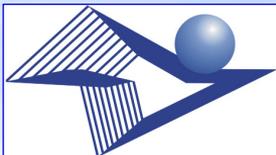


Institute of Chemistry Center for Glycomics



Slovak Academy of Sciences

Mission

The Institute is focused on **chemistry and biochemistry of carbohydrates** to unravel the information system "language of carbohydrates - glycode" in various biological and industrial processes with emphasis on:

- synthesis, biosynthesis, structure, and transformation of biologically important mono- and oligosaccharides, their derivatives, and glycomimetics;
- structure and functional properties of polysaccharides, their derivatives, and conjugates with other compounds;
- structure, function, and the catalytic mechanism of glycosyltransferases and glycoside hydrolases;
- development of physico-chemical methods for structural analysis of carbohydrates;
- gene engineering and nutritional and biologically active proteins;
- environmental and industrial glycobiotechnology, biotechnological potential of microorganisms, nanotechnology;
- ecology, taxonomy, and phylogenesis of yeasts and yeasts-like fungi.

Glycomics - a very perspective field

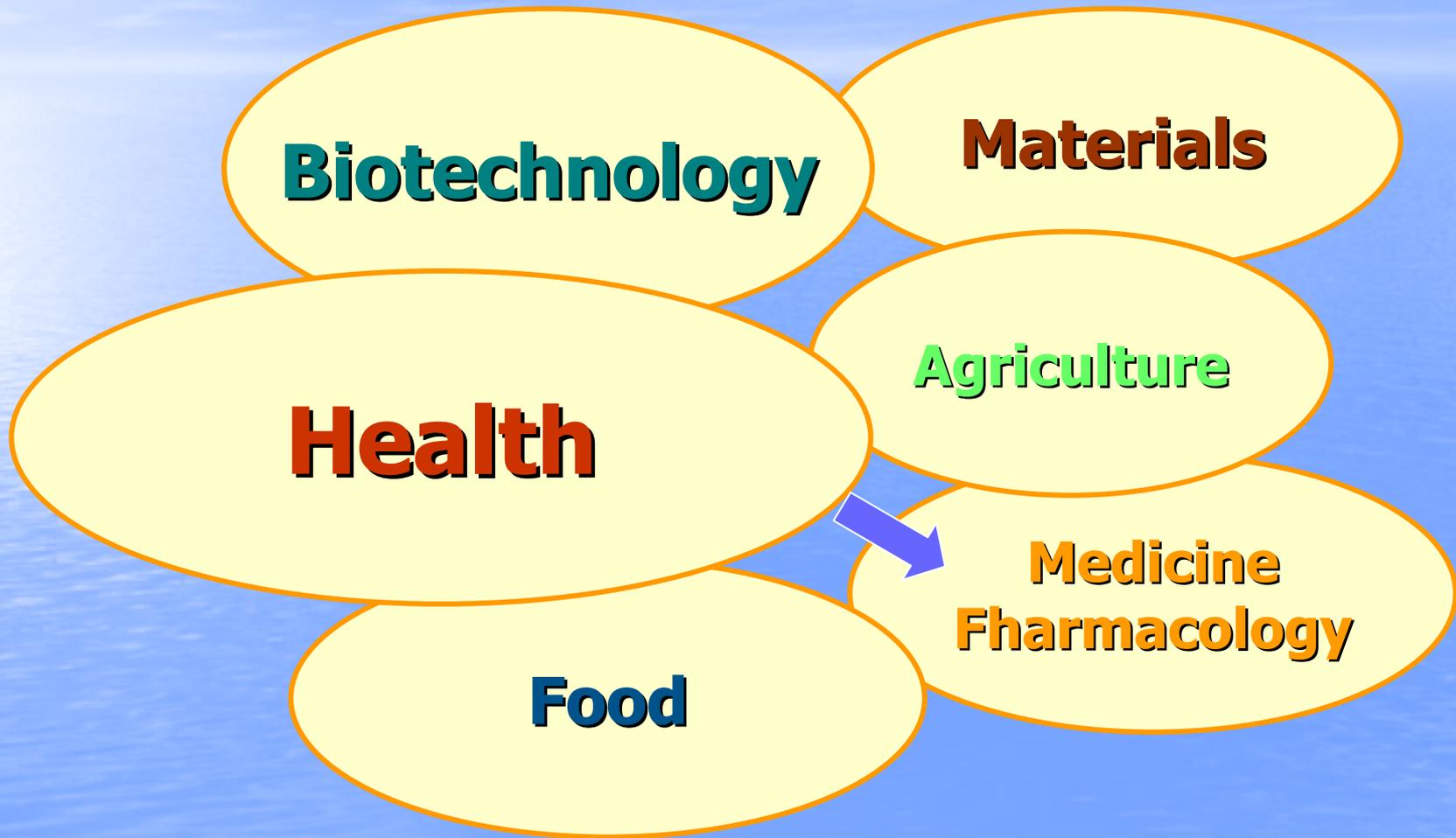
As a science's “**next big thing**”, the potential of **glycomics** research is expected to eclipse even that of the human genome project.

- Carbohydrates are involved in a broad range of biological processes, including intercellular adhesion, signal transduction, receptor activation, immune system modulation, protein folding and host-pathogen interaction.
- The design of novel **carbohydrate-based therapeutics** (glycotherapeutics, glycomimetics) promises a new avenue for the control of a variety of metabolic disorders (cancer, diabetes, cholera, tuberculosis, influenza, HIV, multiple sclerosis and rare diseases).

“Glycomics is a fertile area for the new generation of young scientists interested in gaining a more complete understanding of biology and diseases at a molecular level.”

(Ajit Varki, distinguished professor of medicine and cellular and molecular medicine:
Nature, 2007, 446, 1023-1029)

Output of R&D – Impact on Society





Center for Glycomics (from 2005)

<u>Department</u>	<u>* FTE</u>
1. Glycochemistry	10.70
2. Structure and Function of Saccharides	6.41
3. Glycobiology	7.54
4. Glycobiotechnology	13.91
5. Immunochemistry of Glycoconjugates	7.41
6. Enzymology of Saccharides	3.96
7. Glycomaterials	3.99
8. Culture Collection of Yeasts	2.71
Analytical Department	6.33
Production Department	1.00

*FTE = full time equivalent of employees engaged in R&D - average for 2012–2015

Employees

	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>AVN/Y</u>
All personnel	131	130	138	147	136.5
Employees with UD*	91	90	95	104	95
Employees with UD* (FTE)	67.9	71.3	73.7	79.5	73.1
Research staff**	82	81	87	96	86
Research staff** (FTE)	57.8	62.8	64.1	71.1	63.9
Research staff***	68	69	73	77	72
Research staff*** (FTE)	49.4	52.3	56.8	58.1	54.2
PhD students	25	27	23	25	25
Instit. salary budget (mil. €)	1.140	1.148	1.154	1.182	1.156

*Employees with university degree – total number.

**Research staff with university degree – employees engaged in research.

***Research staff with PhD degree – employees engaged in research.

AVN/Y = averaged number per year (for 2012–2015).

Budget

<u>Resources (in mil. €)</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>AVN/Y</u>
Salary budget ¹	1.140	1.148	1.154	1.182	1.156
Overheads ¹	0.079	0.070	0.064	0.065	0.069
Add. salary budget ²	0.066	0.153	0.243	0.240	0.176
External ²	1.042	0.409	0.813	0.723	0.747
Internal ³	0.201	0.150	0.179	0.288	0.205
Overall budget ⁴	8.584	3.627	3.811	24.201	10.055

¹Institutional resources: from SAS.

²External resources: from ongoing and new research projects – national (SRDA, RA, VEGA, COST, Centres of Excellence; international (7FP EU, ESF, custom research, bilateral agreements, ...).

³Internal resources: mainly from commercial activities of Production Department and Analytical Department).

⁴Including resources from SF EU.

Research outputs

	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>AVN/Y</u>
CCC papers	63	52	60	68	60.8
WoS & Scopus papers	15	12	4	9	10.0
Total	78	64	64	77	70.8
Other papers	0	0	1	0	0.3
Chapters in monographs	6	2	3	2	3.3
Papers in proceedings	26	13	20	12	18
Lectures, posters	115	108	168	129	130
Citations (WoS & Scopus)	1851	2237	2481	2654	2306
Citations (other)	39	29	34	58	40
Averaged IF	2.594	3.176	2.408	3.405	2.895

Note: Citations and averaged IF are given for period of 2011–2014

Summary of scientific output (for period of 2012–2015)

- CCC, WoS & Scopus publications: **283**
 - Impact Factor ranges from **0.196 to 46.568**; averaged IF = **2.895**
[for previous assessment period (2007–2011): averaged IF = **2.266**]
- Chapters in monographs: **13**
- Publications in other journals: **1**
- Publications in proceedings: **71**
- WoS & Scopus citations: **9223**
 - Number of citations per one publication: **32.6**
(for previous assessment period: **21**)
- Patents and patent applications: **3**
- Lectures and poster presentations: **520**

Note: Citations and averaged IF are given for period of 2011–2014

National research projects and cooperations

➤ **VEGA (SGA) projects - 35**

➤ **APVV (SRDA) projects - 21**

(including 11 projects where IC SAS is project coordinator)

➤ **SAS Centre of Excellence (Glycomed) - 1**

➤ **Bilateral contracts and projects - 11**

Cooperations within Slovakia: Comenius University in Bratislava (faculties in Bratislava and Martin), Slovak University of Technology in Bratislava, Slovak Medical University, Slovak University of Agriculture in Nitra, Pavol Jozef Šafárik University in Košice, University of Ss. Cyril and Methodius in Trnava, Alexander Dubček University in Trenčín, National Agricultural and Food Centre, Institute of Apiculture, International Laser Centre, Axxence Slovakia s.r.o., HighChem s.r.o., Saneca Pharmaceuticals a.s., Tau-Chem s.r.o. (now Biosynth), ...

International research projects

- **FP7 EU – 7 projects**
(including **1 ERC project** – the first and till now, the only in Slovakia)
- **EU Structural Funds (ERDF) – 8 projects**
(including 5 projects where IC SAS is project coordinator)
 - **ESF RNP – 2 projects**
 - **Multilateral (COST) – 10 projects**
 - **Others (SASPRO) – 1 project**
 - **Bilateral (with funding) – 6 projects**
- **Bilateral (without direct funding) – 17 projects**

Significant international cooperation

University of Oxford, University of York, University of Bath, University of Leeds, Manchester Intedisciplinary Biocentre (UK); Lund University, Chalmers University of Technology (Sweden); VTT Technical Research Centre of Finland, Åbo Academi University (Finland); Norwegian University of Life Sciences (Norway); University of Copenhagen, Novozymes AS (Denmark); University of Natural Resources and Life Sciences (BOKU) in Vienna, University of Vienna (Austria); University of Nancy, University of Liege, Blaise Pascal University, Grenoble Alpes University, UMR CNRS, INRA (France); Leibnitz Institute DSMZ (Germany), Wroclaw University of Technology (Poland); University of Debrecen (Hungary); Ege University (Turkey); Complutense University of Madrid, University of Cordoba (Spain); University of Bari, University of Milan, University of Pisa, Institute for Macromolecular Studies, Illycaffè S.p.a. (Italy); University of Trás-os-Montes and Alto Douro (Portugal); Russian Academy of Sciences; University of Belgrade (Serbia); USDA ARS Western Regional Research Center, NIH (USA); Food Research Institute (Japan); Qatar University (Qatar); Stellenbosch University, University of KwaZulu-Natal (South Africa); University of Adelaide (Australia); The Catholic University of Korea; University of Burdwan (India); University of Chemistry and Technology in Prague, Masaryk University, Brno University of Technology (Czech Republic), ...

PhD study

Accredited programmes of doctoral studies

➤ Faculty of Chemical and Food Technology STU

- Organic chemistry
- Physical chemistry
- Macromolecular chemistry
- Biochemistry
- Biotechnologies

➤ Faculty of Natural Sciences CU

- Organic chemistry
- Physical chemistry
- Biochemistry
- Biotechnologies
- Microbiology

Period of validity (for all programmes):

Since 2015 (last accreditation of supervising universities) until next complex accreditation of STU and CU (for 4-year internal and 5-year external studies).

PhD study

	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>AVN/Y</u>
Internal	25	27	23	24	24.8
External	2	4	6	1	3.3
Supervised at ext.	2	3	3	2	2.5
Defended theses	7	8	8	8	7.8
No. of supervisors	38	39	42	47	41.5

Limitations (quota from SAS):

No. of starting PhD students: max. 4–5/year supported from SAS

Total no. of PhD students: max. 15/year supported from SAS

Limitation by law: Period for internal PhD study = 4 years
Period for external PhD study = 5 years

Postdoctoral positions and visitors (2012–2015)

- Supporting Fund of Stefan Schwarz – 8 postdocs
 - SASPRO – 1 postdoc
 - 7 FP EU (ERC) – 2 postdocs
- From IC SAS in foreign laboratories – 12 postdocs
 - Visitors from abroad – 47*

*Among them: 7 for more than 1 month; 4 for more than 2 months; 8 for more than 3 months; 1 for 5 months; 1 for 6 months

Other outputs

❖ Major international conferences organized by IC SAS

- 40th Annual Conference on Yeasts (2012)
- EAST-NMR Meeting of Young Researchers (2012)
- 30th ISSY: Cell Surface & Organelles in Yeasts (2013)
 - 41st Annual Conference on Yeasts (2014)
 - 13th Bratislava Symposium on Saccharides (2014)
- PROSENSE Workshop "Application of Lectins in Various Format of Analysis for Glycoprofiling" (2014)
 - 42nd Annual Conference on Yeasts (2015)
 - 43rd Annual Conference on Yeasts (organized for 2016)
- Decision of ICO: XXXII ICS 2024 will be organized by IC SAS

❖ Edition of scientific journal

- **Chemical Papers** (since 1946; 12 issues/year)

The only Slovak chemistry journal (English); co-published and distributed by Versita/Springer; since 2015 by De Gruyter; indexed/abstracted in: CCC, WOS, Scopus, CAS, ...; IF2011 = 1.096, IF2012 = 0.879, IF2013 = 1.193, IF2014 = 1.468, IF2015 = 1.326 (for Chemistry, Multid.: MIF = 1.798; for Chemistry, Miscellaneous: quartiles = Q2/Q3).

Other outputs

❖ Production Department

- Production of rare saccharides for commercial and research purposes
- In many items, the Institute of Chemistry is the unique producer
- In portfolio is more than 70 different compounds
- Income: 184 899 € in 2012; 131 555 € in 2013
168 907 € in 2014; 230 936 € in 2015

Totally: 716 297 € in 2012–2015

Average: 179 075 € per year

❖ Culture Collection of Yeasts (CCY)

- The CCY has the status of the International Depository Authority for the purpose of patent procedure (according to the Budapest Treaty). Approx. 3600 yeast cultures, among them the type strains, yeasts of medical importance (pathogenic yeasts), industrial importance (brewing and wine yeasts) and isolates from various natural sources (water, soil and plant environments, insects) are maintained. As a service collection it offers: isolation of yeast cultures from various environments, deposit of yeast cultures (in an open part of the collection, safe deposit, patent deposit), identification and a long-time storage of yeast cultures.

Popularisation activities

- Articles in press media: 40
- Appearance in telecommunication media: 14
- Public popularisation lectures: 47
- Exhibitions & trade fairs (Agrokomplex, Techforum, Slovmedica) (**each year**; several prizes and awards were presented)
- Science and Technology Week in Slovakia (**each year**)
- Excursions for high school students:
 - ◆ project “The Science for Future” (122 students; 4 high schools)
 - ◆ project “Superschool” (7 high schools attended)
- Individual excursions for groups of universities’s students
- The Doors Open Day (regularly **each year** in November)

Summary of specialties

- **Management and administration of the main building**
 - ◆ 6 institutes of SAS reside in the main building but all servicing and maintenance staff (9 employees) is incorporated only into staff of IC SAS
- **Partial reconstruction of the Production Department building (2013)**
 - ◆ decrease of the income from the sales of products
- **Complex reconstruction of the Pavilion of Glycomics (additional building – instrumental base; 2012)**
- **Institutional Library (2 employees)**
 - ◆ offers usual librarian, recherche and reprographic services
 - ◆ holds 25482 book units including more than 30 titles of periodical journals.

Visions/Strategies/Perspectives

- Studies on elucidation of the structure-catalytic activity-function relationship of the enzymes degrading plant cell wall polysaccharides and studies on systems biocatalysis in the field of protein-glycan recognition.
- Development of original immobilised biocatalysts and high-throughput optical biochips and biosensors integrating nanotechnology tools for determination of glycobiomarkers for cancer, autoimmune and neurodegenerative diseases.
- Design, quantum-chemical simulations, synthesis and structural analysis of a next generation of the potential inhibitors of glycosyltransferases and glycoside hydrolases; application of biocatalytic reactions in glycochemistry.
- Studies on polysaccharides and their conjugates isolated from higher plants (medicinal, agricultural) and from lowest plant organisms (microalgae) with potential biological effects (applications in industry and medicine).
- Studies on immunomodulatory conjugate preparations based on surface carbohydrate antigens isolated from microorganisms (to develop highly efficient sub-cellular vaccines against threatening new emerging and old pathogens).
- Studies on yeasts related to the soil adjacent to fruit trees; authentication, a long-time storage and a data set building on the yeast cultures.

SWOT

- STRENGTHS:**
1. Human potential and quality of research
 2. Infrastructure (new instrumental technique)
 3. International and domestic recognition and cooperation (universities, research public and private institutions, commercial area)
 4. Production Dept. (benefits of income)

- WEAKNESSES:**
1. Employee's age structure

- OPPORTUNITIES:**
1. External financial resources
 2. Funds for PhD study from other sources

- THREATS:**
1. Sustainability of operation and maintenance of expensive instrumental technique
 2. Trends in economical situation (budget, income from grants and Production Dept., legislative, ...)
 3. Sanitary fittings and facilities in the building
 4. Accreditation in some programmes of PhD study

Thank You (1st)!

Invitation

14th BRATISLAVA SYMPOSIUM ON SACCHARIDES
"Glycochemistry for biology and medicine"
June 25–30, 2017, Smolenice Castle, Slovakia



Thank You (2nd)!

