (18), 3249.

Acknowledgement: The research was supported by the National Research, Development and Innovation Office under the project FK128766.

PALLADIUM CATALYSED CROSS-COUPLING REACTIONS OF 2-IODO 1-C-SUBSTITUTED GLYCALS: HECK AND SONOGASHIRA REACTIONS

Ágnes Homolya, Eszter Csomay, Éva Juhász-Tóth, László Somsák, Marietta Tóth, László Juhász

University of Debrecen, Department of Organic Chemistry, H-4032, Debrecen, Hungary
E-mail: juhasz.laszlo@science.unideb.hu

Based on the research in recent decades the function of carbohydrates has been revaluated. In addition to their primary functions - serve as energy sources and as essential structural components in organisms – they play a key role in many physiological and pathological processes, because their conjugates are found in almost all living cells and cell surfaces.[1] Beside these biological functions, carbohydrates can serve as a chiral, non-racemic starting compounds of natural products and biologically active synthetic compounds. The glycosidic bond of natural glycosides shows low stability against chemical and enzymatic hydrolysis, so one of the most important goals of synthetic carbohydrate chemistry is to produce compounds that mimic the structure and biological function of natural derivatives.[2] These compounds are called glycomimetics, and for the preparation of these derivatives developing of new procedures and methods are necessary.

C-2 branched carbohydrate derivatives and 1,2-annulated sugars can be potential antibiotics, or glycomimetics of 2-*N*-acetyl sugars and inhibitors of lipid biosynthesis.

1-C-Substituted glycals are unsaturated carbohydrate derivatives bearing endocyclic double bond and carbon substituents on the anomeric carbon. We have elaborated synthetic methods for 1-C-acceptor-substituted (CN, $CONH_2$, $COOCH_3$) glycals sarting from anhydro-aldonic acid and (ulosylbromide)onic acid derivatives[3-6] and the reactivity of these type of derivatives have been studied in detail.

In this presentation we will represent the synthesis of 2-iodo-1-C-substituted glycals and optimization of their palladium catalyzed Heck and Sonogashira cross-coupling reactions which were resulted 1,2-bis-C-substituted glycal derivatives.

1. H. J. Gabius, Ed. The Sugar Code - Fundamentals of Glycosciences; Wiley-VCH: Weinheim, **2009**.
2. C.-H. Wong, *Acc. Chem. Res.* **1999**, *32*, 376.
3. S. H. Mahmoud, L. Somsák, I. Farkas; *Carbohydr. Res.*, **1994,** *254*, 91.
4. L. Somsák, *Carbohydr. Res.*, **1989**, *195*, C1-C2.
5. L Kiss, L. Somsák, *Carbohydr. Res.* **1996**, *291*, 43.
6. Kun, S.; Deák, S.; Czifrák, K.; Apelt, O.; Juhász, L.; Somsák, L. Carbohydrate Chemistry: Proven Synthetic Methods, Volume 4, ed. by Vogel, C.; Murphy, P. Chapter 10, **2017**, CRC Press, ISBN: 978-1-4987-2691-7.

Acknowledgement: This work was financially supported by the Hungarian National Research, Development, and Innovation Office (Grant: FK 128766). Ágnes Homolya thanks the Gedeon Richter Talentum Foundation for supporting her PhD studies.

"NORMAL" AND CARBONYLATIVE SUZUKI-MIYAURA COUPLING REACTIONS OF 2-IODO 1-*C*-SUBSTITUTED GLYCALS

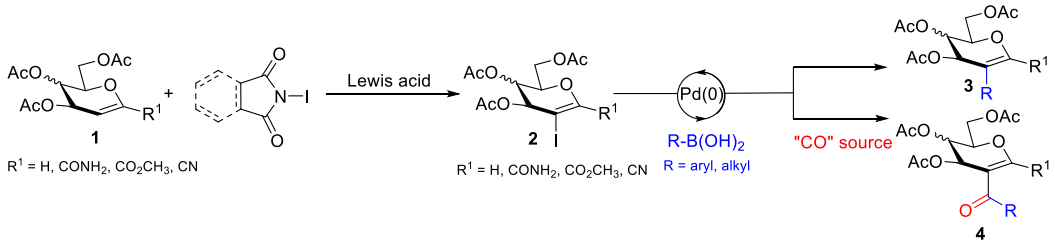
Éva Juhász-Tóth, Ferenc Dániel Petróczi, Ádám Szilárd Malecz, Marietta Tóth, László Somsák, László Juhász

Department of Organic Chemistry, University of Debrecen, H-4032 Debrecen, Hungary
E-mail: toth.eva@science.unideb.hu

Glycals are sugar enol ethers in which there is a double bond between the C-1 and C-2 carbon atoms of the ring.[1] These compounds are key precursors for the synthesis of biologically valuable molecules and natural substances, as these can be easily and in good yield converted to intermediates which are suitable for the preparation of complex target compounds.[2]

2-Haloglycals are important starting materials of 2-*C*-branched carbohydrate derivatives which can be transformed into 1,2-annulated sugars, heterocycles and glycoconjugates. *C*-branched sugars are potential antibiotics, and they represent mimics of 2-*N*-acetylsugars for cell surface engineering and inhibitors of lipid biosynthesis.[3] Functionalization of the C-2 carbon atom of glycals can be accomplished by metal-catalyzed coupling reactions of 2-haloglycals, such as Heck, Suzuki, Sonogashira, and carbonylative coupling reactions.[4]

There are only few articles in the literature on the chemistry of glycals **1** containing an electron withdrawing group on the C-1 carbon (CN, $CONH_2$, CO_2CH_3) since these compounds are not commercially available and difficult to prepare. Our research team has developed an efficient, multi-step synthetic route for the preparation of these derivatives,[5] which provides an opportunity to study the reactivity of these compounds **1**. In our recent work, we have developed a synthetic method for the preparation of 2-iodo 1-*C*-substituted glycals **2** and then investigated in detail the "normal" and carbonylative Suzuki-Miyaura coupling reactions of these derivatives. Experiments were performed to optimize the reaction conditions using various Pd sources, phosphine ligands, temperature, and solvents.



1. Priebe, W.; Grynkiewicz, G. Formation and Reactions of Glycal Derivatives in Glycoscience: Chemistry and Chemical Biology I-III, Fraser, B. O.; Tatsuta, R. K.; Thiem, J. (eds.) Springer-Verlag, Berlin Heidelberg 2001, 749-783.
2. Kinfe, H. H. *Org. Biomol. Chem.* **2019**, *17*, 4153-4182.
3. Yin, J.; Linker, T. *Org. Biomol. Chem.* **2012**, *10*, 2351-2362.
4. Hussain, N.; Ahmed, A.; Mukherjee, D. *Asian J. Org. Chem.* **2020,** *9*, 882-897.
5. Kun, S.; Deák, S.; Czifrák, K.; Apelt, O.; Juhász, L.; Somsák, L. Carbohydrate Chemistry: Proven Synthetic Methods, Volume 4, ed. by Vogel, C.; Murphy, P. chapter 10, 2017, CRC Press, ISBN: 978-1-4987-2691-7.

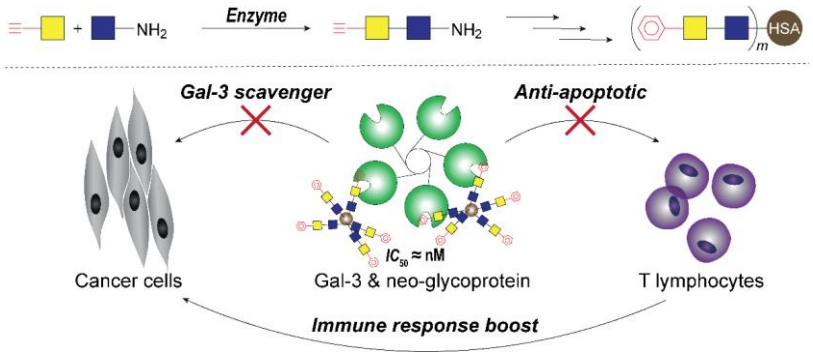
Acknowledgement: This work was financially supported by the Hungarian National Research, Development, and Innovation Office (Grant: FK 128766).

UNIQUE TRANSGLYCOSYLATION OF C-3 FUNCTIONALIZED GALACTOSE YIELDS POTENT GLYCOMIMETICS FOR GALECTIN-3 INHIBITION

Pavla Bojarová[a], Michaela Hovorková[a], Viktoria Heine[a,b], Miluše Vlachová[a], Marcela Filipová[c], Lothar Elling[b], Vladimír Křen[a]

[a]*Institute of Microbiology of the Czech Academy of Sciences, CZ-14220, Prague 4, Czech Republic*
[b]*Institute for Biotechnology and Helmholtz-Institute for Biomedical Engineering, RWTH Aachen University, D-52074 Aachen, Germany*
[c]*Institute of Macromolecular Chemistry of the Czech Academy of Sciences, CZ-16206 Prague 6, Czech Republic*
E-mail: kren@biomed.cas.cz

Galectin-3 (Gal-3) plays a crucial role in cancerogenesis, and its targeting is prospective for cancer diagnostics and therapy. Multivalent presentation of glycans can strongly increase the affinity to Gal-3, and further strengthening of interaction may be reached through aryl substitutions in the carbohydrate molecule.[1] We established novel chemoenzymatic method to produce selective C-3-substituted *N*,*N*'-diacetyllactosamine glycomimetics and coupled them to human serum albumin. The β-*N*-acetylhexosaminidase from *Talaromyces flavus* had the unique ability to synthesize the C-3-propargylated disaccharide, which was further conjugated with various aryl residues *via* click chemistry. Coupling to HSA afforded multivalent neo-glycoproteins with up to 21 000-fold increased inhibitory potency compared to the lactose. SPR brought further information on the kinetics of Gal-3 inhibition. The potential of neo-glycoproteins to target Gal-3 was demonstrated on colorectal adenocarcinoma cells. The neo-glycoproteins efficiently scavenged exogenous Gal-3 in the microenvironment of cancer cells, inhibiting its interaction with the cells, and protecting T-lymphocytes against Gal-3-induced apoptosis.[2] Due to their high efficiency for targeting exogenous Gal-3, these neo-glycoproteins are prospective for application in the immunomodulatory treatment of Gal-3-overexpressing cancers.[3]



1. Laaf, D.; Bojarová, P.; Elling, L.; Křen, V. *Trends Biotechnol*. **2019**, *37*, 402-415.
2. Filipová, M. *et* al., *Biomacromolecules* **2020**, *21*, 3122-3133.
3. Heine, V.*et* al., *Eur. J. Med. Chem.* **2021**, *220*, 113500.

Acknowledgment: Czech Science Foundation project No. 20-00215S and mobility project LTC 20069 (COST CA18132 GlycoNanoProbes) by the Czech Ministry of Education are gratefully acknowledged.

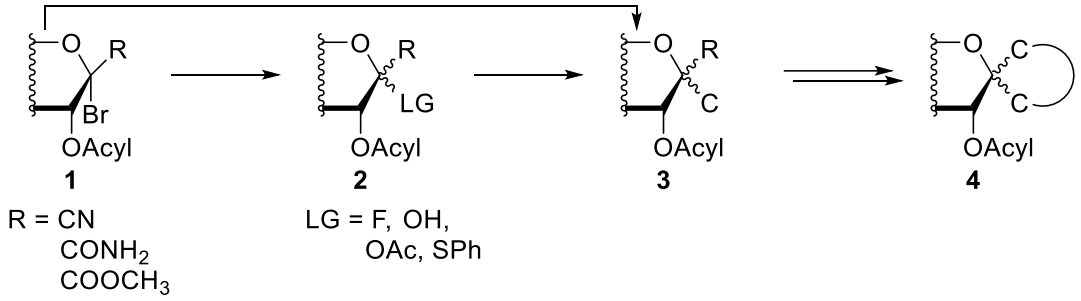
SYNTHETIC STUDIES TOWARD SPIROCYCLIC BIS-C,C-GLYCOSYL DERIVATIVES OF ULOSONIC ACIDS

Sándor Kun, Nándor Kánya, László Somsák

Department of Organic Chemistry, University of Debrecen, H-4032, Debrecen, Hungary
E-mail: kun.sandor@science.unideb.hu, somsak.laszlo@science.unideb.hu

Several bioactive natural and synthetic compounds bear spirocyclic units. Synthesis of this motif is still a great challenge, especially on a carbohydrate framework. Natural anomeric spirocyclic compounds such as the herbicide hydantocidin[1] and the papulacandins[2] with antifungal activity are well known, other synthetic compounds show glycosidase,[3] glycogen phosphorylase[4] and SGLT2 inhibition.[5] A representative from the latter group has been marketed recently for the treatment of type 2 diabetes mellitus.

C-Glycosyl derivatives of ulosonic acids are scarcely known in the literature, such type of structures are limited only to the 3-deoxy type sialic acid derivatives. Herein we report a systematic study on the synthesis of bis-*C,C*-glycopyranosyl compounds from fully substituted heptulosonic acids followed by cyclization to novel spirocycles. From per-*O*-acylated (ulopyranosyl bromide)onic acid derivatives (**1**) further glycosyl donors (**2**) were prepared with various leaving groups and anomeric configurations and the ionic and radical reactions of **1** and **2** were investigated towards bis-*C,C*-glycosyl derivatives **3**. Transformations of the anomeric *C*-substituents and cyclization steps led to spirocycles **4** with five and six membered heterorings.



1. Soengas, R. G.; Da Silva, G.; Estévez, J. C. *Molecules* **2017**, *22*, 2028.
2. Kobayashi, T.; Regens, C. S.; Denmark, S. E. In *Strategies and Tactics in Organic Synthesis*, Harmata, M., Ed. Academic Press: **2012**, *8*, 79-126.
3. Tite, T.; Tomas, L.; Docsa, T.; Gergely, P.; Kovensky, J.; Gueyrard, D.; Wadouachi, A. *Tetrahedron Lett.* **2012**, *53*, 959-961.
4. Somsák, L. *Compt. Rend. Chimie* **2011**, **14**, 211-223.
5. Aguillón, A. R.; Mascarello, A.; Segretti, N. D.; de Azevedo, H. F. Z.; Guimaraes, C. R. W.; Miranda, L. S. M.; de Souza, R. O. M. A. *Org. Process Res. Dev.* **2018**, *22*, 467-488.

SYNTHESIS OF ANOMERIC SPIRO-MORPHOLINONES FROM GLYCULOSONAMIDES

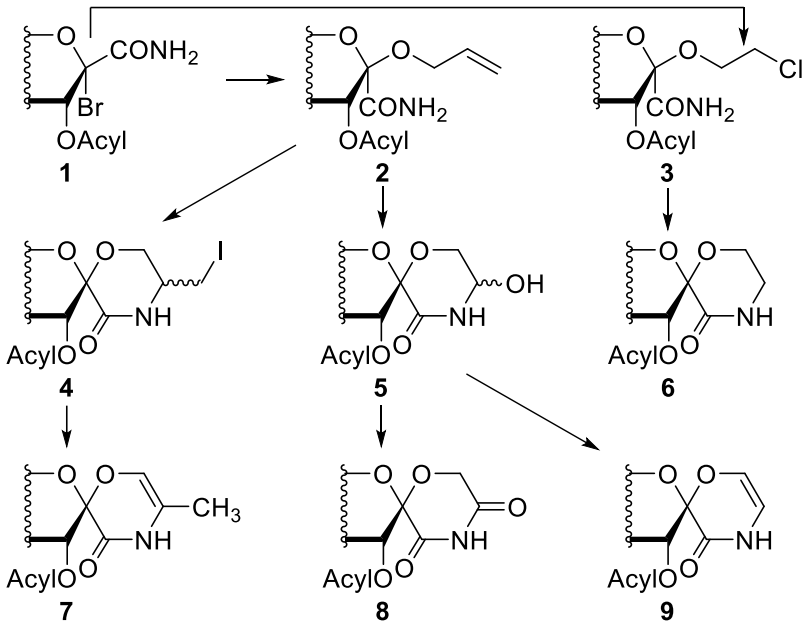
Nándor Kánya, Sándor Kun, László Somsák

Department of Organic Chemistry, University of Debrecen, H-4032, Debrecen, Hungary
E-mail: kun.sandor@science.unideb.hu, somsak.laszlo@science.unideb.hu

Drug molecules containing morpholine ring have been proving their beneficial physicochemical, biological and metabolic properties for nearly seven decades in analgesic, anti-depressant, immunosuppressive, anti-infection and anti-cancer medications.[1] Due to its importance in medicinal chemistry, countless methods have been developed for the construction of the morpholine motif. Spirocyclic morpholines, including carbohydrate derivatives are much less known, although these compounds show interesting biological properties.[2,3]

Herein we report methods to synthesize glycosylidene-spiro-morpholinones from glyculosonamides, including a new, unprecedented ring closure for the construction of the morpholine ring. Allyl (**2**) and 2-chloroethyl (**3**) glycosides were prepared from ulosylbromide(onamides) (**1**) by conventional glycosylation methods. Iodine induced, base promoted and a novel ring closure under ozonolysis conditions gave morpholinones **4**, **6** and **5**, respectively. Elimination and oxidation reactions furnished unsaturated (**7**, **9**) and dion (**8**) derivatives, respectively.

Details of the syntheses will be disclosed on the poster.



1. Kourounakis, A. P.; Xanthopoulos, D.; Tzara, A. *Med. Res. Rev.* **2020**, *40*, 709-752.
2. Wood, J. M.; Furkert, D. P.; Brimble, M. A. *Nat. Prod. Rep.* **2019**, *36*, 289-306.
3. Faisal, M.; Shahzad, D.; Larik, F. A.; Dar, P. *Fitoterapia* **2018**, *129*, 366-382.

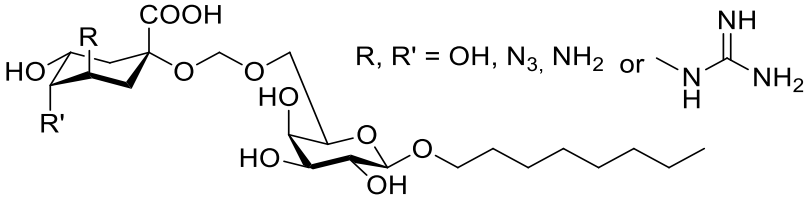
QUINIC ACID-GALACTOSE CONJUGATES EQUIPPED WITH LIPOPHILIC SIDE CHAINS AGAINST INFLUENZA VIRUSES

Eszter Boglárka Lőrincz[a,b], Pál Herczegh[a], Anikó Borbás[a], Ilona Bakai-Bereczki[a]

[a]*Department of Pharmaceutical Chemistry, University of Debrecen, H-4032, Debrecen, Hungary*
[b]*Pharmaceutical Sciences Doctoral School, University of Debrecen, H-4032, Debrecen, Hungary*
E-mail: lorincz.eszter@euipar.unideb.hu

There are several dangerous viruses on Earth with no effective treatment against them. Emerging and re-emerging viruses could be the biggest threat for the human population nowadays. Common influenza epidemic kills 290,000 to 650,000 people annually and there were greater influenza pandemics around the world in the history. The most deadly flu pandemic was the Spanish flu with about 50 million casualties in 1918. A similarly dangerous influenzavirus could kill close to 33 million people worldwide within six months nowadays. Because of the resistance against current medications, there is an urgent need for effective antiviral drugs with new mode of actions.

In the case of influenza, hindering the viral attachment on the host cell's surface would be a very promising strategy against infection and resistance. Influenza hemagglutinin attach to the sialic acid terminals of the surface receptors, where sialic acid molecules are bound to the subsequent galactose sugar moiety. Quinic acid could be a simplified sialic acid analog and it is used for the synthesis of oseltamivir, an antiinfluenza medication. Self-assembling multivalent quinic acid - galactose conjugates might act as a viral hemagglutinin trap, these compounds may hinder the viral infection. Therefore, we have synthesized some self-assembling amphiphilic quinic acid derivatives conjugated to galactose equipped with lipophilic octyl groups. Oseltamivir and another antiinfluenza medication zanamivir contain nitrogen containing functional groups (amino or guanidino groups), therefore we have prepared some derivatives equipped with similar N-containig groups.



SEARCHING FOR NEW LECTINS IN MUSHROOMS

Lenka Malinovská[a,b], Kamila Zimová[c], Dominika Pončáková[c], Vojtěch Juza[d], Michaela Wimmerová[a,b,c]

[a]*NCBR, Faculty of Science, Masaryk University, 61137, Brno, Czech Republic*
[b]*CEITEC, Masaryk University, 62500, Brno, Czech Republic*
[c]*Department of Biochemistry, Faculty of Science, Masaryk University, 62500, Brno, Czech Republic*
[d]*Gymnázium Aloise Jiráska v Litomyšli, 57001, Litomyšl, Czech Republic*
E-mail: malinovska@mail.muni.cz

Lectins are carbohydrate-binding proteins of non-immune origin occurring in all organisms and executing various functions. Microbial lectins can recognize carbohydrates on host cells and mediate infectious processes. Animal lectins play diverse functions, including numerous cell adhesion and cell recognition events. Plant lectins are supposed to be involved in defence mechanisms.

However, the functions of fungal lectins are largely unknown. They could be involved in growth and morphogenesis, defense or mycorrhization. Moreover, lectins have a wide range of applications in research, medicine and industry. Some fungal lectins have mitogenic, antitumor, or immunomodulatory activities.

New lectins with potentially interesting and useful properties could be found by bioinformatic research, using similarity to known lectins. On the other hand, unique novel lectins with no known homologues could be only detected in and isolated from the natural sources. Also, not all mushrooms genomes are sequenced and characterized, leaving the "wet" laboratory work the only way how to discover lectins in these species.

Searching for novel exploitable lectins is one of our long-term aim. We will present the discovery of several lectins in both edible and inedible mushrooms using affinity interactions with carbohydrate resins. The binding specificity of lectins was determined by hemagglutination inhibition assay. This methodology is relatively simple and inexpensive but identification of lectins in natural sources actually faces many obstacles, including availability and complexity of samples (mushroom gathering and processing), extremely variable concentrations of lectins in specimens or stability of lectins. However, successfully identified new lectins have a potential to produce interesting results with possible future applications.

Acknowledgement: This work is supported by Grant Agency of Czech Republic (GA21-29622S).

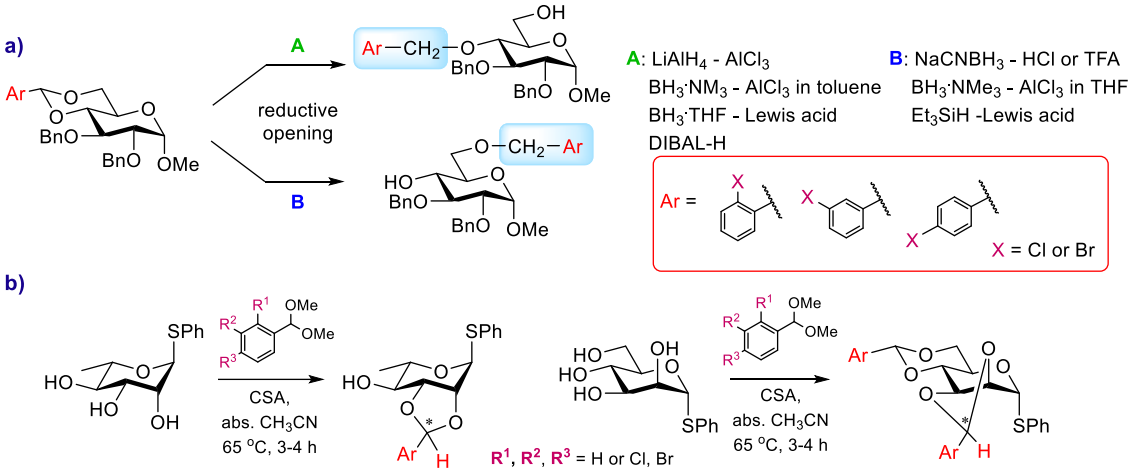
SYNTHESIS AND HYDROGENOLYSIS OF DIOXOLANE-TYPE 2,3-*O*-HALOBENZYLIDENE ACETALS OF GLYCOSIDES

Erika Mező, Bayar Boldtumur, Anikó Borbás

Department of Pharmaceutical Chemistry, University of Debrecen, H-4032, Debrecen, Hungary
E-mail: mezo.erika@science.unideb.hu

The production of oligo- and polysaccharides is often a challenge for chemists due to the presence of hydroxyl groups with almost the same reactivity. Acetals are one of the most versatile protecting groups, as they can simultaneously protect two hydroxyl groups. Their excellence also lies in the fact that they can be selectively opened by reductive hydrogenolysis resulting in an etherprotected with a free hydroxyl group.

Recently, our research group studied the synthesis and reductive ring opening of new halogen-containing benzylidene acetals (Scheme a).[1] In general, it can be said that these acetals and the ethers formed from them are more stable than their traditional, non-halogenated counterparts. An additional advantage of *para*-substituted derivatives is that they can be easily converted into the less stable methoxy counterpart, which can be easily removed under mildly acidic conditions.



While 4,6-*O*-dioxane acetals are formed in a fully stereoselective manner, 2,3-*O*-dioxolane acetals are obtained an almost 1:1 mixtures of *endo* and *exo* arylmethyl stereoisomers. We wondered whether, in the case of halogenated derivatives, significant stereoselectivity can be observed during the formation of the dioxolane acetal. Thus, as a continuation of our previous work, we started the synthesis of halogen-substituted dioxolane acetals from 1-thio α-L-rhamnoside and 1-thio α-D-mannoside. We performed the acetalation reactions with all halogenated reagents (Scheme b), and we also started to study the reductive ring-opening reactions on the *meta*-brominated mannoside diacetal.

1. Mező, E.; Herczeg, M.; Demeter, F.; Bereczki, I.; Csávás, M.; Borbás, A.; *J. Org. Chem.* **2021**, *86*, 12973-12987.

UNEXPECTED REACTIONS OF *N*-(2,3,4,6-TETRA-*O*-ACYL-β-D-GLYCOPYRANOSYL-CARBONYL)-*N*'-TOSYLHYDRAZINES WITH *N*-, *O*-NUCLEOPHILES

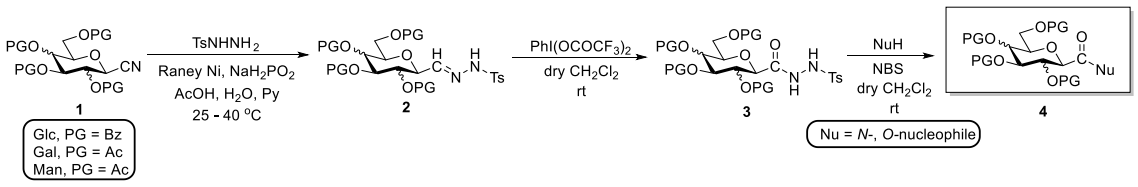
Éva Juhász-Tóth, Mariann Kiss, Imre Ignáth, Zwivhuya Phoebe Mudau, László Somsák, Marietta Tóth

Department of Organic Chemistry, University of Debrecen, H-4032 Debrecen, Hungary
E-mail: toth.marietta@science.unideb.hu

A general method for the conversion of glycosyl cyanides **1** to *C*-(β-D-glycopyranosyl)formaldehyde tosylhydrazones **2** has been developed in our research group,[1-4] allowing to study the reactivity of these compounds extensively, such as transformations into synthetically and biologically important *exo*-glycals.[2,4,5]

In continuation of our research, a new synthetic route was planned for the preparation of substituted *exo*-glycals *via* nucleophilic substitution of hydrazonoyl halide intermediates, followed by a Bamford-Stevens reaction.

Aromatic hydrazonoyl halides can be synthesized directly from *N*-acyl-*N*'-tosylhydrazines and their reactions with secondary amines give amidrazones,[6] however carried out the reaction of *N*-(per-*O*-acyl-β-D-glycopyranosyl-carbonyl)-*N*'-tosylhydrazines **3** in the presence of *N*- and *O*-nucleophiles resulted in the corresponding *N*-substituted and *N*,*N*-disubstituted *C*-(per-*O*-acyl-β-D-glycopyranosyl)formamides and *C*-glycopyranosyl formic acid ester type derivatives **4**.



1. M. Tóth, L. Somsák *Tetrahedron Lett.* **2001**, *42*, 2723-2725.
2. M. Tóth, L. Somsák *J. Chem. Soc. Perkin. Trans.* **2001**, *1*, 942-943.
3. M. Tóth, K. E. Kövér, A. Bényei, L. Somsák *Org. Biomol. Chem.* **2003**, *1*, 4039-4046.
4. Tóth, M.; Somsák, L.; Goyard, D. Preparation of 2,6-Anhydro-aldose-tosylhydrazones. In Carbohydrate Chemistry: Proven Synthetic Methods, Kovac, P., Ed. CRC Press: Boca Raton, 2012; Vol. 1, pp 355-365.
5. C. Taillefumier, Y. Chapleur *Chem. Rev.* **2004**, *104*, 263-292.
6. H. M. Hassaneen, A. A. Fahmi, H. Abdelhamid, A. A. Yassin, A. S. Shawali *J. Het. Chem.* **1984**, *21*, 797-800.

Acknowledgement: This work was financially supported by the Hungarian National Research, Development, and Innovation Office (Grant: FK 128766).

FIRST SYNTHESIS OF 3-GLYCOPYRANOSYL-1,2,4-TRIAZINES

Éva Bokor, Attila Ferenczi, Mahir Hashimov, Alshimaa Ibrahim Zaki, Éva Juhászné Tóth, László Somsák

University of Debrecen, Department of Organic Chemistry, H-4032, Debrecen, Hungary
E-mail: bokor.eva@science.unideb.hu

C-Glycosyl heterocycles belong to the intensively investigated groups of hydrolytically stable sugar conjugates, especially due to their potential use as glycomimetics for drug design.[1] Within this compound class, *C*-glycofuranosyl N-heterocycles as analogs of nucleosides and nucleotides have been widely studied for a long time.[2-4] In addition, five-membered *C*-glycopyranosyl heterocycles have also received great attention,[1] while *C*-glycopyranosyl derivatives of six-membered heterocycles are barely represented.[1]

As part of our ongoing project aimed at the syntheses of representatives of the latter compound class, the preparation of hitherto unknown 3-glycopyranosyl-1,2,4-triazines (Figure 1, **I**) and -1,2,4-triazin-5(4*H*)-ones (**II**) has also been examined.

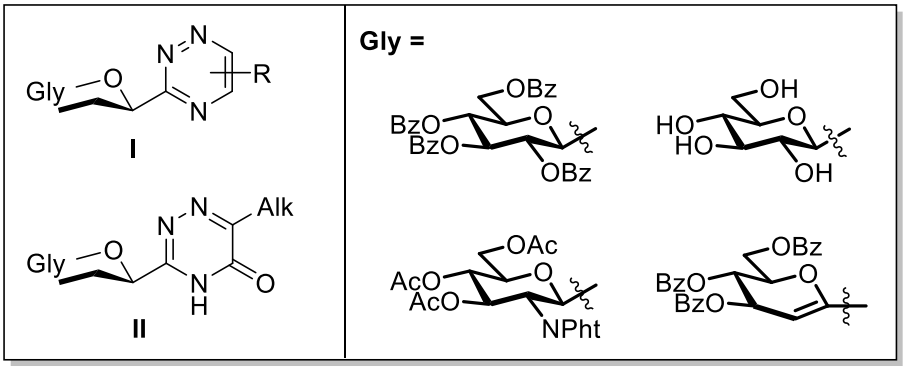


Figure 1.

In the presentation the synthetic details of these new six-membered *C*-glycosyl heterocycles will be summarized.

1. Bokor, É.; Kun, S.; Goyard, D.; Tóth, M.; Praly, J.-P.; Vidal, S.; Somsák, L. *Chem. Rev.*, **2017**, *117*, 1687−1764.
2. Štambaský, J.; Hocek, M; Kočovský, P. *Chem. Rev.* **2009**, *109*, 6729-6764.
3. De Clercq, E. *J. Med. Chem.* **2016**, *59*, 2301-2311.
4. Temburnikar, K.; Seley-Radtke K. L. *Beilstein J. Org. Chem.* **2018,** *14*, 772–785.

LECTIN-BASED GLYCOPROTEIN MICROARRAY: HIGH-THROUGHPUT GLYCOMICS TOOL

Jaroslav Katrlík, Lucia Pažitná, Paras Kundalia, Kristína Kianičková

Institute of Chemistry, Slovak Academy of Sciences, 845 38 Bratislava, Slovakia
E-mail: katrlik@yahoo.com

Changes in glycan structures of proteins and cell surfaces are in relationship with many biological functions (pathogen-host interactions, immune system, stem cells, fertilization, etc.) as well as with various diseases (cancer, inflammatory diseases, neurological diseases, psychiatric diseases, congenital diseases of glycosylation and others). We are focused on development and application of affinity bioanalytical techniques analysing glycans based on biochips for biomedicine, biology and biotechnology applications. As biorecognition elements are used lectins, proteins recognizing glycan structures enabling glycoprofiling of proteins, cells and tissues. Lectin-based glycoprotein microarrays provide effective high-throughput glyco-profiling of samples and screening/analysis of glyco-biomarkers. We applied our microarray platform for the study of glycan changes in number of various cases, as eg cancers, gestational diabetes mellitus, congenital disorder of glycosylation (CDG), attention-deficit hyperactivity disorder (ADHD), age-related glycosylation changes, or glycostructure of therapeutic proteins.

Acknowledgement: COST CA18132, APVV SK-SRB-21-0046, this publication is the result of the project implementation Centre for Advanced Therapies for Chronic Inflammatory Diseases of the Musculoskeletal System, ITMS2014+: 313011W410 supported by the Operational Programme Integrated Infrastructure funded by the European Regional Development Fund.

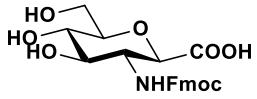
APPLICATION OF ACETYL-GROUP ON PYRANOID β-SAAs TO SYNTHESISE CHIMERA PEPTIDES WITH VARIABLE HYDROFILICITY

István Varga[a], Viktória Goldschmidt Gőz[b], András Perczel[b,c]

[a]*György Hevesy PhD School of Chemistry, Institute of Chemistry, Eötvös Loránd University, H-1117 Budapest, Hungary*
[b]*MTA-ELTE Protein Modeling Research Group, Eötvös Loránd Research Network, H-1117 Budapest, Hungary*
[c]*Laboratory of Structural Chemistry and Biology, Institute of Chemistry, Eötvös Loránd University, H-1117 Budapest, Hungary*
E-mail: vargaistvan6@gmail.com, andras.perczel@ttk.elte.hu

In the last years, different pyranoid and furanoid ringed β-sugaraminoacids (β-SAAs) were synthetized in our research group and used as building blocks in solid phase peptide synthesis (SPPS). To reach these goals, it was important to determine that the OH groups of the monosaccharide moiety needed to be protected, and that this protection was compatible with the commonly used Fmoc/^{t}Bu SPPS strategy.

To find answer to these questions, two β-SAAs were synthesized, namely Fmoc-GlcAPC-OH and Fmoc-GlcAPC(Ac)-OH in efficient and scalable route. The active ester forming and coupling abilities of these molecules were investigated by 1H NMR. It was found that both molecules readily form active esters, and slowly form peptide bond with H-Gly-OMe in an unstirred NMR tube. The stability of the acetyl groups was also followed by 1H NMR in widely used Fmoc-cleaving conditions, which showed high stability against basic conditions.



Fmoc-GlcAPC-OH

Fmoc-GlcAPC(Ac)-OH

Finally, these β-SAAs were used to synthesize GXG and GXXG model chimera peptides (where X is the β-SAA moiety). During the final cleavage, the acetyl groups were also stable, therefore Zemplén deacetylation was used to remove them, selectively, from the model peptides. Based on these results, the acetyl groups can be used as new SPPS protection for sugar amino acid moieties to tune the hydrophilicity of the peptides.

IN SILICO EXPLORATION OF ANTITROMBIN BINDING OF NOVEL HEPARIN PENTASACCHARIDE DERIVATIVES

Samar Alnukari, Krisztina Fehér

Molecular Recognition and Interaction Research Group, Hungarian Academy of Science, University of Debrecen, H-4032 Debrecen, Hungary
E-mail: samar.alnukari@science.unideb.hu

Heparin derivatives are used as antitrombotic drugs as they block multiple clotting factors of the anticoagulation pathway such as thrombin, factor Xa, factor IXa via activation of Antitrombin III (AT). AT is a plasma glycoprotein and a member of the serine protease inhibitor family (serpin). AT inhibits serine proteases, including several of the clotting factors, most importantly, thrombin (Factor IIa) and Factor Xa. Inducing antithrombin leads to anticoagulation effects which can treat or prevent many CVDs, heparin and its derivatives are one of these anticoagulation agents

Details of the antithrombin structure and its interaction with heparin pentasaccharides were studied by visualising structures of antithrombin after downloaded them from the PDB database (1E03, 2GD4, 3KCG) using two molecular visualizer programs Pymol & Maestro. Pentasaccharides bind to antithrombin by multiple bonds with essential amino acids like Arg129, Lys125, Arg47 and Lys114 causing a new P helix.

The new P helix makes an allosteric conformation to antithrombin, which makes RCL residues free and can connect to thrombin or fXa. Fondaparinux is one of these pentasaccharides, but we still aim to find new molecules induce antithrombin to be anticoagulant compounds.

AUTHOR INDEX

.

DEBCARB - GUIDE AND FAQS

VENUE

Learning Center at the main campus of the University of Debrecen (UD).

Visit the interactive campus map (https://debrecen.hostexp.com/?locale=en). The Learning Center is a triangle shaped building near the sport center.

Public transport: You can reach the UD main campus using Tram 1 (stop is signed by Red **X**). From the tram stop the Learning Center can be reached by a 5 min walk passing by the Main Building and the Chemistry Building.

Taxi service: +3652444444 or you can use BOLT application.

REGISTRATION

August 24, 14:00-15:30

The registration desk is open:

24/08 14:00-18:30

25/08 8:30-13:00

Your conference bag will contain the certification of attendance.

COMMEMORATION TO REZSŐ BOGNÁR

24/08 18:45 Chemistry Building, ground floor, laying a wreath at his memorial plaque. (Chemistry Building can be found between the Learning Center and the Main Building)

WELCOME PARTY

24/08 19:00-21:00

Learning Center Smart Bistro, buffet style.

LUNCHES

25/08 and 26/08 12:30-14:00 Learning Center Smart Bistro, buffet style.

CONFERENCE DINNER

26/08 19:00 Learning Center park, self-service grill party with piano music.

COFFEE BREAKS

Sweety and salty snacks, coffee, beverages.

LECTURES

Lectures will be held in the main lecture hall in the Learning Center. There will be no parallel sessions. Speakers are requested to upload their presentation in the lecture hall during the break preceding the given scientific session.

POSTER SESSION

25/08 and 26/08 15:45-16:45, in the lobby of the Learning Center. The presenting persons are requested to be at their posters in both days. Poster size: A0 portrait (90 cm wide 120 cm high).

POSTER PRIZES

There will be three poster prizes: two Springer e-book vouchers and a Biosynth Carbosynth Prize (150 EUR each), which will be awarded by the decision of the poster jury. The winners will be announced during the Closing session.

GUIDED TOUR AT THE MAIN CAMPUS

25/08 11:45, free guided tour in the Main Building and surroundings.

DEBRECEN SIGHTSEEING AND MUSEUMS

The sightseeing was cancelled due to minimal interest; cost will be reimbursed.

TRIP TO TOKAJ WINE REGION – SOCIAL PROGRAM

Departure: 27/08 9:30 Leaning Center

Arrival to Mád: 11:00, Program: visiting of Borsay Castle and Jewish Synagogue

13:30 Lunch with wine tasting

14:30 Wine cellar tour with wine tasting

Departure to Debrecen: 16:30 Estimated arrival: 18:00

IN CASE OF EMERGENCY

Call 112

CONTACT

debcarb@unideb.hu (general)

somsak.laszlo@science.unideb.hu (scientific issues)

csavas.magdolna@science.unideb.hu (DEBCARB)

toth.marietta@science.unideb.hu (COST)

herczeg.mihaly@pharm.unideb.hu (DEBCARB)

INTERNET ACCESS

Wifi connection: SSID: **DEBCARB**
Password: **DEBCARB2022**
and the eduroam network is also available

UNIVERSITY of DEBRECEN

NATIONAL RESEARCH, DEVELOPMENT AND INNOVATION OFFICE

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BIOSYNTH®
Carbosynth

GEDEON RICHTER

https://konferencia.unideb.hu/en/node/463