Questionnaire
Summary of the main activities of a research institute of the Slovak Academy of Sciences

Period: January 1, 2016 - December 31, 2021

1. Basic information on the institute:

1.1. Legal name and address

Institute of Chemistry, Slovak Academy of Sciences
Dúbravská cesta 9, SK-845 38 Bratislava, Slovakia

1.2. URL of the institute web site

http://chem.sk

1.3. Executive body of the institute and its composition

Directoriat	Name	Year of birth	Years in the position, from - to
Director	Ing. Miroslav Kóš, DrSc.	1952	2011 – 2021
Deputy director	Mgr. Stanislav Kozmon, PhD.	1978	2017 – 2021
Deputy director	RNDr. Ján Gajdoš, PhD.	1953	2011 – 2017
Scientific secretary	Mgr. Jana Blahutová, PhD.	1980	2019 -
Scientific secretary	RNDr. Desana Lišková, PhD.	1953	2009 – 2018

Add more rows for any changes during the evaluation period

1.4. Head of the Scientific Board

Ing. Vladimír Mastihuba, PhD.; 2017 – 2021
Ing. Ján Tkáč, DrSc.; 2010 - 2017

1.4.1 Composition of the International Advisory Board

Professor Sabine Flitsch - School of Chemistry & Manchester Institute of Biotechnology, United Kingdom

Professor Jésus Jiménez-Barbero – CIC bioGUNE, Parque Tecnológico de Bizkaia, Spain

Professor Paul Kosma – Department of Chemistry, University of Natural Resources and Life Schiences, Vienna, Austria

Assoc. Prof Evangelos Topakas – Biotechnology Laboratory, School of Chemical Engineering, National Technical University of Athens, Greece

Professor Paula A. Videira, PhD. - UCIBIO, Departamento Ciências da Vida, Faculdade de Ciências e Tecnologia, Univerdidade Nova de Lisboa, Portugal

Prof. Dr. Ľubor Borsig – Institute of Physiology, University of Zurich, Switzerland

Professor Rachel Auzély-Velty - Centre de Recherches sur les Macromolécules Végétales (CERMAV-CNRS) Université Grenoble Alpes, France

1.5. Basic information on the research personnel

1.5.1. Fulltime equivalent work capacity of all employees (FTE all), FTE of employees with university degrees engaged in research projects (FTE researchers)

2016		2017		2018		2019		2020		2021		2016-2021	
FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	average FTE all per year	average FTE researchers per year
114.66	67.82	114.19	68.14	109.43	64.69	113.86	68.47	118.87	74.90	120.16	73.67	**115.20**	**69.62**

1.5.2. If applicable, add also a short information on the merger of the institute in the evaluation period. You can also add rows in the above table corresponding to the founding institutes

Not applicable.

1.6. Basic information on the funding of the institute

1.6.1. Institutional salary budget, other salary budget[1], non-salary budget[2]

Salary budget	2016	2017	2018	2019	2020	2021	average
Institutional salary budget *[millions of EUR]*	1.127	1.646	1.905	2.172	2.435	2.406	**1.949**
Other salary budget *[millions of EUR]*	0.893	0.399	0.249	0.287	0.501	0.641	**0.495**
Total salary budget *[millions of EUR]*	2.020	2.044	2.154	2.459	2.936	3.047	**2.444**
Non-salary budget *[millions of EUR]*	1.221	1.022	0.953	1.344	1.334	1.446	**1.220**

1.7. Mission Statement of the Institute as presented in the Foundation Charter indicating the years when it was adopted and revised

a) The Institute of Chemistry of the Slovak Academy of Sciences is aimed at the scientific and research activities in the field of chemistry and biochemistry of saccharides with emphasis on following directions:

[1] Salary budget originating outside the regular budgetary resources of the organization, e.g. from the project funding.
[2] Includes Goods and Services and PhD fellowships

- synthesis, biosynthesis, structure, function, and transformation of biologically important mono- and oligosaccharides and their derivatives;
- structure and functional properties of polysaccharides, glycoproteins and their conjugates with other polymers;
- structure, function, and mechanism of action of glycanases;
- development of physicochemical methods for structural analysis of carbohydrates;
- gene engineering of nutritional and biologically active proteins;
- environmental and industrial biotechnology, biotechnological potential of microorganisms, nanotechnology;
- ecology, physiology, taxonomy, and phylogenesis of yeasts and yeasts-like microorganisms;

b) The Institute contributes to development of new technologies for isolation of natural compounds and preparation of new materials based on saccharides and their derivatives for commercial purposes.

c) The Institute realises its own production of rare saccharides for commercial purposes. In this respect, the Institute provides facilities for a large-scale isolation of natural compounds and synthesis of saccharides, cooperations, know-how, licences, and consulting and expert's services. For popularisation of its outputs, the Institute takes part in specialised exhibitions and trades.

d) The Institute closely cooperates with many research establishments and universities abroad and within the country, mainly in the framework of common research grant projects and agreements.

e) The Institute provides publication of research results through scientific periodicals, lectures, and patents. The main editing activity of the Institute is the publishing of Chemical Papers, the only Slovak chemistry journal printed in English, published and distributed by De Gruyter (2015–2016) (during 2006–2014 it was co-published by Versita and Springer-Verlag and distributed by Springer-Verlag); since 2017 it is published and distributed by Springer Nature.

f) The Institute regularly organises international scientific conferences/symposia (Bratislava Symposium on Saccharides, Annual Conference on Yeasts).

g) The Institute houses the Culture Collection of Yeasts, the largest yeast collection in Central Europe, registered as a member of ECCO and WFCC.

h) The Institute is a training base for education of experts and scientific workers in research fields: organic chemistry, biochemistry, microbiology, physical chemistry, macromolecular chemistry, biotechnology, and plant biology. In these fields, doctoral and postdoctoral studies, including also foreign students, are organised. The Institute also provides participation on pedagogic process at universities.

In addition to above mentioned scientific directions, current research activities are also focused on following specialised area:

- structure, function and catalytic properties of glycoside hydrolases, carbohydrate esterases, glycosyltransferases and transglycosylases;
- biochips and biosensors for determination of activity of carbohydrate-active enzymes and for determination of structure of saccharides;
- environmental and industrial glycobiotechnology; biotechnological potential of selected microorganisms and plants, biofuel cells and nanotechnology.

1.8. Summary of R&D activity pursued by the institute during the evaluation period in both national and international contexts. Describe the scientific importance and societal impact of each important result/discovery. Explain on general level – the information should be understandable for a non-specialist (recommended 5 pages, max. 10 pages for larger institutes with more than 50 average FTE researchers per year as per Table 1.5.1.)

Researchers at the Institute of Chemistry of the Slovak Academy of Sciences tackle some of the most upfront research problems of today. With the widest scope in terms of research tools, they apply new progressive approaches collaborating with both domestic and foreign universities as well as various scientific institutions. Their research is being funded through 101 national resources, as well as through 39 foreign projects. They have achieved unique outputs thanks to the outstanding research infrastructure available at the Institute. As a proof of excellence, the citation overview of publications published in an evaluated period of 2016-2021 gives one CC paper with 250+ citations, four CC publications with a number of citations in the range of 100-200, six CC scientific works with a number of citations in the range of 50-100, and sixteen CC articles with a number of citations in the range of 25-50. The average impact factor (IF) value of 6.40 was determined for selected publications documenting the most important results of basic research (total number of publications of 69 for consideration). During the evaluated period of 2016-2021, 2 books and 9 chapters were published.

The Institute is a training base for a number of fields: organic chemistry, biochemistry, microbiology, physical chemistry, macromolecular chemistry, and biotechnologies. The Institute supports doctoral and postdoctoral studies for domestic as well as foreign students.

A number of research directions and activities are pursued at 8 individual departments—*Department of Enzymology of Saccharides*, *Department of Glycobiology*, *Department of Glycobiotechnology*, *Department of Glycochemistry*, *Department of Immunochemistry of Glycoconjugates*, *Department of Glycomaterials, and Department of Structure and Function of Saccharides* and *Culture Collection of Yeasts*. Moreover, additional divisions, namely *Analytical Department, Production Department*, and *Library* and *Chemical Papers—aneditorial office,* have provided profound assistance to the research activities at the Institute. A detailed description of the research interest is given in the following paragraphs.

Human disease diagnostics

Our society is dealing with many different civilisation and rare inherited diseases. Some of them are related directly to saccharide metabolism; others are associated with the occurrence of modified glycan structures. Several scientific groups at the Institute are investigating aberrant glycosylation as a tool for early diagnostic procedures and/or biomarker discovery.

The research in the *Laboratory of Glycomics and Proteomics* is focused on structural analysis of glycans by mass spectrometry and their role in human health and disease. Advanced glycomics has been studied in several large-scale international and domestic collaborations, for example, together with the Center for Inherited Metabolic Diseases (National Institute of Children`s Diseases). This collaboration has led to many successfully completed diagnoses of patients with rare diseases (Chapter 2.1.2, Art. no. 31). For example, the clinical and experimental results were summarized in an article describing a new homozygous mutation in the *ALG12* gene, with only 15 patients known worldwide (Chapter 2.6.1., Case study 3).

The detection of sugars and larger glycan structures is rather technically demanding with mass spectrometry (MS) used as one of the leading analytical tools. In addition to advanced glycan analyses, existing facilities were used to establish an MS-based proteomic laboratory during the reporting period. The laboratory has quickly become a substitute for a core facility that does not exist at university or academic level in Slovakia. Scientists have developed numerous strategies for different types of proteomic experiments, including untargeted proteomic analysis of complex protein samples, identification of posttranslational modifications, or determination of protein glycosides with their individual occupancy analysis. Among other results, the proteomic group contributed to the description of mitochondria succinylome in yeast, analysis of the unusual structure of oligomannan in *Mycobacterium tuberculosis* (Chapter 2.1.2, Art. no. 4) or to description of the glycosylation status of recombinant ceruloplasmin (Chapter 2.1.2, Art. no. 32, 34 and 35).

The *group of Glycobionanotechnology* focuses on the integration of nanotechnological tools to design various bioanalytical devices and biosensors applicable in the detection of a wide range of bioactive biomolecules and cancer biomarkers (Chapter 2.1.2, Art. no. 8). Other approach includes the application of nanomaterials for a robust glycan separation.

In particular, the researchers are working on the application of gold nanoparticles (Chapter 2.1.2, Art. no. 41), hybrid nanoparticles (nanoparticles with magnetic core and golden shell; Chapter 2.1.2, Art. no. 7), carbon nanotubes, graphene (Chapter 2.1.2, Art. no. 9), and MXene (hydrophilic 2D nanomaterial) to design electrochemical biosensors to detect cancer biomarkers such as Prostate-Specific Antigen (PSA) with high analytical performance. The utilization of magnetic nano- and micro-particles was successfully applied for the enrichment of cancer biomarkers from blood serum with subsequent detection in ELISA-like formats (Chapter 2.1.2, Art. no. 27). ELISA-like formats of detection of fluorescent lectin biochips were successfully applied for the identification of novel prospective glycan-based cancer biomarkers for cancer of prostate, testicles, breast and colorectal cancer (Chapter 2.1.2, Art. no. 23). Some of them show great potential for application as cancer biomarkers for the early-stage diagnostics, prognosis, therapy monitoring, or identification of patients resistant to chemotherapy. Recently, the scientists have started to evaluate the true potential of exosomes (small extracellular vesicles) as a rich source of active biomolecules with the potential to become cancer biomarkers.

Much attention has also been paid to the development of lectin-based protein microarray biochips that have been designed and optimized to measure glycan changes in many sample types for medical and biotechnology applications. Lectin-based microarray method (Chapter 2.1.2, Art. no. 12 and 69), for example, enabled highly sensitive glycoprofiling (pM level) of insulin-like growth factor receptors of colorectal cancer as potential cancer biomarkers (Chapter 2.1.2, Art. no. 53). Innovative analytical methods have also been developed to determine the glycosylation of therapeutic proteins on two platforms, lectin-based microarray and MALDI-MS. The lectin lateral flow assay (LFA) biosensor in the form of a paper strip for the glycoprofiling of the PSA biomarker has been developed at the Institute. This biosensor can serve as a point-of-care device and is the first published LFA biosensor to monitor glycosylation changes in the world. Also, other optical biosensors, based on a surface plasmon resonance platform, were prepared and successfully applied for the analysis of biomarkers and other biorecognition events. A lectin-based assay in ELISA format with fluorescence detection was developed to measure neuraminidase inhibitors.

Substantial effort was devoted to revealing the redox properties of novel and interesting forms of 2D nanomaterial MXene. The researchers in this scientific team are at the forefront of the study of the electrochemical properties of MXene, and the group was the first one that reported the oxidation peak of MXene compromising the redox properties of such nanomaterial. The MXene-based sensors were then applied for the detection of toxic or biologically active molecules with sensitivities and limits of detection amongst the best ones described so far (Chapter 2.1.2, Art. no. 65 and 38). The group also studied the proper conditions for the synthesis of MXene in order to achieve high electrochemical activity of MXene (Chapter 2.1.2, Art. no. 24) and ways for MXene modification by zwitterions resisting biofouling on one side and allowing immobilisation of bioaffinity molecules on the other side. Recent pioneering studies have been aimed at finding MXene material that would help to enrich glycans from complex matrices for further glycoproteomics analysis.

Advances in the immunoglycomics

Immunochemistry of Glycoconjugates deals with the synthesis and structural characterisation of oligosaccharides or artificial glycoconjugates and their modifications to visualise or bind them to other molecules. The scientists in this department are interested in their preparation as potential immunogens, receptor agonists/antagonists, and antibodies in vaccine research, sensors, and diagnostics (Chapter 2.1.2, Art. no. 20). Common yeast *Saccharomyces cerevisiae* and the well-known pathogen *Candida albicans* are used mainly used as model organisms and a source of polysaccharides within the infrastructure of the Institute – *The Culture Collection of Yeasts*.

The *Immunological laboratory* mainly investigates the glyco-/bioimmunological efficacy of synthetically and naturally prepared immunogens that mimic fungal virulence factors. The research stressed the importance of immunoglycomics focusing on the role of oligo-/polysaccharides of relevant human fungal pathogens in the induction of immune responses at the molecular, cellular, subcellular, and functional levels of innate and acquired immunities (Chapter 2.1.5, Art. no. 14). The antigenic formulas represented well-defined structures,

suitable not only for incorporation into the vaccines but also promising for the development of *in vitro* diagnostics of human candidiasis (Chapter 2.1.5, Art. no. 15 and 16). The methodology was adapted and optimized for the animal model and the relevant immortalized and primary cell lines to be as close as possible to transmit information towards the human application. Scientists do their best for Replacement, Reduction, and Refinement (3R), avoiding tests on animals to the maximum possible extent.

Another example of expertise in the framework of international collaboration is leading to a self-adjuvanted carrier for the construction of vaccines, which are safer and do not need potentially hazardous or unpopular adjuvants. The purest *O*-specific polysaccharide-core fragment from the lipopolysaccharide reported to date using sophisticated and optimized methods has been prepared to define the polysaccharide immune targets against *Vibrio cholerae* (specifically O139; Chapter 2.1.2, Art. no. 58).

Inappropriate and excessive use of antibiotics led to the emergence of various multidrug-resistant bacterial strains. Together with the slow development of new antibiotics, this poses a growing global health concern. Cationic polysaccharides have been proposed at the Institute and have shown promising antimicrobial properties. Yeast polysaccharides represent a readily available source of biodegradable materials for tailored derivatives that could be effective in biomedical applications. Prepared cationic derivatives of yeast mannan effectively inhibit bacterial growth, including multi-resistant *Staphylococcus aureus* (MRSA), which is considered, along with other resistant bacteria, to be the leading cause of nosocomial infections (Chapter 2.1.2, Art. no. 17 and 30).

Two significant discoveries have been made in the research of the antimicrobial properties of royal jellies (RJs) in protecting honeybee larvae from a serious disease known as American foulbrood (AFB). The co-workers from the *Laboratory of apidology* discovered that 10-HDA (Chapter 2.1.5, Art. no. 4), the major fatty acid of RJs, is *in vitro* able to inhibit different strains of *Paenibacillus larvae*, the causative agent of AFB, with different pH-dependent efficacies. The findings suggest that 10-HDA is an important antipathogenic substance of RJs. Additionally, they found that the saccharides fructose and trehalose, occurring in higher amounts in RJs, represent important sporulation factors selectively increasing the sporulation of *P. larvae* strains with different ERIC I and ERIC II genotypes (ERIC, enterobacterial repetitive intergenic consensus, Chapter 2.1.5, Art. no. 3). The findings led to the development of a new procedure for the preparation of spores from different strains of the pathogen for applications in exposure bioassays.

Plant polysaccharides

The main research line associated with the chemistry and biochemistry of plant carbohydrates from different sources (pumpkin biomass (Chapter 2.1.5, Art. no. 8), spruce sawdust, hazelnut husks (Chapter 2.1.2, Art. no. 42), and microalgae or plants products) is based on a comprehensive structure investigation. Cultivation of green microalgae allows the significant production of metabolites, which undoubtedly include extracellular polysaccharides (EPS; Chapter 2.1.2, Art. no. 15). Biological activity tests showed that EPS isolated from the *Chlorella vulgaris* (Chapter 2.1.2, Art. no. 52 and 67) and *Dictyosphaerium chlorelloides* algae had significant bronchodilator, anti-inflammatory (Chapter 2.1.2, Art. no. 56) and antitussive effects on the tested animals. EPS produced by the mentioned algae appears to be promising in preventing chronic airway inflammation, which is an essential pathogenic mechanism of many respiratory diseases, including bronchial asthma.

Among the plants studied in the Institute laboratories, *Sanguisorba officinalis* L. was the one from which the macromolecular complex was isolated and structurally characterised. *In vitro* tests of anticoagulant activity have shown its significant inhibitive effect on the creation of plasma clots. *Fagus sylvatica* was studied as a renewable source of glycomaterials for various applications in pharmacy. The separated glucuronoxylan derivatives after subsequent sulfation showed antiviral activity against herpes virus strains, comparable to that of heparin.

Investigation of 3D structure has shown that alkyl glycosides take forms depending on the location and type of substituents. This evidence is important to describe the interactions between glycosides and proteins, and thus to understand their biological activity. Toxicity, antimicrobial activity and biodegradability studies on *Pseudomonas* bacteria also showed a

significant relationship between the structure and biological activity of the studied derivatives, aiming for the potential utilization of these compounds in medicine and pharmacy.

In the case of biomass from agricultural waste, our scientists confirmed that this biomass may not only be an ecological source of energy, but also a source of original substances with appealing biological properties.

The issue of water remediation is very current, and the involvement of microalgae brings benefit in the synthesis of hybrid composites applicable in wastewater treatment in the form of biosorbents. At the same time, they can form a substrate for the incorporation of ZnO nanoparticles with photocatalytic properties denoted as efficient bio-nanohybrid catalysts (Chapter 2.1.2, Art. no. 21 and 25).

The *Plant physiology group* has focused on the composition of the plant cell wall, a dynamic structure acting as the first barrier against pollutants. In 2013, the training schools in Bratislava (Slovakia); Parma (Italy) and Turku (Finland) established research on changes in the structure of the cell wall that continues to this day and brought to light new details about the structure and response of maize cell walls to cadmium and/or auxin and highlighted the importance of cellulose and lignin in stress tolerance. New and optimised methods for monitoring cell wall formation on protoplast surfaces and intake of cadmium during long cultivations were developed (Chapter 2.1.5, Art. no. 2). Various compounds (galactoglucomannan oligosaccharides from plant cell walls, auxin, and silicon (Chapter 2.1.2, Art. no. 36 and 37), which could be utilised in the agriculture, were found to improve the survival of plants cultivated in the presence of cadmium. The positive effects of silicon in plants suffering from cadmium or arsenic stress and the formation of silica aggregates as a barrier for the toxic element entry were confirmed, published in prestigious journals, and well-received in the scientific community. Furthermore, new alternatives to improve long-term cultures *in vitro* of *Harpagophytum procumbens* (a medicinally important plant) were developed.

The role of enzymes in the phytomass degradation

Due to the complexity of the saccharides, the scientists focused on their decomposition by applying efficient enzymes. The crucial step of the study is the searching, isolation, and description of novel enzymes. Thus, xylanolytic enzymes responsible for the natural degradation of xylan (plant polysaccharides) are some of the most studied by some of our colleagues (Chapter 2.1.2, Art. no. 5, 50 and 16). An enzyme crucial for xylan degradation to smaller oligosaccharides is endoxylanase, belonging to several glycoside hydrolase families. The best characterised endoxylanases are classified in families 10 and 11, which are non-specific enzymes that prefer non-substituted regions of xylan. There are other so-called appendage-dependent xylanases, *i.e.*, their action is determined by polysaccharide decoration. One type of the appendage-dependent xylanases is glycoside hydrolase family of 30 glucuronoxylanases that are strictly dependent on the presence of glucuronic acid or 4-*O*-methylglucuronic acid side chains in the substrate (Chapter 2.1.2, Art. no. 30).

In the evaluated period, eukaryotic GH30 xylanases and their comparison with prokaryotic counterparts were examined. It has been found that eukaryotic GH30 members are grouped into the GH30_7 subfamily with much more diverse specificity. Moreover, some GH30_7 glucuronoxylanases (Chapter 2.1.2, Art. no. 29) show a minor xylobiohydrolase activity, releasing disaccharide xylobiose from the non-reducing end. The ratio of glucuronoxylanase and xylobiohydrolase activity is influenced by subtle changes of the active site. In a particular case, the ratio is completely shifted in favour of the exoactivity, which led to discovery of a completely novel catalytic activity within the GH30 family (Chapter 2.1.2, Art. no. 63). Subsequently, the specific xylobiohydrolases (without the assigned EC number) were suggested to be grouped into a new subfamily GH30_10. The knowledge about the GH30 enzyme specificity allows selective production of target oligosaccharides ranging from substituted long xylooligosaccharides to disaccharide xylobiose which may be employed in the pharmaceutical and food industry.

The ability of certain xyloglucan endo-transglycosylase isoforms (Chapter 2.1.2, Art. no. 2; Chapter 2.1.5, Art. no. 9) catalysing the transfer of xyloglucan and cellulose fragments to pectin was demonstrated worldwide for the very first time by the experts from the Institute (Chapter 2.1.2, Art. no. 26). This discovery could change the outlook on the role of this enzyme

in the creation and re-structuralization of plant cell walls, as well as modify the existing cell wall models. This area of research represents a novel and in plants not yet described possibilities of bond formations between structural polysaccharides.

Synthesis, conformational, and structural analysis of biologically active saccharides and other derivatives

With respect to the history and long tradition of the Institute as *the Centre of Glycomics*, scientific activities in the *glycochemistry* field were mainly devoted to the development of novel synthetic methods of glycomimetics, as well as synthesis of natural glycophenolics and their analogues (Chapter 2.1.2, Art. no. 10; Chapter 2.1.5, Art. no. 17 and 18).

The study of glycomimetics focuses on the synthesis of enzyme inhibitors linked with various oncological, metabolic, and neurodegenerative diseases mimicking the transition state of their natural substrates. Natural substances such as immunosaccharides and mimetics of common saccharides serve as an inspiration for this research. The first generation of potential inhibitors was selected and will be further modified to improve the inhibition effect.

The latter group of studied substances, glycophenolics, comprises compounds that combine saccharides with phenolic fragments in their structure (usually linked through a ester or glycosidic bond), thus providing series of modified gallotanins or phenylehtanoid and phenylpropanoid secondary metabolites of medicinal plants and their non-natural analogues. The products are strong antioxidants, radical scavengers, and DNA-protective agents or inhibitors and disruptors of *Staphylococcus aureus* bacterial biofilms. The results showed that the compounds studied could be considered as biocompatible, non-toxic agents, and promising candidates for biomedical applications. The synthesis of biologically active carbohydrates combined with nitrogen heterocyclic compounds has also been performed.

Besides the techniques of standard organic synthesis, biocatalytic approaches were widely studied to simplify the synthesis of phenylethanoid and phenylpropanoid glycophenolics through selective enzymatic glycosylations and acylations.

The conformational and structural analysis of biologically active target molecules deals with the analysis of the biomolecules structure, such as saccharides and proteins, their dynamics in solution and intermolecular protein-carbohydrate interactions. The applied methods of theoretical chemistry and molecular modelling are beneficial in understanding of biological processes such as enzyme catalysis, reaction mechanisms, and structure-function relationship of biomolecular systems.

The researchers involved in studying the carbohydrate structures and their interactions focused on the basic research, and the knowledge obtained is transferred to the development of new potential pharmaceutical products marked as the inhibitors of the enzymes. The enzymes examined play a key role in emerging human diseases such as cancer, diabetes, Alzheimer`s disease, deadly bacterial or viral infections, and the results obtained correlate with those of other colleagues working on research of similar diseases at the Institute.

One group of the enzymes studied are glycosyltransferases and glycoside hydrolases (Chapter 2.1.2, Art. no. 3, 46, 48, 49, 57). The direct involvement of glycosyltransferases in cancer development is illustrated by worldwide studies that clearly show slower tumour growth and decreased metastases in the GnT-V knockout mouse compared to oncomouse. Such experiments show considerable potential for their use as a therapeutic intervention through their inhibition. The new generation of carbohydrate mimetics-based inhibitors represents the main goal of this research at the Institute. Compounds of this family are structurally altered analogues of carbohydrates designed to simulate the shape and functionalities of the natural substrates in the ground state or the transition state. The most common structural modification is the replacement of the endocyclic or the glycosidic oxygen atom with a heteroatom or a carbon atom. Carbohydrate mimetic is often used to mimic the transition state of the enzymatic reaction, rather than the ground state, promising a better inhibition than the natural carbohydrate substrate.

Another research group has studied enzymes that participate in the building of the *N*-glycan structure in glycoproteins. The group has focused on α-mannosidase II (ManII) and *N*-acetylglucosaminyltransferase I (GnTI), Golgi-resident enzymes essential for the processing of high-mannose to hybrid and complex *N*-glycans. The changes in the structure of these

glycans are characteristic of carcinogenesis. The enzymes mentioned above have become potential therapeutic targets for drugs with anticancer activities. A method for heterologous expression of *Drosophila* and *Caenorhabditis elegans* mannosidases in the *Pichia* yeast has been developed in cooperation with organic chemists from the Institute and abroad. These enzymes can be used to screen potential mannosidase inhibitors. In the case of GnTI enzyme, a sensitive non-radioactive method for GnTI assay has been adapted. Furthermore, a simple system could be introduced to express this enzyme in-house, which would be much cost effective compared to commercial GnTI enzyme.

In recent years, the scientific team has also started to work on method development in the realm of protein residue networks (PRN), resulting in an improved understanding of the amino acid interactions (Chapter 2.1.2, Art. no. 44; Chapter 2.1.5, Art. no. 19). In particular, contributions have been made to the definition of so-called pair interaction energy-based PRNs, the PIE-PRNs. It has beenshown that the topology of the PIE-PRNs differs qualitatively from previously used distance-based PRNs. The researchers combine highly accurate quantum chemical calculations with algorithms from network science and graph theory to develop the PRN methods to be a viable source of reproducible qualitative and quantitative data on the importance of individual residues in the processes of molecular recognition in proteomics.

Big efforts have also been focused on theoretical and experimental analysis of glycosaminoglycans (GAGs), the family of highly sulfated and complex polysaccharides involved in the extracellular matrix assembly, cell-matrix and cell-cell interactions, cellular signalling, control of chemokine and cytokine activities etc. Quantum-chemical and NMR methods disclosed details of the structural diversity of GAGs in solution and helped to explain molecular details of the GAG-protein interactions. In addition, quantum-chemical methods enabled the calculation of NMR spectroscopic parameters, such as NMR chemical shifts and spin-spin coupling constants. Deciphering and mastering GAG structure-function relationships play a key role in the development of new anticoagulant pharmaceuticals.

In line with a current trend of solving some ecological issues by replacing plastics, the preparation of polysaccharide composites containing ion-exchanging groups is also one of the scientific aims at the Institute. Various films have been prepared from sugar beet and bagasse in order to prepare suitable environmentallyfriendly cover materials for food or for medical applications. An important group of materials, such as carrageenan hybrid polysaccharides, is suitable for industrial applications in food processing or medicine. Their polysaccharide films (Chapter 2.1.2, Art. no. 22, 60 and 64) are prepared using water extraction of red algae.

The Culture Collection of Yeasts (CCY)

The Institute houses the *Culture Collection of Yeasts*, the largest yeast collection in the Central Europe (a corporate member of the European Culture Collections' Organisation and the World Federation for Culture Collections). The representatives of the yeast species are available for research and industry for further studies, and the maintenance of these yeast cultures and the service works take approximately 50 % of research capacity of the staff. The CCY has contributed to a comprehensive understanding of yeasts associated with the phylloplane of healthy fruit trees.

Microorganisms, including yeasts, form the largest, most diverse and most important biological group in the soil. They are involved in biogeochemical cycles, the solubilization of nutrients, the stabilization of soil particles, and pest and disease control; therefore, they also play an important role in crop production. Although many research programmes have been aimed at the characterization of microorganisms in different soils, knowledge of the yeast ecology of managed soils is available only from very limited and very recent studies.

The CCY study focused on the diversity of yeasts (59 yeast species) associated with the soil adjacent to five fruit trees, in two localities in Slovakia, in four sampling periods. Moreover, identification of yeasts using the combination of MALDI-TOF MS analysis and rDNA sequencing has been employed in the ecological study of yeasts for the first time.

The yeast *Metschnikowia pulcherrima* has been isolated among ascomycetous yeasts that inhabited the soil adjacent to fruit trees. The species also commonly inhabits the above-ground part of plants, produces the pulcherrimin pigment, and is considered as a promising biocontrol

agent. The results obtained by the scientists from the CCY showed strong dependence of the pulcherrimin production on the presence of ferric ions and their concentration in the cultivation medium. Moreover, the strains that produced the highest amounts of pulcherrimin exhibited strong antagonism against some phytopathogenic molds and produced lytic enzymes, both of which activities probably play an important role in the biocontrol ability of *M. pulcherrima*.

The yeasts of the genus *Taphrina* are parasites pathogenic to various vascular plants, such as important economic fruit trees and shrubs. The study discovered new *Taphrina* species in the Vysoké Tatry Mts, Slovakia. The new species *Taphrina geum-montanum* was isolated from the infected host plant tissue of *Geum montanum* belonging to the *Rosaceae* family.

α-Galactosidases are assigned to the class of hydrolases and the subclass of glycoside hydrolases (GHs). The lactose-inducible α-galactosidase produced by the yeast *Papiliotrema flavescens* has been analysed. The enzyme was present on the surface of cells and in the cytosol. This α-galactosidase also exhibited transglycosylation activity. The data obtained recognized the first yeast α-galactosidase, which belongs to the GH 36 family. Up to the CCY study, only α-galactosidases which belong to the GH 24 family have been known.

Carotenoids are of interest to the food, feed, and pharmaceutical industries. The urediniomycetous yeasts of the species *Rhodotorula glutinis*, *Rhodosporidium kratochvilovae,* and *Sporobolomyces salmonicolor* synthesize carotenoids, being their principal pigments and antioxidant agents. The composition and quantity of carotenoids produced can be influenced by stress factors. According to observations of the CCY, the production of beta-carotene increased in all species in the presence of individual stress factors hydrogen peroxide and zinc ions. However, the combination of hydrogen peroxide and zinc ions significantly activated the pathways for the production of torularhodin in the strain *R. glutinis,* as well as beta-carotene and torulene in *Sp. salmonicolor*. The results of another study also showed that a diet rich in yeast biomass of *Rh. kratochvilovae* containing carotenoids (beta-carotene, torulene, and torularhodin) could protect mechanisms regulating paracellular endothelial barrier function from lipopolysaccharide-induced damage, caused by Gram negative bacteria, in the heart of model animals, rats.

Associated *departments and divisions*

The *Analytical Department* has supported the above-mentioned scientific departments through the excellent infrastructure tools including electrophoresis; Raman Spectroscopy; Atomic Force Microscopy; High-Performance Liquid Chromatography; Gas Chromatography; Polarimetry*etc.* (Chapter 2.1.2, Art. no. 6).

The *Production Department* (Chapter 2.1.2, Art. no. 61) provides facilities for large-scale isolation of natural compounds and synthesis of saccharides and their derivatives for commercial purposes. Some rare saccharides are produced only at the Institute on the basis of monopoly basis.

The main editing activity of the Institute is the publishing of Chemical Papers, the only Slovak chemistry journal printed in English.

The library at the Institute collects journals in many chemical fields of interest, processes employees` scientific outputs, and is free of charge for them.

A number of activities aimed at public outreach were carried out, including a series of lectures targeting highs chool students at the Bílikova Grammar School, L. Sáru Grammar School, Grammar School in Trenčín, and Petržalská superškola educational project" *etc*.

Additional opportunities that were covered by the Institute staff include active participation in "Bratislava`s scientific tea shop" at the National Center for Popularisation of Science and Technology in Society in Bratislava, "Open door day" and "European Researcher's Night" events. Other events with a more targeted audience included the "Slovak ERC Day" and "Life Science Innovation Day" and "Science Slam European Final 2019."

Our staff regularly contributed to the Slovak popular science magazine "Quark". Our articles appeared in a number of other popular magazines such as "Yeast Newsletter, ChemZi, PROFIT, Forbes, MIRRI News, Učiteľské noviny, and Život *etc*."

Occasionally, the Institute employees appeared on public television and radio and contributed to the "Science at hand" Internet domain, as well as to the “Atlas of Science” and “In Vivo” magazines.

Finally, the Institute staff contributed to the series of ”Chemical Horizons“ lectures of the Slovak Chemical Society.

The Institute holds a number of awards for its activities, including “Zlatá INCHEBA*”* and “Zlatý kosák*”* at the International Chemical Fair in Bratislava, the *NOVTECH Award* at the event of the same name in Žilina, and the *GENIUS* medal in Budapest. A number of employees have been awarded prestigious awards and prizes, including the *Order of Ľ. Štúr, 2nd class*, the *Scientist of the Year*, the *Technologist of the Year*, the *Young Personality of Science*, the *Science and Technology Award*, the *Charles D. Scott Award*, *The Jan Patočka Memorial Medal*, the *Samuel Mikovíni Medal*, the *Daniel Belluš Medal*, the *SCHS Medal at the SAS*, the *Slovak Republic Presidential Award*, the *SAS Award*, the *Gold Medal of the SAS*, *Medals for the promotion of science* etc.

2. Partial indicators of main activities:

2.1. Research output

2.1.1. Principal types of research output of the institute: basic research/applied research, international/regional (in percentage)

Principal types of research output of the Institute are basic research (90%) and applied research (10%). It is difficult to express unambiguously this ratio because the border between these two terms is often not too sharp. In addition, most of research activities performed at the Institute are nearly always directed to somehow/somewhere applied/utilised. Therefore, this ratio of 90/10 should be regarded as only approximately estimated value. The international/regional ratio of research output should be estimated as 90/10.

2.1.2 List of selected publications documenting the most important results of basic research. The total number of publications should not exceed the number of average FTE researchers per year. The principal research outputs (max. 10% of the total number of selected publications, including Digital Object Identifier – DOI if available) should be underlined. Authors from the evaluated organizations should be underlined.

Selected seven principal research outputs are highlighted by underlined order number in the first column. Number of citations according to WOS (May 2022).

Num.	Publication	Num. of Citations
1.	PUCHART, Vladimír** - ŠUCHOVÁ, Katarína - BIELY, Peter. Xylanases of glycoside hydrolase family 30 – An overview. In *Biotechnology Advances*, 2021, vol. 47, art. no. 107704 [16] p. (2020: 14.227 - IF, Q1 - JCR, 2.772 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 0734-9750. DOI Link: https://doi.org/10.1016/j.biotechadv.2021.107704	10
2.	FANG, Wenxia - SANZ, Ana Belén - BARTUAL, Sergio Galán - WANG, Bin - FERENBACH, Andrew T. - FARKAŠ, Vladimír - HURTADO-GUERRERO, Ramón - ARROYO, Javier** - VAN AALTEN, Daan M.F.**. Mechanisms of redundancy and specificity of	9

the *Aspergillus fumigatus* Crh transglycosylases. In *Nature Communications*, 2019, vol. 10, art. no. 1669. (2018: 11.878 - IF, Q1 - JCR, 5.992 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 2041-1723. DOI Link: https://doi.org/10.1038/s41467-019-09674-0

3. STRELTSOV, Victor A. - LUANG, Sukanya - PEISLEY, Alys - VARGHESE, Joseph N. - KETUDAT CAIRNS, James R. - FORT, Sebastien - HIJNEN, Marcel - TVAROŠKA, Igor - ARDÁ, Ana - JIMÉNEZ-BARBERO, Jesús - ALFONSO-PRIETO, Mercedes - ROVIRA, Carme - MENDOZA, Fernanda - TIESSLER-SALA, Laura - SÁNCHEZ-APARICIO, José-Emilio - RODRÍGUEZ-GUERRA, Jaime - LLUCH, José M. - MARÉCHAL, Jean-Didier - MASGRAU, Laura - HRMOVÁ, Mária**. Discovery of processive catalysis by an exo-hydrolase with a pocket-shaped active site. In *Nature Communications*, 2019, vol. 10, article no. 2222. (2018: 11.878 - IF, Q1 - JCR, 5.992 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 2041-1723. DOI Link: https://doi.org/10.1038/s41467-019-09691-z — 5

4. SAVKOVÁ, Karin - HUSZÁR, Stanislav - BARÁTH, Peter - PAKANOVÁ, Zuzana - KOZMON, Stanislav - VANCOVÁ, Marie - TESAŘOVÁ, Martina - BLAŠKO, Jaroslav - KALIŇÁK, Michal - SINGH, Vinayak - KORDULÁKOVÁ, Jana - MIKUŠOVÁ, Katarína**. An ABC transporter Wzm–Wzt catalyzes translocation of lipid-linked galactan across the plasma membrane in mycobacteria. In *Proceedings of the National Academy of Sciences of the United States of America*, 2021, vol. 118, art. no. e2023663118 [10] p. (2020: 11.205 - IF, Q1 - JCR, 5.011 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 0027-8424. DOI Link: https://doi.org/10.1073/pnas.2023663118 — 1

5. BIELY, Peter** - SINGH, Suren - PUCHART, Vladimír. Towards enzymatic breakdown of complex plant xylan structures: State of the art. In Biotechnology Advances, 2016, vol. 34, p. 1260-1274. (2015: 9.848 - IF, Q1 - JCR, 2.915 - SJR, Q1 - SJR). (2016 - Current Contents). ISSN 0734-9750. DOI Link: https://doi.org/10.1016/j.biotechadv.2016.09.001 — 135

6. JÁRVÁS, Gábor** - GUTTMAN, András - MIĘKUS, Natalia - BĄCZEK, Tomáš - JEONG, Sunkyung - CHUNG, Doo Soo - PÄTOPRSTÝ, Vladimír - MASÁR, Marián - HUTTA, Milan - DATINSKÁ, Vladimíra - FORET, František. Practical sample pretreatment techniques coupled with capillary electrophoresis for real samples in complex matrices. In *Trends in Analytical Chemistry*, 2020, vol. 122, art. no. 115702 [9] p. (2019: 9.801 - IF, Q1 - JCR, 2.153 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 0165-9936. DOI Link: https://doi.org/10.1016/j.trac.2019.115702 — 17

7. BERTÓK, Tomáš - LORENCOVÁ, Lenka - HRONČEKOVÁ, Štefánia - PINKOVÁ GAJDOŠOVÁ, Veronika - JÁNÉ, Eduard - HÍREŠ, Michal - KASÁK, Peter - KAMAN, Ondrej - SOKOL, Roman - BELLA, Vladimír - ECKSTEIN ANDICSOVÁ, Anita - MOSNÁČEK, Jaroslav - VIKARTOVSKÁ, Alica - TKÁČ, Ján**. Advanced impedimetric biosensor configuration and assay protocol for glycoprofiling of a prostate oncomarker using Au nanoshells with a magnetic core. In *Biosensors and Bioelectronics*, 2019, vol. 131, p. 24-29. (2018: 9.518 - IF, Q1 - JCR, 2.553 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 0956-5663. DOI Link: https://doi.org/10.1016/j.bios.2019.01.052 — 14

8. CHOCHOLOVÁ, Erika - FILIP, Jaroslav - BERTÓK, Tomáš - BOTH, Peter - KASÁK, Peter - TKÁČ, Ján. Nanotechnology in glycomics: Applications in diagnostics, therapy, imaging, and separation precesses. In *Medicinal Research Reviews*, 2017, vol. 37, p. 514-626. (2016: 8.763 - IF, Q1 - JCR, 2.701 - SJR, Q1 - — 39

SJR). (2017 - Current Contents). ISSN 0198-6325. DOI Link: https://doi.org/10.1002/med.21420

9. FILIP, Jaroslav - ECKSTEIN ANDICSOVÁ, Anita - VIKARTOVSKÁ, Alica - TKÁČ, Ján. Immobilization of bilirubin oxidase on graphene oxide flakes with different negative charge density for oxygen reduction. The effect of GO charge density on enzyme coverage, electron transfer rate and current density. In *Biosensors & Bioelectronics*, 2017, vol. 89, p. 384-389. (2016: 7.780 - IF, Q1 - JCR, 2.095 - SJR, Q1 - SJR). (2017 - Current Contents). ISSN 0956-5663. DOI Link: https://doi.org/10.1016/j.bios.2016.06.006 — 20

10. KARNIŠOVÁ POTOCKÁ, Elena - MASTIHUBOVÁ, Mária - MASTIHUBA, Vladimír**. Transrutinosylation of tyrosol by flower buds of *Sophora japonica*. In *Food chemistry*, 2021, vol. 336, art. no. 127674 [5] p. (2020: 7.514 - IF, Q1 - JCR, 1.772 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 0308-8146. DOI Link: https://doi.org/10.1016/j.foodchem.2020.127674 — 5

11. HUSHEGYI, András - DAMBORSKÁ, Dominika - BERTÓK, Tomáš - ADAM, Vojtech - KIZEK, René - TKÁČ, Ján. Ultrasensitive detection of influenza viruses with a glycan-based impedimetric biosensor. In *Biosensors and Bioelectronic*, 2016, vol. 79, p. 644-649. (2015: 7.476 - IF, Q1 - JCR, 2.044 - SJR, Q1 - SJR). (2016 - Current Contents). ISSN 0956-5663. DOI Link: https://doi.org/10.1016/j.bios.2015.12.102 — 55

12. JOLLY, Pawan - DAMBORSKÝ, Pavel - MADABOOSI, Narayanan - SOARES, Ruben - CHU, Virginia - CUNDI, Joao P. - KATRLÍK, Jaroslav - ESTRELA, Pedro. DNA aptamer-based sandwich microfluidic assays for dual quantification and multi-glycan profiling of cancer biomarkers. In *Biosensors and Bioelectronic*, 2016, vol. 79, p. 313-319. (2015: 7.476 - IF, Q1 - JCR, 2.044 - SJR, Q1 - SJR). (2016 - Current Contents). ISSN 0956-5663. DOI Link: https://doi.org/10.1016/j.bios.2015.12.058 — 44

13. ŠKODOVÁ-SVERÁKOVÁ, Ingrid** - ZÁHONOVÁ, Kristína - JURICOVÁ, Valéria - DANCHENKO, Maksym - MOOS, Martin - BARÁTH, Peter - PROKOPCHUK, Galina - BUTENKO, Anzhelika - LUKÁČOVÁ, Veronika - KOHÚTOVÁ, Lenka - BUČKOVÁ, Barbora - HORÁK, Aleš - FAKTOROVÁ, Drahomíra - HORVÁTH, Anton - ŠIMEK, Petr - LUKEŠ, Julius. Highly flexible metabolism of the marine euglenozoan protist *Diplonema papillatum*. In *BMC Biology*, 2021, vol. 19, art. no. 251, [21] p. (2020: 7.431 - IF, Q1 - JCR, 3.952 - SJR, Q1 - SJR). ISSN 1741-7007. DOI Link: https://doi.org/10.1186/s12915-021-01186-y — 1

14. PINKOVÁ GAJDOŠOVÁ, Veronika - LORENCOVÁ, Lenka - BLŠÁKOVÁ, Anna - KASÁK, Peter - BERTÓK, Tomáš - TKÁČ, Ján**. Challenges for impedimetric affinity sensors targeting protein detection. In *Current Opinion in Electrochemistry*, 2021, vol. 28, art. no. 100717 [7] p. (2020: 7.271 - IF, Q1 - JCR, 1.980 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 2451-9103. DOI Link: https://doi.org/10.1016/j.coelec.2021.100717 — 7

15. SUSHYTSKYI, Leonid** - LUKÁČ, Pavol - SYNYTSYA, Andriy - BLEHA, Roman - RAJSIGLOVÁ, Lenka - CAPEK, Peter - POHL, Radek - VANNUCCI, Luca - ČOPÍKOVÁ, Jana - KAŠTÁNEK, Petr. Immunoactive polysaccharides produced by heterotrophic mutant of green microalga *Parachlorella kessleri* HY1 (Chlorellaceae). In *Carbohydrate Polymers*, 2020, vol. 246, art. no. 116588 [11] p. (2019: 7.182 - IF, Q1 - JCR, 1.514 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 0144-8617. DOI Link: https://doi.org/10.1016/j.carbpol.2020.116588 — 9

16. PUCHART, Vladimír** - GJERMANSEN, Morten - MASTIHUBOVÁ, — 3

Mária - MØRKEBERG KROGH, Kristian B.R. - BIELY, Peter. Positional specificity of *Flavobacterium johnsoniae* acetylxylan esterase and acetyl group migration on xylan main chain. In *Carbohydrate Polymers*, 2020, vol. 232, art. no. 115783 [8] p. (2019: 7.182 - IF, Q1 - JCR, 1.514 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 0144-8617. DOI Link: https://doi.org/10.1016/j.carbpol.2019.115783

17. VALÁRIKOVÁ, Jana - ČÍŽOVÁ, Alžbeta** - RAČKOVÁ, Lucia - BYSTRICKÝ, Slavomír. Anti-staphylococcal activity of quaternized mannan from the yeast *Candida Albicans*. In *Carbohydrate Polymers*, 2020, vol. 240, art. no. 116228 [9] p. (2019: 7.182 - IF, Q1 - JCR, 1.514 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 0144-8617. DOI Link: https://doi.org/10.1016/j.carbpol.2020.116288 — 0
18. SMUŁEK, Wojciech** - BURLAGA, Natalia - HRICOVÍNI, Michal - MEDVEĎOVÁ, Alžbeta - KACZOREK, Ewa - HRICOVÍNIOVÁ, Zuzana. Evaluation of surface active and antimicrobial properties of alkyl D-lyxosides and alkyl L-rhamnosides as green surfactants. In *Chemosphere*, 2021, vol. 271, art. no. 129818, [8] p. (2020: 7.086 - IF, Q1 - JCR, 1.632 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 0045-6535. DOI Link: https://doi.org/10.1016/j.chemosphere.2021.129818 — 3
19. NAHÁLKA, Jozef**. The role of the protein-RNA recognition code in neurodegeneration. In *Cellular and Molecular Life Sciences*, 2019, vol. 76, p. 2043-2058. (2018: 7.014 - IF, Q1 - JCR, 3.006 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 1420-682X. DOI Link: https://doi.org/10.1007/s00018-019-03096-3 — 11
20. PAULOVIČOVÁ, Ema - PAULOVIČOVÁ, Lucia - HRUBIŠKO, Martin - KRYLOV, Vadim B. - ARGUNOV, Dmitry A. - NIFANTIEV, Nikolay E. Immunobiological activity of synthetically prepared immunodominant galactomannosides structurally mimicking *Aspergillus galactomannan*. In *Frontiers in Immunology*, 2017, vol. 8, art. no. 1273. (2016: 6.429 - IF, Q1 - JCR, 3.034 - SJR, Q1 - SJR). ISSN 1664-3224. DOI Link: https://doi.org/10.3389/fimmu.2017.01273 — 10
21. RUTHERFORD, David** - JÍRA, Jaroslav - KOLÁŘOVÁ, Kateřina - MATOLÍNOVÁ, Iva - MIČOVÁ, Júlia - REMEŠ, Zdeněk - REZEK, Bohuslav. Growth inhibition of Gram-positive and Gram-negative bacteria by zinc oxide hedgehog particles. In *International Journal of Nanomedicine*, 2021, vol. 16, p. 3541-3554. (2020: 6.400 - IF, Q1 - JCR, 1.245 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 1176-9114. DOI Link: https://doi.org/10.2147/IJN.S300428 — 6
22. HRICOVÍNIOVÁ, Zuzana** - MASCARETTI, Šárka - HRICOVÍNIOVÁ, Jana - ČÍŽEK, Alois - JAMPÍLEK, Josef. New unnatural gallotannins: A way toward green antioxidants, antimicrobials and antibiofilm agents. In *Antioxidants*, 2021, vol. 10, art. no. 1288, p. 1-19. (2020: 6.313 - IF, Q1 - JCR, 1.067 - SJR, Q2 - SJR). ISSN 2076-3921. DOI Link: https://doi.org/10.3390/antiox10081288 — 1
23. BERTÓK, Tomáš - BERTÓKOVÁ, Anikó - JÁNÉ, Eduard - HÍREŠ, Michal - AGUEDO, Juvissan - POTOČÁROVÁ, Mária - LUKÁČ, Ľudovít - VIKARTOVSKÁ, Alica - KASÁK, Peter - BORSIG, Ľubor - TKÁČ, Ján**. Identification of a whole-serum glycomarkers for colorectal carcinoma using reverse-phase lectin microarray. In *Frontiers in Oncology Gastrointestina Cancers*, 2021, vol. 11, art. no. 735338 [11] p. (2020: 6.244 - IF, Q2 - JCR, 1.834 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 2234-943X. DOI Link: https://doi.org/10.3389/fonc.2021.735338 — 0
24. GAJDOŠOVÁ, Veronika* - LORENCOVÁ, Lenka* - PROCHÁZKA, — 10

Michal - MIČUŠÍK, Matej - OMASTOVÁ, Mária - PROCHÁZKOVÁ, Simona - KVĚTOŇ, Filip - JERIGOVÁ, Monika - VELIČ, Dušan - KASÁK, Peter - TKÁČ, Ján**. Remarkable differences in the voltammetric response towards hydrogen peroxide, oxygen and Ru(NH3)6 3+ of electrode interfaces modified with HF or LiF-HCl etched Ti3C2Tx MXene. In *Microchimica Acta*, 2020, vol. 187, no. 1, art. no. 52, [8] p. (2019: 6.232 - IF, Q1 - JCR, 1.300 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 0026-3672. DOI Link: https://doi.org/10.1007/s00604-019-4049-6

25. BURYI, Maksym** - BABIN, Vladimír - CHANG, Yu Ying - REMEŠ, Zdeněk - MIČOVÁ, Júlia - ŠIMEK, Daniel. Influence of precursor age on defect states in ZnO nanorods. In *Applied Surface Science*, 2020, vol. 525, art. no. 146448 [8] p. (2019: 6.182 - IF, Q1 - JCR, 1.230 - SJR, Q1 - SJR). (2020 - Current Contents, WOS, SCOPUS). ISSN 0169-4332. DOI Link: https://doi.org/10.1016/j.apsusc.2020.146448 — 9

26. STRATILOVÁ, Barbora - ŠESTÁK, Sergej - MRAVEC, Jozef - GARAJOVÁ, Soňa - PAKANOVÁ, Zuzana - KOVÁČOVÁ, Kristína - KUČEROVÁ, Danica, Richterová - KOZMON, Stanislav - SCHWERDT, Julian G. - SHIRLEY, Neil - STRATILOVÁ, Eva - HRMOVÁ, Mária**. Another building block in the cell wall: Barley xyloglucan xyloglucosyl transferases link covalently xyloglucan and anionic oligosaccharides derived from pectin. In *Plant Journal*, 2020, vol. 104, p. 752-754. (2019: 6.141 - IF, Q1 - JCR, 3.161 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 0960-7412. DOI Link: https://doi.org/10.1111/tpj.14964 — 9

27. BERTÓK, Tomáš - JÁNÉ, Eduard - BERTÓKOVÁ, Anikó - LORENCOVÁ, Lenka - ZVARA, Peter - SMOLKOVÁ, Božena - KUČERA, Radek - KLOCKER, Helmut - TKÁČ, Ján**. Validating fPSA glycoprofile as a prostate cancer biomarker to avoid unnecessary biopsies and re-biopsies. In *Cancers*, 2020, vol. 12, no. 10, art. no. 2988 [10] p. (2019: 6.126 - IF, Q1 - JCR, 1.938 - SJR, Q1 - SJR). ISSN 2072-6694. DOI Link: https://doi.org/10.3390/cancers12102988 — 6

28. BARTHELDYOVÁ, Eliška - TURÁNEK-KNOTIGOVÁ, Pavlína - ZACHOVÁ, Kateřina - MAŠEK, Jozef - KULICH, Pavel - EFFENBERG, Roman - ZYKA, Daniel - HUBATKA, František - KOTOUČEK, Jan - ČELECHOVSKÁ, Hana - HÉŽOVÁ, Renata - TOMEČKOVÁ, Andrea - MAŠKOVÁ, Eliška - FOJTÍKOVÁ, Martina - MACAULAY, Stuart - BYSTRICKÝ, Peter - PAULOVIČOVÁ, Lucia - PAULOVIČOVÁ, Ema** - DROŽ, Ladislav - LEDVINA, Miroslav** - RAŠKA, Milan** - TURÁNEK, Jaroslav**. N-Oxy lipid-based click chemistry for orthogonal coupling of mannan onto nanoliposomes prepared by microfluidic mixing: Synthesis of lipids, characterisation of mannan-coated nanoliposomes and in vitro stimulation of dendritic cells. In *Carbohydrate Polymers*, 2019, vol. 207, p. 521-532. (2018: 6.044 - IF, Q1 - JCR, 1.377 - SJR, Q1 - SJR). (2019 - Current Contents, WOS, SCOPUS). ISSN 0144-8617. DOI Link: https://doi.org/10.1016/j.carbpol.2018.10.121 — 15

29. PUCHART, Vladimír - MØRKEBERG KROGH, Kristian B.R. - BIELY, Peter. Glucuronoxylan 3-O-acetylated on uronic acid-substituted xylopyranosyl residues and its hydrolysis by GH10, GH11 and GH30 endoxylanases. In *Carbohydrate Polymers*, 2019, vol. 205, p. 217-224. (2018: 6.044 - IF, Q1 - JCR, 1.377 - SJR, Q1 - SJR). (2019 - Current Contents, WOS, SCOPUS). ISSN 0144-8617. DOI Link: https://doi.org/10.1016/j.carbpol.2018.10.043 — 8

30. ČÍŽOVÁ, Alžbeta** - CSOMOROVÁ, Katarína - RYCHLÝ, Jozef - BYSTRICKÝ, Slavomír. Stability of cationic and amphoteric derivatives of mannan from the yeast *Candida albicans*. In — 1

Carbohydrate Polymers, 2019, vol. 207, p. 440-446. (2018: 6.044 - IF, Q1 - JCR, 1.377 - SJR, Q1 - SJR). (2019 - Current Contents, WOS, SCOPUS). ISSN 0144-8617. DOI Link: https://doi.org/10.1016/j.carbpol.2018.11.101

31. ONDRUŠKOVÁ, Nina - HONZÍK, Tomáš - KOLÁŘOVÁ, Hana - PAKANOVÁ, Zuzana - MUCHA, Ján - ZEMAN, Jiří - HANSÍKOVÁ, Hana**. Aberrant apolipoprotein C-III glycosylation in glycogen storage disease tape III and IX. In *Metabolism, Clinical and Experimental*, 2018, vol. 82, p. 135-141. (2017: 5.963 - IF, Q1 - JCR, 2.285 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 0026-0495. DOI Link: https://doi.org/10.1016/j.metabol.2018.01.004 — 6
32. SIVÁKOVÁ, Barbara* - JURČÍK, Ján* - LUKÁČOVÁ, Veronika - SELICKÝ, Tomáš - ČIPÁKOVÁ, Ingrid* - BARÁTH, Peter* - ČIPÁK, Ľuboš*. Label-free quantitative phosphoproteomics of the fission yeast *Schizosaccharomyces pombe* using strong anion exchange- and porous graphitic carbon-based fractionation strategies. In *International Journal of Molecular Sciences*, 2021, vol. 22, no. 4, art. no. 1747. (2020: 5.924 - IF, Q1 - JCR, 1.455 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 1422-0067. DOI Link: https://doi.org/10.3390/ijms22041747 — 3
33. HRICOVÍNIOVÁ, Jana - HRICOVÍNIOVÁ, Zuzana - KOZICS, Katarína**. Antioxidant, cytotoxic, genotoxic, and DNA-protective potential of 2,3-substituted quinazolinones: structure-activity relationship study. In *International Journal of Molecular Sciences*, 2021, vol. 22, no. 2, art. no. 610 [18] p. (2020: 5.924 - IF, Q1 - JCR, 1.455 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 1422-0067. DOI Link: https://doi.org/10.3390/ijms22020610 — 2
34. BONACCORSI DI PATTI, Maria Carmela** - CUTONE, Antimo - NEMČOVIČ, Marek - PAKANOVÁ, Zuzana - BARÁTH, Peter - MUSCI, Giovanni**. Production of Recombinant Human Ceruloplasmin: Improvements and Perspectives. In *International Journal of Molecular Sciences*, 2021, vol. 22, art. no. 8228, [10] p. (2020: 5.924 - IF, Q1 - JCR, 1.455 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 1422-0067. DOI Link: https://doi.org/10.3390/ijms22158228 — 0
35. MIKOLÁŠKOVÁ, Barbora - JURČÍK, Matúš - CIPAKOVA, I. - SELICKÝ, Tomáš - JURČÍK, Ján - BÁGEĽOVÁ POLÁKOVÁ, Silvia - STUPEŇOVÁ, Erika - DUDÁŠ, Andrej - SIVÁKOVÁ, Barbara - BELLOVÁ, Jana - BARÁTH, Peter - ARONICA, Lucia - GREGAN, Juraj - ČIPÁK, Ľuboš**. Identification of Nrl1 Domains Responsible for Interactions with RNA-Processing Factors and Regulation of Nrl1 Function by Phosphorylation. In *International Journal of Molecular Sciences*, 2021, vol. 22, no. 13, art. no. 7011. (2020: 5.924 - IF, Q1 - JCR, 1.455 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 1422-0067. DOI Link: https://doi.org/10.3390/ijms22137011 — 0
36. VACULÍK, Marek** - LUKAČOVÁ, Zuzana - BOKOR, Boris - MARTINKA, Michal - TRIPATHI, Durgesh Kumar - LUX, Alexander. Alleviation mechanisms of metal(loid) stress in plants by silicon: a review. In *Journal of Experimental Botany*, 2020, vol. 71, no. 21, p. 6744-6757. (2019: 5.908 - IF, Q1 - JCR, 2.647 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 0022-0957. DOI Link: https://doi.org/10.1093/jxb/eraa288 — 41
37. SOUKUP, Milan** - RODRIGUEZ ZANCAJO, Victor M. - KNEIPP, Janina - ELBAUM, Rivka**. Formation of root silica aggregates in sorghum is an active process of the endodermis. In *Journal of Experimental Botany*, 2020, vol. 71, p. 6807-6817. (2019: 5.908 - IF, Q1 - JCR, 2.647 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 0022-0957. DOI Link: https://doi.org/10.1093/jxb/erz387 — 12

38.	LORENCOVÁ, Lenka - BERTÓK, Tomáš** - FILIP, Jaroslav - JERIGOVÁ, Monika - VELIČ, Dušan - KASÁK, Peter - MAHMOUD, Khaled A. - TKÁČ, Ján**. Highly stable Ti3C2Tx (MXene)/Pt nanoparticles-modified glassy cyrbon electrode for H2O2 and small molecules sensing applications. In *Sensors and Actuators B*, 2018, vol. 263, p. 360-368. (2017: 5.667 - IF, Q1 - JCR, 1.406 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 0925-4005. DOI Link: https://doi.org/10.1016/j.snb.2018.02.124	102
39.	CHOCHOLOVÁ, Erika - BERTÓK, Tomáš** - LORENCOVÁ, Lenka - ŠEDIVÁ, Alena - FARKAŠ, Pavol - VIKARTOVSKÁ, Alica - BELLA, Vladimír - VELICOVÁ, Darina - KASÁK, Peter - ECKSTEIN ANDICSOVÁ, Anita - MOSNÁČEK, Jaroslav - HAŠKO, Daniel - TKÁČ, Ján**. Advanced antifouling zwitterionic layer based impedimetric HER2 biosensing in human serum: Glycoprofiling as a novel approach for breast cancer diagnostics. In *Sensors and Actuators B*, 2018, vol. 272, p. 626-633. (2017: 5.667 - IF, Q1 - JCR, 1.406 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 0925-4005. DOI Link: https://doi.org/10.1016/j.snb.2018.07.029	20
40.	ÖZGÜNSEVEN, Ayşenur - BARUT, Burak - ŠORAL, Michal - SARI, Suat - AKAYDIN, Galip - ÖZEL, Arzu - ŞÖHRETOĞLU, Didem**. Alpha-glucosidase and tyrosinase inhibiton of polyphenols isolated from *Potentilla speciosa* var. *speciosa*: In vitro and in silico perspectives. In *Industrial Crops and Products*, 2021, vol. 170, art. no. 113806 [7] p. (2020: 5.645 - IF, Q1 - JCR, 1.066 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 0926-6690. DOI Link: https://doi.org/10.1016/j.indcrop.2021.113806	1
41.	JOLLY, Pawan - ZHURAUSKI, Pavel - HAMMOND, Jules L. - MIODEK, Anna - LIÉBANA, Susana - BERTÓK, Tomáš - TKÁČ, Ján - ESTRELA, Pedro. Self-assembled gold nanoparticles for impedimetric and amperometric detection of a prostate cancer biomarker. In *Sensors and Actuators B: Chemical*, 2017, vol. 251, p. 637-643. (2016: 5.401 - IF, Q1 - JCR, 1.343 - SJR, Q1 - SJR). (2017 - Current Contents). ISSN 0925-4005. DOI Link: https://doi.org/10.1016/j.snb.2017.05.040	35
42.	KOŠŤÁLOVÁ, Zuzana** - HROMÁDKOVÁ, Zdenka. Structural characterisation of polysaccharides from roasted hazelnut skins. In *Food Chemistry*, 2019, vol. 286, p. 179-184. (2018: 5.399 - IF, Q1 - JCR, 1.768 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 0308-8146. DOI Link: https://doi.org/10.1016/j.foodchem.2019.01.203	26
43.	TRNKA, Tomáš - TVAROŠKA, Igor - KOČA, Jaroslav**. Automated training of reaxFF reactive force fields for energetics of enzymatic reactions. In *Journal of Chemical Theory and Computation*, 2018, vol. 14, p. 291-302. (2017: 5.399 - IF, Q1 - JCR, 2.497 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 1549-9618. DOI Link: https://doi.org/10.1021/acs.jctc.7b00870	15
44.	SLÁDEK, Vladimír** - TOKIWA, Hiroaki - SHIMANO, Hitoshi - SHIGETA, Yasuteru. Protein residue networks from energetic and geometric data: Are they identical? In *Journal of Chemical Theory and Computation*, 2018, vol. 14, p. 6623-6631. (2017: 5.399 - IF, Q1 - JCR, 2.497 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 1549-9618. DOI Link: https://doi.org/10.1021/acs.jctc.8b00733	14
45.	MASTIHUBA, Vladimír** - KARNIŠOVÁ POTOCKÁ, Elena - UHLIARIKOVÁ, Iveta - KIS, Peter - KOZMON, Stanislav - MASTIHUBOVÁ, Mária. Reaction mechanism of beta-apiosidase from *Aspergillus aculeatus*. In *Food Chemistry*, 2019, vol. 274, p. 543-546. (2018: 5.399 - IF, Q1 - JCR, 1.768 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 0308-8146. DOI Link: https://doi.org/10.1016/j.foodchem.2018.09.003	5

46. MIRABELLA, Stefania - D'ADAMIO, Giampiero - MATASSINI, Camilla - GOTI, Andrea - DELGADO, Sandra - GIMENO, Ana - ROBINA, Inmaculada - MORENO-VARGAS, Antonio J. - ŠESTÁK, Sergej - JIMÉNEZ-BARBERO, Jesus - CARDONA, Francesca. Mechanistic insight into the binding of multivalent pyrrolidines to alpha-mannosidases. In *Chemistry -A European Journal*, 2017, vol. 23, p. 14585-14596. (2016: 5.317 - IF, Q1 - JCR, 2.352 - SJR, Q1 - SJR). (2017 - Current Contents). ISSN 0947-6539. DOI Link: https://doi.org/10.1002/chem.201703011 — 21

47. HARADA, Ryuhei** - SLÁDEK, Vladimír** - SHIGETA, Yasuteru**. Nontargeted parallel cascade selection molecular dynamics using time-localized prediction of conformational transitions in protein dynamics. In *Journal of Chemical Theory and Computation*, 2019, vol. 15, p. 5144-5153. (2018: 5.313 - IF, Q1 - JCR, 2.236 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 1549-9618. DOI Link: https://doi.org/10.1021/acs.jctc.9b00489 — 32

48. JANOŠ, Pavel - TRNKA, Tomáš - KOZMON, Stanislav - TVAROŠKA, Igor - KOČA, Jaroslav. Different QM/MM approaches to elucidate enzymatic reactions: Case study on ppGalNAcT2. In *Journal of Chemical Theory and Computation*, 2016, vol. 12, no. 12, p. 6062-6076. (2015: 5.301 - IF, Q1 - JCR, 2.702 - SJR, Q1 - SJR). (2016 - Current Contents). ISSN 1549-9618. DOI Link: https://doi.org/10.1021/acs.jctc.6b00531 — 8

49. DELLA SALA, Paolo - VANNI, Costanza - TALOTTA, Carmen - DI MARINO, Luca - MATASSINI, Camilla - GOTI, Andrea - NERI, Placido - ŠESTÁK, Sergej - CARDONA, Francesca** - GAETA, Carmine**. Multivalent resorcinarene clusters decorated with DAB-1 inhitopes: targeting Golgi α-mannosidase from *Drosophila melanogaster*. In *Organic Chemistry Frontiers*, 2021, vol. 8, p. 6648-6656. (2020: 5.281 - IF, Q1 - JCR, 1.377 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 2052-4129. DOI Link: https://doi.org/10.1039/d1qo01048d — 1

50. MONRAD, Rune Nygaard** - EKLOF, Jens - KROGH, Kristian B.R. - BIELY, Peter**. Glucuronoyl esterases: diversity, properties and biotechnological potential. A review. In *Critical Reviews in Biotechnology*, 2018, vol. 38, p. 1121-1136. (2017: 5.239 - IF, Q1 - JCR, 1.243 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 0738-8551. DOI Link: https://doi.org/10.1080/07388551.2018.1468316 — 9

51. GARAJOVÁ, Soňa - MATHIEU, Yann - BECCIA, Maria Rosa - BENNATI-GRANIER, Chloé - BIASO, Frédéric - FANUEL, Mathieu - ROPARTZ, David - GUIGLIARELLI, Bruno - RECORD, Eric - ROGNIAUX, Héléne - HENRISSAT, Bernard - BERRIN, Jean-Guy. Single-domain flavoenzymes trigger lytic polysaccharide monooxygenases for oxidative degradation of cellulose. In *Scientific Reports*, 2016, vol. 6, art. no. 28276. (2015: 5.228 - IF, Q1 - JCR, 2.034 - SJR, Q1 - SJR). (2016 - Current Contents). ISSN 2045-2322. DOI Link: https://doi.org/10.1038/srep28276 — 72

52. CAPEK, Peter** - MATULOVÁ, Mária - ŠUTOVSKÁ, Martina - BARBORÍKOVÁ, Jana - MOLITORISOVÁ, Miroslava - KAZIMIEROVÁ, Ivana. *Chlorella vulgaris* α-L-arabino-α-L-rhamno-α,β-D-galactan structure and mechanisms of its anti-inflammatory and anti-remodelling effects. In *International Journal of Biological Macromolecules*, 2020, vol. 162, p. 188-198. (2019: 5.162 - IF, Q1 - JCR, 0.972 - SJR, Q1 - SJR). (2020 - Current Contents, WOS, SCOPUS). ISSN 0141-8130. DOI Link: https://doi.org/10.1016/j.ijbiomac.2020.06.151 — 4

53. ROBAJAC, Dragana - KRIŽÁKOVÁ, Martina, Zámorová - MASNIKOSA, Romana - MILJUŠ, Goran - ŠUNDERIĆ, Miloš - — 4

NEDIĆ, Olgica - KATRLÍK, Jaroslav**. Sensitive glycoprofiling of insulin-like growth factor receptors isolated from colon tissue of patients with colorectal carcinoma using lectin-based protein microarray. In *International Journal of Biological Macromolecules*, 2020, vol. 144, p. 932-937. (2019: 5.162 - IF, Q1 - JCR, 0.972 - SJR, Q1 - SJR). (2020 - Current Contents, WOS, SCOPUS). ISSN 0141-8130. DOI Link: https://doi.org/10.1016/j.ijbiomac.2019.09.170

54. UHLIARIKOVÁ, Iveta - ŠUTOVSKÁ, Martina** - BARBORÍKOVÁ, Jana - MOLITORISOVÁ, Miroslava - KIM, Hee Jin - PARK, Yong Il - MATULOVÁ, Mária - LUKAVSKÝ, Lubomír - HROMÁDKOVÁ, Zdenka - CAPEK, Peter**. Structural characteristics and biological effects of exopolysaccharide produced by cyanobacterium *Nostoc sp*. In *International Journal of Biological Macromolecules*, 2020, vol. 160, p. 364-371. (2019: 5.162 - IF, Q1 - JCR, 0.972 - SJR, Q1 - SJR). (2020 - Current Contents, WOS, SCOPUS). ISSN 0141-8130. DOI Link: https://doi.org/10.1016/j.ijbiomac.2020.05.135 — 3

55. UHLIARIKOVÁ, Iveta** - MATULOVÁ, Mária - CAPEK, Peter**. Structural features of the bioactive cyanobacterium *Nostoc sp*. exopolysaccharide. In *International Journal of Biological Macromolecules*, 2020, vol. 164, p. 2284-2292. (2019: 5.162 - IF, Q1 - JCR, 0.972 - SJR, Q1 - SJR). (2020 - Current Contents, WOS, SCOPUS). ISSN 0141-8130. DOI Link: https://doi.org/10.1016/j.ijbiomac.2020.08.113 — 2

56. CAPEK, Peter** - ŠUTOVSKÁ, Martina** - BARBORÍKOVÁ, Jana - KAZIMIEROVÁ, Ivana - FRAŇOVÁ, Soňa - KOPÁČOVÁ, Mária. Structural characterization and anti-asthmatic effect of α-L-arabino(4-O-methyl-α-D-glucurono)-β-D-xylan from the roots of *Rudbeckia fulgida*. In *International Journal of Biological Macromolecules*, 2020, vol. 165, part A, p. 842-848. (2019: 5.162 - IF, Q1 - JCR, 0.972 - SJR, Q1 - SJR). (2020 - Current Contents, WOS, SCOPUS). ISSN 0141-8130. DOI Link: https://doi.org/10.1016/j.ijbiomac.2020.09.246 — 0

57. JÁNOŠ, Pavel - KOZMON, Stanislav - TVAROŠKA, Igor** - KOČA, Jaroslav. How *mycobacterium tuberculosis* galactofuranosyltransferase 2 (GlfT2) generates alternating β-(1-6) and β-(1-5) linkages: QM/MM molecular dynamics study of the chemical steps. In *Chemistry-A European Journal*, 2018, vol. 24, p. 7051-7059. (2017: 5.160 - IF, Q1 - JCR, 2.265 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 0947-6539. DOI Link: https://doi.org/10.1002/chem.201800558 — 7

58. XU, Peng** - KORCOVÁ, Jana, Vráblová - BARÁTH, Peter - ČÍŽOVÁ, Alžbeta - VALÁRIKOVÁ, Jana - QADRI, Firdausi - KELLY, Megan - O´CONNOR, Robert D. - RYAN, Edward T. - BYSTRICKÝ, Slavomír - KOVÁČ, Pavol. Isolation, purification, characterization and direct conjugation of the lipid A-free lipopolysaccharide of *Vibrio cholerae* O139. In *Chemistry -A European Journal*, 2019, vol. 25, p. 12946-12956. (2018: 5.160 - IF, Q1 - JCR, 1.842 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 0947-6539. DOI Link: https://doi.org/10.1002/chem.201902263 — 4

59. HALAJ, Michal - MATULOVÁ, Mária - ŠUTOVSKÁ, Martina** - BARBORÍKOVÁ, Jana - KAZIMIEROVÁ, Ivana - FRAŇOVÁ, Soňa - PŘIBYL, Pavel - CEPÁK, Vladislav - LUKAVSKÝ, Jaromír - CAPEK, Peter**. Chemico-physical and pharmacodynamic properties of extracellular *Dictyosphaerium chlorelloides* biopolymer. In *Carbohydrate Polymers*, 2018, vol. 198, p. 215-224. (2017: 5.158 - IF, Q1 - JCR, 1.428 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 0144-8617. DOI Link: https://doi.org/10.1016/j.carbpol.2018.06.018 — 7

60. ŠIMKOVIC, Ivan** - GUCMANN, Filip - MENDICHI, Raniero - GIACOMETTI SCHIERONI, Alberto - PIOVANI, Daniele - DOBROČKA, Edmund - HRICOVÍNI, Miloš. Extraction and characterization of polysaccharide films prepared from *Furcellaria lumbricalis* and *Gigartina skottsbergii* seaweeds. In *Cellulose*, 2021, vol. 28, p. 9567-9588. (2020: 5.044 - IF, Q1 - JCR, 0.948 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 0969-0239. DOI Link: https://doi.org/10.1007/s10570-021-04138-5 — 3

61. STREĎANSKÝ, Miroslav - REDIVO, Luca** - MAGDOLEN, Peter - STREĎANSKÝ, Adam - NAVARINI, Luciano. Rapid sucrose monitoring in green coffee samples using multienzymatic biosensor. In *Food Chemistry*, 2018, vol. 254, p. 8-12. (2017: 4.946 - IF, Q1 - JCR, 1.793 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 0308-8146. DOI Link: https://doi.org/10.1016/j.foodchem.2018.01.171 — 14

62. HOUSER, Josef - KOZMON, Stanislav - MISHRA, Deepti - HAMMEROVÁ, Zuzana - WIMMEROVÁ, Michaea - KOČA, Jaroslav**. The CH–π interaction in protein–carbohydrate binding: Bioinformatics and *in vitro* quantification. In *Chemistry - A European Journal*, 2020, vol. 26, p. 10769-10780. (2019: 4.857 - IF, Q1 - JCR, 1.681 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 0947-6539. DOI Link: https://doi.org/10.1002/chem.202000593 — 7

63. ŠUCHOVÁ, Katarína** - PUCHART, Vladimír - BIELY, Peter. A novel bacterial GH30 xylobiohydrolase from *Hungateiclostridium clariflavum*. In *Applied Microbiology and Biotechnology*, 2021, vol. 105, p. 185-195. (2020: 4.813 - IF, Q1 - JCR, 1.074 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 0175-7598. DOI Link: https://doi.org/10.1007/s00253-020-11023-x — 1

64. ŠIMKOVIC, Ivan - KELNAR, Ivan - MENDICHI, Raniero - BERTÓK, Tomáš - FILIP, Jaroslav. Composite films prepared from agricultural by-products. In *Carbohydrate Polymers*, 2017, vol. 156, p. 77-85. (2016: 4.811 - IF, Q1 - JCR, 1.419 - SJR, Q1 - SJR). (2017 - Current Contents). ISSN 0144-8617. DOI Link: https://doi.org/10.1016/j.carbpol.2016.09.014 — 10

65. LORENCOVÁ, Lenka - BERTÓK, Tomáš - CHOCHOLOVÁ, Erika - ŠEDIVÁ, Alena - PAPRČKOVÁ, Darina - VIKARTOVSKÁ, Alica - SASINKOVÁ, Vlasta - FILIP, Jaroslav - KASÁK, Peter - JERIGOVÁ, Monika - VELIČ, Dušan - MAHMOUD, Khaled A. - TKÁČ, Ján. Electrochemical performance of Ti3C2TX MXene in aqueous media: towards ultrasensitive H2O2 sensing. In *Electrochimica Acta*, 2017, vol. 235, p. 471-479. (2016: 4.798 - IF, Q1 - JCR, 1.355 - SJR, Q1 - SJR). (2017 - Current Contents). ISSN 0013-4686. DOI Link: https://doi.org/10.1016/j.electacta.2017.03.073 — 135

66. BELICKÝ, Štefan - DAMBORSKÝ, Pavel - ZAPATERO-RODRÍGUEZ, Julia - O´KENNEDY, Richard - TKÁČ, Ján. Full-length antibodies versus single chain antibody fragments for a selective impedimetric lectin-based glycoprofiling of prostate specific antigen. In *Electrochimica Acta*, 2017, vol. 246, p. 399-405. (2016: 4.798 - IF, Q1 - JCR, 1.355 - SJR, Q1 - SJR). (2017 - Current Contents). ISSN 0013-4686. DOI Link: https://doi.org/10.1016/j.electacta.2017.06.065 — 13

67. BARBORÍKOVÁ, Jana - ŠUTOVSKÁ, Martina - KAZIMIEROVÁ, Ivana - JOŠKOVÁ, Marta - FRAŇOVÁ, Soňa - KOPECKÝ, Ján - CAPEK, Peter**. Extracellular polysaccharide produced by *Chlorella vulgaris* – Chemical characterization and anti-asthmatic profile. In *International Journal of Biological Macromolecules*, 2019, vol. 135, p. 1-11. (2018: 4.784 - IF, Q1 - JCR, 0.962 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 0141-8130. DOI Link: https://doi.org/10.1016/j.ijbiomac.2019.05.104 — 23

68.	DAMBORSKÁ, Dominika - KASÁK, Peter - KUBÁNIKOVÁ, Petra - SOKOL, Roman - TKÁČ, Ján. Aberrant sialylation of a prostate-specific antigen: Electrochemical label-free glycoprofiling in prostate cancer serum samples. In *Analytica Chimica Acta*, 2016, vol. 934, p. 72-79. (2015: 4.712 - IF, Q1 - JCR, 1.469 - SJR, Q1 - SJR). (2016 - Current Contents). ISSN 0003-2670. DOI Link: https://doi.org/10.1016/j.aca.2016.06.043	46
69.	DAMBORSKÝ, Pavel - ŠVITEL, Juraj - KATRLÍK, Jaroslav**. Optical biosensors. In *Essays in Biochemistry*, 2016, vol. 60, no. 1, p. 91-100. (2015: 3.378 - IF, Q2 - JCR, 2.420 - SJR, Q1 - SJR). ISSN 0071-1365. DOI Link: https://doi.org/10.1042/EBC20150010	231

2.1.3 List of monographs/books published abroad

2.1.4. List of monographs/books published in Slovakia

1. BERTÓK, Tomáš - BERTÓKOVÁ, Anikó - FILIP, Jaroslav - HOLAZOVÁ, Alena - BELICKÝ, Štefan - KASÁK, Peter - TKÁČ, Ján. *Nanobiotechnológie alebo Od lepiacej pásky k medicínskym aplikáciám*. Bratislava: VEDA, 2017. 172 s. ISBN 978-80-224-1580-4
2. BIELY, Peter. *Veda s anjelom*. Bratislava: Veda, vydavateľstvo Slovenskej akadémie vied, 2020. 264 s. ISBN 978-80-224-1850-8

2.1.5. List of other scientific outputs specifically important for the institute, max. 10 items for institute with less than 50 average FTE researchers per year, 20 for institutes with 50 – 100 average FTE researchers per year and so on

Other research outputs having high importance for the Institute of Chemistry SAS covers area such as isolation, structural characterization, biosynthesis, biological and medical activity and modification of biologically important (poly)saccharides, together with study of enzymes involved in their degradation as a sustainable catalysts for bio-refineries and for production of value-added products, as well as protection of honeybees (as the most important pollinator in agriculture) against bacterial diseases and potential of various plants in remediation of ground contaminated with heavy metals. These topics reflect the environmental, sustainability and health challenges of the present-day life. Just a note, the list of main outputs (selected according to scientometric parameters) is summarized in Section 2.1.2.

Num.	Publication	Num. of Citations
1.	ŠÍPOŠOVÁ, Kristína - LABANCOVÁ, Eva - KUČEROVÁ, Danica, Richterová - KOLLÁROVÁ, Karin - VIVODOVÁ, Zuzana**. Effects of exogenous application of indole-3-butyric acid on maize plants cultivated in the presence or absence of cadmium. In *Plants*, 2021, vol. 10, no. 11, art. no. 2503. (2020: 3.935 - IF, Q1 - JCR, 0.892 - SJR, Q1 - SJR). (2021 - Current Contents). ISSN 2223-7747. DOI Link: https://doi.org/10.3390/plants10112503	0
2.	KOLLÁROVÁ, Karin** - KUSÁ, Zuzana - VATEHOVÁ, Zuzana - LIŠKOVÁ, Desana. The response of maize protoplasts to cadmium	12

stress mitigated by silicon. In *Ecotoxicology and Environmental Safety*, 2019, vol. 170, p. 488-494. (2018: 4.527 - IF, Q1 - JCR, 1.174 - SJR, Q1 - SJR). (2019 - Current Contents, WOS, SCOPUS). ISSN 0147-6513. DOI Link: https://doi.org/10.1016/j.ecoenv.2018.12.016

3. LAHO, Maroš** - ŠEDIVÁ, Mária - MAJTÁN, Juraj - KLAUDINY, Jaroslav**. Fructose and trehalose selectively enhance *in vitro* sporulation of *Paenibacillus larvae* ERIC I and ERIC II strains. In *Microorganisms*, 2021, vol. 9, art. no. 225 [15] p. (2020: 4.128 - IF, Q2 - JCR, 0.858 - SJR, Q2 - SJR). (2021 - WOS, SCOPUS). ISSN 2076-2607. DOI Link: https://doi.org/10.3390/microorganisms9020225 — 0
4. ŠEDIVÁ, Mária - LAHO, Maroš - KOHÚTOVÁ, Lenka - MOJŽIŠOVÁ, Andrea - MAJTÁN, Juraj - KLAUDINY, Jaroslav**. 10-HDA, a major fatty acid of royal jelly, exhibitis pH dependent gowth-inhibitory activity against different strains of *Paenibacillus larvae*. In *Molecules*, 2018, vol. 23, iss. 12, art. no. 3236, 14 p. (2017: 3.098 - IF, Q2 - JCR, 0.855 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 1420-3049. DOI Link: https://doi.org/10.3390/molecules23123236 — 17
5. PAWLACZYK-GRAJA, Izabela** - BALICKI, Sebastian - ZIEWIECKI, Rafał - CAPEK, Peter - MATULOVÁ, Mária. New isolation process for bioactive food fiber from wild strawberry leaf. In *Biochemical Engineering Journal*, 2020, vol. 161, art. no. 107639 [10] p. (2019: 3.475 - IF, Q2 - JCR, 0.879 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 1369-703X. DOI Link: https://doi.org/10.1016/j.bej.2020.107639 — 4
6. ARUMUGAM, Nathakumar - BIELY, Peter - PUCHART, Vladimír - GERRANO, Abe Shegro - DE MUKHERJEE, Koel - SINGH, Suren - PILLAI, Santhosh**. Xylan from bambara and cowpea biomass and their structural elucidation. In *International Journal of Biological Macromolecules*, 2019, vol. 132, p. 987-993. (2018: 4.784 - IF, Q1 - JCR, 0.962 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 0141-8130. DOI Link: https://doi.org/10.1016/j.ijbiomac.2019.04.030 — 10
7. BRODACZEWSKA, Natalia - KOŠŤÁLOVÁ, Zuzana - UHRÍN, Dušan**. (3, 2)D 1H, 13C BIRDr,X-HSQC-TOCSY for NMR structure elucidation of mixtures: application to complex carbohydrates. In *Journal of Biomolecular NMR*, 2018, vol. 70, p. 115-122. (2017: 2.534 - IF, Q2 - JCR, 1.371 - SJR, Q1 - SJR). (2018 - Current Contents). DOI Link: https://doi.org/10.1007/s10858-018-0163-8 — 9
8. KOŠŤÁLOVÁ, Zuzana - AGUEDO, Mario - HROMÁDKOVÁ, Zdenka. Microwave-assisted extraction of pectin from unutilized pumpkin biomass. In *Chemical Engineering and Processing: Process Intensification*, 2016, vol. 102, p. 9-15. (2015: 2.154 - IF, Q2 - JCR, 0.855 - SJR, Q1 - SJR). (2016 - Current Contents). ISSN 0255-2701. DOI Link: https://doi.org/10.1016/j.cep.2015.12.009 — 2
9. STRATILOVÁ, Barbora - FIRÁKOVÁ, Zuzana, Zemková - KLAUDINY, Jaroslav - ŠESTÁK, Sergej - KOZMON, Stanislav - STROUHALOVÁ, Dana - GARAJOVÁ, Soňa - AIT-MOHAND, Fairouz - HORVÁTHOVÁ, Ágnes - FARKAŠ, Vladimír - STRATILOVÁ, Eva - HRMOVÁ, Mária**. Engineering the acceptor substrate specificity in the xyloglucan endotransglycosylase TmXET6.3 from nasturtium seeds (*Tropaeolum majus* L.). In *Plant Molecular Biology*, 2019, vol. 100, no. 1-2, p. 181-197. (2018: 3.928 - IF, Q1 - JCR, 1.705 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 0167-4412. DOI Link: https://doi.org/10.1007/s11103-019-00852-8 — 11
10. ARROYO, Javier - FARKAŠ, Vladimír - SANZ, Ana B - CABIB, Enrico. Strengthening the fungal cell wall through chitin–glucan cross-links: effects on morphogenesis and cell integrity. In *Cellular* — 46

microbiology. - Veľká Británia: Blackwell Synergy, 2016, vol. 18, p. 1239-1250. (2015: 4.460 - IF, Q1 - JCR, 2.949 - SJR, Q1 - SJR). (2016 - Current Contents). ISSN 1462-5814. DOI Link: https://doi.org/10.1111/cmi.12615

11. CHOI, Ji Won - SYNYTSYA, Andriy - CAPEK, Peter - BLEHA, Roman - POHL, Radek - PARK, Yong Il. Structural analysis and anti-obesity effect of a pectic polysaccharide isolated from Korean mulberry fruit Oddi (*Morus alba* L.). In *Carbohydrate Polymers*, 2016, vol. 146, p. 187-196. (2015: 4.219 - IF, Q1 - JCR, 1.440 - SJR, Q1 - SJR). (2016 - Current Contents). ISSN 0144-8617. 66
12. TSIRIGOTIS-MANIECKA, Marta - PAWLACZYK-GRAJA, Izabela** - ZIEWIECKI, Rafal - BALICKI, Sebastian - MATULOVÁ, Mária - CAPEK, Peter - CZECHOWSKI, Franciszek - GANCARZ, Roman. The polyphenolic-polysaccharide complex of *Agrimonia* L. as an indirect thrombin inhibitor - isolation and chemical characterization. In *International Journal of Biological Macromolecules*, 2019, vol. 125, p. 124-132. (2018: 4.784 - IF, Q1 - JCR, 0.962 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 0141-8130. DOI Link: https://doi.org/10.1016/j.ijbiomac.2018.12.017 15
13. HALAJ, Michal - PAULOVIČOVÁ, Ema - PAULOVIČOVÁ, Lucia - JANTOVÁ, Soňa - CEPÁK, Vladislav - LUKAVSKÝ, Jaromír - CAPEK, Peter**. Extracellular biopolymers produced by *Dictyosphaerium* family - Chemical and immunomodulative properties. In *International Journal of Biological Macromolecules*, 2019, vol. 121, p. 1254-1263. (2018: 4.784 - IF, Q1 - JCR, 0.962 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 0141-8130. DOI Link: https://doi.org/10.1016/j.ijbiomac.2018.10.116 7
14. TSVETKOV, Yury E. - PAULOVIČOVÁ, Ema** - PAULOVIČOVÁ, Lucia - FARKAŠ, Pavol - NIFANTIEV, Nikolay E. Synthesis of biotin-tagged chitosan oligosaccharides and assessment of their immunomodulatory activity. In *Frontiers in Chemistry. Special issue: Carbohydrate-Based Molecules in Medicinal Chemistry*, 2020, vol. 8, art. no. 554732 [22] p. (2019: 3.693 - IF, Q2 - JCR, 0.852 - SJR, Q1 - SJR). (2020 - Current Contents). ISSN 2296-2646. DOI Link: https://doi.org/10.3389/fchem.2020.554732 5
15. PAULOVIČOVÁ, Ema** - PAULOVIČOVÁ, Lucia - FARKAŠ, Pavol - KARELIN, Alexander A. - TSVETKOV, Yury E. - KRYLOV, Vadim B. - NIFANTIEV, Nikolay E.**. Importance of *Candida* antigenic factors: structure-driven immunomodulation properties of synthetically prepared mannooligosaccharides in RAW264.7 macrophages. In *Frontiers in Cellular and Infection Microbiology*, 2019, vol. 9, article no. 378, p. 1-14. (2018: 3.518 - IF, Q2 - JCR, 1.541 - SJR, Q1 - SJR). (2019 - Current Contents). ISSN 2235-2988. DOI Link: https://doi.org/10.3389/fcimb.2019.00378 5
16. PAULOVIČOVÁ, Ema - PAULOVIČOVÁ, Lucia - PILIŠIOVÁ, Ružena - JANČINOVÁ, Viera - YASHUNSKY, Dmitry V. - KARELIN, Alexander A. - TSVETKOV, Yury E. - NIFANTIEV, Nikolay E. The evaluation of beta-(1-3)-nonaglucoside as an anti-*Candida albicans* immune response inducer. In *Cellular Microbiology*, 2016, vol. 18, no. 9, p. 1294-1307. (2015: 4.460 - IF, Q1 - JCR, 2.949 - SJR, Q1 - SJR). (2016 - Current Contents). ISSN 1462-5814. DOI Link: https://doi.org/10.1111/cmi.12631 13
17. KIS, Peter - HORVÁTHOVÁ, Eva - GÁLOVÁ, Eliška - ANTALOVÁ, V. - KARNIŠOVÁ POTOCKÁ, Elena - MASTIHUBA, Vladimír - MASTIHUBOVÁ, Mária**. Synthesis of tyrosol and hydroxytyrosol glycofuranosides and their biochemical and biological activities in cell-free and cellular assays. In *Molecules*, 2021, vol. 26, no. 24, art. no. 7607. (2020: 4.412 - IF, Q2 - JCR, 0.782 - SJR, Q1 - SJR). (2021 0

- Current Contents, WOS, SCOPUS). ISSN 1420-3049. DOI Link: https://doi.org/10.3390/molecules26247607

18. KIS, Peter - MASTIHUBOVÁ, Mária**. A sustainable approach to phenylethanoid glycopyranosides: Study of glycosylations promoted by zinc salts. In *Sustainable Chemistry and Pharmacy*, 2021, vol. 24, art. no. 100537 [9] p. (2020: 4.508 - IF, Q2 - JCR, 0.728 - SJR, Q2 - SJR). (2021 - Current Contents). ISSN 2352-5541. DOI Link: https://doi.org/10.1016/j.scp.2021.100537 — 1
19. SLÁDEK, Vladimír** - YAMAMOTO, Yuta - HARADA, Ryuhei - SHOJI, Mitsuo - SHIGETA, Yasuteru - SLÁDEK, Vladimír. pyProGA—A PyMOL plugin for protein residue network analysis. In *PLoS ONE*, 2021, vol. 16, art. no. e0255167 [17] p. (2020: 3.240 - IF, Q2 - JCR, 0.990 - SJR, Q1 - SJR). ISSN 1932-6203. DOI Link: https://doi.org/10.1371/journal.pone.0255167 — 1
20. ŠUCHOVÁ, Katarína - SPODBERG, Nikolaj - MØRKEBERG KROGH, Kristian B.R. - BIELY, Peter - PUCHART, Vladimír**. Non-specific GH30_7 endo-β-1,4-xylanase from *Talaromyces leycettanus*. In *Molecules*, 2021, vol. 26, art. no. 4614 [13] p. (2020: 4.412 - IF, Q2 - JCR, 0.782 - SJR, Q1 - SJR). (2021 - Current Contents, WOS, SCOPUS). ISSN 1420-3049. DOI Link: https://doi.org/10.3390/molecules26154614 — 1

2.1.6. List of patents, patent applications, and other intellectual property rights registered abroad

1. Pub.No: 288915
   Title: Biopreparát z *Exiguobacterium undae*, spôsob jeho výroby a jeho použitie (Eng: „Biopreparation from *Exiguobacterium undae*, method of its production and its use")
   Inventor: Baráth Peter, Pangallo Domenico, Bauerová Vladena, Bučková Mária, Puškárová Andrea, Kraková Lucia, Nagy Štefan, Štafura Andrej, Jeszeová Lenka, Čulík Martin
2. Pub.No: US 2016/0208301 A1
   Title: Polypeptide having xylanase activity and polynucleotides encoding same.
   Inventor: Biely Peter, Stringer Mary Ann, Spodsberg Nikolaj, Morkeberg Krogh Kristian Bertel Roemer

2.1.7. List of patents, patent applications, and other intellectual property rights registered in Slovakia

1. Pub.No: PP 50012-2018
   Title: Biopreparát z *Exiguobacterium undae*, spôsob jeho výroby a jeho použitie (Eng: „Biopreparation from *Exiguobacterium undae*, method of its production and its use")
   Inventor: Baráth Peter, Pangallo Domenico, Bauerová Vladena, Bučková Mária, Puškárová Andrea, Kraková Lucia, Nagy Štefan, Štafura Andrej, Jeszeová Lenka, Čulík Martin

2.1.8. Narrative on the most important research outputs of the institute – especially focused on their importance for society (3-5 pages)

Research activities at the Institute of Chemistry SAS are primarily focused on addressing many important societal challenges in several areas, such as health, the environment, and sustainable development.

Great emphasis is placed on research in the health area; a number of resources are devoted to this field, and significant scientific results have been achieved in the ”glycans-for-health“ area in the recent period. Glycan-based bioanalytical approaches have huge applications in a better understanding of a plethora of physiological and pathological processes, including diseases such as cancer, with very promising potential in diagnostics.

The ERC Starting grant implemented at the Institute of Chemistry SAS (2013-2017) was the first ERC grant realised in Slovakia. Within the framework of the grant, we researched and proposed label-free assay strategies enabling to achieve unprecedented sensitivity down to single-molecule level integrating electrochemical impedance spectroscopy with nanomaterials or a nanoscale-controlled immobilisation process. The research work in the framework of the implemented FP7 and H2020 MSCA-ITN grants (2012-2016 and 2018-2023) has been focused on biosensors and biochip-based tools for glycan recognition in diagnostics and therapy. Since cancer presents a significant burden on society, citizens and healthcare systems, we wanted to accept the challenge by analysing glycans to improve diagnostics of the selected cancer types. The first one was prostate cancer, which is one of the most frequent types of cancer in men. An ultrasensitive strategy for glycoprofiling of a prostate-specific antigen, using electrochemical impedance spectroscopy, was developed and applied for the analysis of human serum samples from patients with prostate cancer and healthy control with significant differences observed (Chapter 2.1.2, Art. no. 68). Electrochemical biosensors were also developed for glycoprofiling of HER2 protein, a breast cancer biomarker (Chapter 2.1.2, Art. no. 39), which is an approach that can be applied for diagnostics of breast cancer with high accuracy. The research on validating fPSA glycoprofile as a prostate cancer biomarker to avoid unnecessary biopsies and re-biopsies using a magnetic bead-based assay with lectin and an ELISA-like format of analysis (Chapter 2.1.2, Art. no. 27) led to the establishment of a start-up company (Chapter 2.6.1., Case study 2). The lectin-based microarray biochip platform developed in the Institute was designed for throughput and sensitive detection of colorectal cancer glyco-biomarkers (Chapter 2.1.2, Art. no. 53; Zámorová et al., 2017), biomarkers of other diseases as diabetes, cirrhosis, and renal disease (Penezić et al., 2019; Baralić et al., 2020), biomarkers of aging (Gligorijević et al., 2018), as well as for glycan analysis of therapeutic proteins, combined with MALDI-MS (Pažitná et al., 2020). Optical biosensors are a very effective tool for biomarker detection (Chapter 2.1.2, Art. no. 69). The developed lectin lateral flow assay (LFA) biosensor in the form of a paper strip for the glycoprofiling of the prostate cancer biomarker PSA, the world's first published LFA biosensor for glycosylation monitoring, can serve as a point-of-care (PoC) device (Damborský, Koczula et al., 2016). Other optical biosensing platforms, e.g. SPR, were also developed and applied in prostate cancer biomarker detection and glycoprofiling (Chapter 2.1.2, Art. no. 12; Damborský, Zámorová et al., 2016). The most recent research on an increase in diagnostic assay sensitivity is focused on implementation of 2D nanomaterials such as graphene and MXenes (Chapter 2.1.2, Art. no. 38 and 65) or magnetic nanoparticles (Chapter 2.1.2, Art. no. 7) for interfacial patterning of conductive interfaces in order to construct electrochemical (bio)sensors for detection of various analytes, including glycans. The approaches developed and based on specifically designed biosensors and biochips are tailored to the specific applications in diagnostics, biomedicine, and biotechnology. These approaches help to improve the trends in diagnostics and therapy of serious diseases, and thus significantly contribute to solving global health and societal challenges.

Other outputs of great importance in the health area are related to the research of rare diseases. There are more than 6000 distinct rare diseases in the EU. Whilst one rare disease may affect only a single patient in the world, another may touch as many as 245 000. Each rare disorder has its specific molecular basis, and most of them are diagnosed using a personalized approach. Based on a wide variety of clinical symptoms, their diagnostics remains challenging. However, because of their rarity, they are not at the heart

of the activities of pharmaceutical companies, but their severity is high and starts in early childhood. Our work is based on highly sensitive targeted analytical approaches, such as mass spectrometry and NMR spectroscopy, and monitoring of metabolites/biomarkers, mostly in congenital disorders of glycosylation (CDG) and lysosomal storage disorders (LSD). The Institute of Chemistry started to collaborate with the National Institute of Children`s Diseases in Bratislava in the area of diagnostics of CDG and LSD patients in order to understand the underlining molecular basis in single-patient cases. Productive collaboration is documented by published results on determination of aberrant apolipoprotein C-III glycosylation in glycogen storage disease type III and IX (Chapter 2.1.2, Art. no. 31) and in the case study on the monitoring of Glc4 tetrasaccharide in the urine of Pompe patients using of MALDI-TOF MS and 1H NMR (Pakanová et al., 2019). The application of highly sophisticated analytical tools in the characterisation of single rare disease subtypes represents an important contribution to basic research of rare diseases, as well as a meaningful benefit for patients and their families. Awareness of CDG and LSD and their diagnostic possibilities is continually increasing through popularization activities for both professionals and the public.

The development of new drugs is always a challenging issue impacting health, which calls for cooperation in many scientific areas, including computational design, synthesis itself, biological assays and many others. In our Institute, we have had such cooperation for many years, and our scientific ideas are focused on synthesis of some human or mycobacterial (tuberculosis causative agent) enzyme inhibitors. In detail, we designed and prepared many structures which were tested for their potential inhibition activity against human glycosyltransferase (GnT-I) and/or mycobacterial galactosyltransferase (GlfT2). Both enzymes show some similarities in their active sites (e.g., bisubstrate enzyme, ion depending, requiring similar substrates). Therefore, only small changes in structures can lead to the preparation of inhibitors, potentially active on both enzymes. While GnT-I overexpression is believed to be responsible for many serious human diseases, GlfT2 is one of the enzymes involved in mycobacterial cell wall biosynthesis – a very rigid structure which makes a tuberculosis treatment difficult. The synthetic strategy for the convenient synthesis of suggested structures containing D-fructofuranosyl and D-tagatofuranosyl sulfones was developed and tested on their GlfT2 inhibition activity (Baráth et al., 2020). Moreover, similar structures bearing the 1-O-sulfono-α-D-fructofuranosyl sulfones scaffold were tested against rabbit GnT-1 as a good replacement for human GnT-I (Jakubčinová et al., 2020). From these pioneer structures, those with the most promising biological results will be selected. Advanced structural changes will be applied in order to increase their potential inhibition activity against both enzymes.

Another scientific area with a significant impact on health, which is the subject of considerable attention at the Institute, is focused on the field of immunochemistry. Fungal infections can make life uncomfortable, but they can also seriously harm it in the case of systemic infections, such as nozocomial infections. The study of carbohydrate structures as important immunogens and molecules in contact with the environment and the host can help to combat this global problem. We focus on the model yeast, *Candida albicans*. Our primary research target are mannooligosaccharides, but we also study glucans and chitin as not less important biomolecules (Chapter 2.1.2, Art. no. 17 and 58; Chapter 2.1.5, Art. no. 14 and 16). The research has the potential to contribute to the development of vaccines, therapeutics, or diagnostic methods. The research underlines the growing relevance of resistant yeasts such as *Candida auris*. We have shown another application of yeast polysaccharide derivatives on quaternized mannan, which has anti-staphylococcal activity. An O-specific polysaccharide from *Vibrio cholerae* was isolated and used to prepare a promising conjugated vaccine. This research has the potential to help to combat cholera outbreaks, but also to contribute to the battle against bacterial diseases in general.

The Institute also pays considerable attention to scientific research with an impact on solutions of environmental problems and on sustainable development. Plant biomass represents a sustainable source of materials with a high content of saccharides transformable to valuable chemicals, fuels, or pharmaceuticals. The agriculture and forestry sectors together with the food and pulp industries produce enormous amounts of such

saccharide-based raw stocks every year. The Institute contributes to their transformation to a value-added product on several levels. The research on green procedures for the isolation of plant polysaccharides, their characterization, and evaluation of their beneficial health activities (Chapter 2.1.2, Art. no. 42; Chapter 2.1.5, Art. no. 7, 8 and 11) has great potential for industrial applications. Moreover, microalgae are studied as a promising source of new structured polysaccharides (Chapter 2.1.2, Art. no. 15, 52, 59 and 67). Due to the complexity of various hemicellulose structures, search for new types of enzymes with relevant substrate specificity (capable to decompose these materials) is a perpetual challenge for researchers on this field.

For several decades, the Institute has been one of the world's leading groups dealing with the enzymatic degradation of the most numerous plant hemicellulose, xylan. In addition to the well-known non-specific endoxylanases from the GH10 and GH11 families, recent attention has also been paid to the hitherto little explored xylanases from the GH30 family. We have found that, in contrast to prokaryotic enzymes from the GH30_8 subfamily, which are dominantly a specific glucuronoxylanase with a separate EC number, the substrate specificity of eukaryotic agents from the GH30_7 subfamily is much more diverse. In addition to glucuroxylanases and non-specific endoxylanases, there are also enzymes with a completely new specificity in this subfamily. These are xylobiohydrolases that cleave the prebiotic disaccharide β-1,4 xylobiose from the non-reducing end (Chapter 2.1.2, Art. no. 29 and 63; Chapter 2.1.5, Art. no. 20; Šuchová et al., 2020; Šuchová et al., 2021). They represent another biotechnologically important catalyst that participates in the carbon cycle in nature. In addition to this physiological function, such as glucuronoxylanases, they will find wide industrial use in the utilization of plant hemicellulose and its conversion into various high value-added products.

A large share of the scientific activities of the Institute is research linked with solving many of environmental problems through the enzymatic and green approaches to procedures of standard organic synthesis. The main synthetic model is the synthesis of natural or nature-inspired glycophenolics (compounds combining in their structures sugars with phenolic acids and alcohols, such as tyrosol and hydroxytyrosol, through ester or glycosidic bonds) and assessment of their biological activities. Several original methods were developed for enzymatic acylation of sugars with phenolic acids (Chyba, Mastihuba et al., 2016; Chyba, Mastihubová et al., 2016), and glycosylations of phenolic alcohols with glycosidases and diglycosidases (Chapter 2.1.2, Art. no. 10; Karnišová Potocká et al., 2018) or with green chemical methods (Chapter 2.1.5, Art. no. 18; Mastihubová and Poláková, 2016), and the products were tested for their chemopreventive activity (Chapter 2.1.5, Art. no. 17). New assays for detection, quantification, and elucidation of the reaction mechanism of the enzymes studied were developed (Chapter 2.1.2, Art. no. 45), and the reaction selectivity was studied (Mastihuba et al., 2017) to enhance the knowledge of the biocatalysts used. The development of a "greener" biocatalyst usable in pharmacy, cosmetic and food chemistry is based on synthetic biology from scratch; biochemical/metabolic pathways are constructed from recombinant enzymes in the form of bacterial inclusion bodies adsorbed on magnetic iron particles (Koszagova et al., 2018). No GMO (genetically modified organism) is designed to be transferred to industry. Instead, all recombinant enzymes are produced separately under well-controlled laboratory conditions, and only purified immobilized enzymes will be transferred to industry to perform metabolic cascade reactions.

The development of immobilized whole cells as biocatalysts for the biotechnological production of specialty chemicals such as chiral drug precursors is an environmentally friendly alternative to chemical syntheses. This research also belongs to the concept of green chemistry with a potentially positive impact on society regarding reduced consumption of hazardous chemicals during production. Current utilisation of the so-called enzyme cascade reactions within the immobilized recombinant cells enables one-pot syntheses of valuable chemicals, which further reduces utilisation of chemicals, energy consumption, and operational costs (Bučko et al., 2016). The techniques developed for the immobilisation of viable cells, preferably by entrapment and encapsulation of cells in semipermeable particles, provide many advantages over the use of free cells (Krajčovič et

al. 2017). These advantages include higher cell density, an increase in specific productivity, easier separation of products and biocatalysts, the possibility of continuous bioreactor arrangement as well as the biocatalyst reuse, and reduction in the production cost. Additional advantages of immobilised microorganisms include no need for isolation and purification of enzymes, the possibility of using multi-enzyme reactions, native cofactor regeneration system, application of the mixed cell cultures, and protection against mechanical stress in the bioreactors and against the action of toxic substances.

The need for the protection of national heritage by restoration of art-historic items using approaches acceptable by restores led to the research on proteolytic enzymes secreted by *Exiguobacterium undae*. The developed biopreparate was applied in the non-destructive disassembly of the animal proteins-based glues on historical artefacts. This biopreparate was patented as well. (Chapter 2.6.1., Case study 1).

Another output dealing with ecological issues is the development of environmentally friendly methods of plant protection against fungal diseases based on microorganisms instead of chemical pesticides. A special process for large-scale production of *Trichoderma* spores was designed to protect potatoes against *Rhizosporidium solani* and to protect the turf against *Sclerotinium* and *Mucor* sp. in the field conditions with good results. The procedure was also patented and licensed (Chapter 2.6.1., Case study 4).

The study of the antibacterial effects of some substances found in royal jellies (RJs) as well as the antibacterial efficacies of RJs obtained from different honeybee colonies against different natural and collection strains of the bacterium *Paenibacillus larvae* has a multiple impact on health, environment, and sustainable development. RJs are produced by worker bees as food for young bee larvae, and the antibacterial substances that are found in RJs are also bees' products (Bucekova et al., 2019). *P. larvae* is a pathogen that causes a serious disease of honeybee larvae, American foulbrood (AFB). Different strains of bacteria show different pathogenicity to larvae and honeybee colonies. AFB is a disease that causes large annual financial losses to beekeepers and many farmers whose production depends on pollination in Slovakia and worldwide. Its control is based on prevention, the application of certain disinfection, and treatment strategies and the destruction of infected hives by incineration. In some countries, antibiotics are used to suppress it. Their use is banned in the EU countries, because it is associated with honey contamination and the development of resistant strains of the pathogen. Therefore, effective methods to suppress it are still being sought. The knowledge we gain can help beekeepers fight AFB. The significant discoveries made in our Institute are that 10-HDA, the major fatty acid of RJs, is *in vitro* capable of inhibiting different strains of *P. larvae* with different efficacies (pH-dependent), and that the carbohydrates fructose and trehalose, found in higher amounts in RJs, are important sporulation factors for various *P. larvae* strains (Chapter 2.1.5, Art. no. 3 and 4).

The research focused on plant biochemistry and physiology oriented to the studies involved various plant biostimulants (auxins, oligosaccharides, silicon) that improve plant response to different environmental obstacles (Chapter 2.1.5, Art. no. 1 and 2). Biostimulants are substances that are naturally present in the environment or can be obtained directly from plants. Climate change, human activities, and many ecological catastrophes might not only negatively influence the plant biomass production, which leads to economic losses, but also endanger human health via the food chain. The substances mentioned above can boost the plant antioxidant system, improve the nutritional value of the plants, and prevent the entry of toxic metals and pollutants into the plant parts consumed by humans, such as shoots, fruits, and seeds. Moreover, the fast-growing plants with a high biomass production, such as poplars, can be used for phytoremediation of the contaminated areas. The application of biostimulants on such plants can improve the biomass of plants; and thus increase the efficiency of phytoremediation. In addition, the application of biostimulants on some medicinal plants, e.g., *Harpagophytum procumbens* in the *in vitro* system, can improve the duration of the cultivation and enable better accessibility of the medicinal substances (Lišková et al., 2016). Understanding of the effects, mechanisms, and efficiency of biostimulants is highly important for agronomy, health care systems, as well as small plant-based businesses. Ecologically friendly solutions that enable a higher production of agricultural plants, improved nutritional value, and decreased health risks are

highly sought out all around the world. Furthermore, the nutrition experts, including medical doctors, emphasise the increased consummation of heavy metals as one of the causes responsible for many allergies and health problems.

Another important field of research is nanotechnology-oriented research focused on the study of nanostructured hybrid organic-inorganic solar cells, which has a clear environmental impact. At the Institute, we prepared the inorganic part consisting of nanostructures of zinc oxide by the hydrothermal growth method and studied its optical properties (Mičová et al., 2018). The research further aims to use of photocatalytic properties of transition metal oxides nanostructures in the process of wastewater treatment. The aim is to prepare usable hybrid materials based on metal oxides, while the matrix (organic component) is formed by polysaccharides as a biodegradable ecological material.

References

Baralić et al., 2020, doi: 10.3390/biom10081165
Baráth et al., 2020, doi: 10.3762/bjoc.16.152
Bucekova et al., 2019, doi: 10.3390/molecules24081573
Bučko et al., 2016, doi: 10.1007/s00253-016-7670-x
Damborský, Koczula et al., 2016, doi: 10.1039/c6an01746k
Damborský, Zámorová et al., 2016, doi: 10.1002/pmic.201500466
Gligorijević et al., 2018, doi: 10.1016/j.ijbiomac.2017.11.016
Chyba, Mastihuba et al., 2016, doi: 10.1016/j.bmcl.2016.02.010
Chyba, Mastihubová et al., 2016, doi: 10.1007/s00706-016-1696-8
Jakubčinová et al., 2020, doi:10.1002/slct.202001098
Karnišová Potocká et al., 2018, doi: 10.1080/10242422.2017.1423060
Koszagova et al., 2018, doi: 10.1186/s12934-018-0987-7
Krajčovič et al. 2017, doi: 10.3390/catal7110353
Lišková et al., 2016, doi: 10.1016/j.sajb.2015.10.008
Mastihuba et al., 2017, doi: 10.1016/j.tetasy.2017.07.007
Mastihubová and Poláková, 2016, doi: 10.3762/bjoc.12.51
Mičová et al., 2018, doi: 10.1016/j.apsusc.2018.05.176
Pakanová et al., 2019, doi: 10.1007/s11696-018-0623-3
Pažitná et al., 2020, doi: 10.1016/j.jbiotec.2020.03.009
Penezić et al., 2019, doi: 10.1002/prca.201800185
Šuchová et al., 2020, doi: 10.1016/j.enzmictec.2019.109484
Šuchová et al., 2021, doi: 10.3390/molecules26154528
Zámorová et al., 2017, doi: 10.1039/C7AY00159B

2.1.9. Table of research outputs

Papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately

Scientific publications	2016			2017			2018			2019			2020			2021			total			
	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. /1 million total salary budget	number	averaged number per year	av. No. / FTE researches	av. No. / one million total salary budget
Scientific monographs and monographic studies in journals and proceedings published abroad *(AAA, ABA)*	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	**0**	**0.000**	**0.000**	**0.000**
Scientific monographs and monographic studies in journals and proceedings published in Slovakia *(AAB, ABB)*	0	0.000	0.000	1	0.015	0.489	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	**1**	**0.167**	**0.002**	**0.068**
Chapters in scientific monographs published abroad *(ABC)*	2	0.029	0.990	2	0.029	0.978	**2**	0.031	0.928	2	0.029	0.813	1	0.013	0.341	0	0.000	0.000	**9**	**1.500**	**0.022**	**0.614**
Chapters in scientific monographs published in Slovakia *(ABD)*	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	**0**	**0.000**	**0.000**	**0.000**
Scientific papers published in journals registered in Current Contents Connect *(ADCA, ADCB, ADDA, ADDB)*	67	0.988	33.163	46	0.675	22.503	52	0.804	24.139	55	0.803	22.364	61	0.814	20.778	57	0.774	18.704	**338**	**56.333**	**0.809**	**23.054**
Scientific papers published in journals registered in Web of Science Core Collection and SCOPUS not listed above *(ADMA, ADMB, ADNA, ADNB)*	8	0.118	3.960	5	0.073	2.446	4	0.062	1.857	13	0.190	5.286	11	0.147	3.747	15	0.204	4.922	**56**	**9.333**	**0.134**	**3.820**
Scientific papers published in other foreign journals (not listed above) *(ADEA, ADEB)*	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	1	0.015	0.407	0	0.000	0.000	0	0.000	0.000	**1**	**0.167**	**0.002**	**0.068**
Scientific papers published in other domestic journals (not listed above) *(ADFA, ADFB)*	2	0.029	0.990	0	0.000	0.000	1	0.015	0.464	0	0.000	0.000	1	0.013	0.341	0	0.000	0.000	**4**	**0.667**	**0.010**	**0.273**
Scientific papers published in foreign peer-reviewed proceedings *(AECA)*	0	0.000	0.000	0	0.000	0.000	1	0.015	0.464	0	0.000	0.000	0	0.000	0.000	3	0.041	0.984	**4**	**0.667**	**0.010**	**0.273**
Scientific papers published in domestic peer-reviewed proceedings *(AEDA)*	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	1	0.013	0.341	0	0.000	0.000	**1**	**0.167**	**0.002**	**0.068**
Published papers (full text) from foreign scientific conferences *(AFA, AFC)*	6	0.088	2.970	3	0.044	1.468	3	0.046	1.393	3	0.044	1.220	0	0.000	0.000	0	0.000	0.000	**15**	**2.500**	**0.036**	**1.023**
Published papers (full text) from domestic scientific conferences *(AFB, AFD)*	9	0.133	4.455	16	0.235	7.827	18	0.278	8.356	21	0.307	8.539	14	0.187	4.769	14	0	5	**92**	**15**	**0**	**6**

2.2. Measures of research outputs (citations, etc.)

2.2.1. Table with citations per annum (without self-citations)

Citations of papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) are listed separately

Citations, reviews	2015		2016		2017		2018		2019		2020		total		
	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	averaged number per year	av. No. / FTE researchers
Citations in Web of Science Core Collection (1.1, 2.1)	2 428	35.80	2 773	40.70	2 818	43.56	3 000	43.81	3 021	40.33	2 818	38.25	**16 858**	**2 809.67**	**40.36**
Citations in SCOPUS (1.2, 2.2) if not listed above	371	5.47	410	6.02	393	6.08	372	5.43	279	3.72	40	0.54	**1 865**	**310.83**	**4.47**
Citations in other citation indexes and databases (not listed above) (3.2,4.2)	17	0.25	48	0.70	60	0.93	90	1.31	21	0.28	2	0.03	**238**	**39.67**	**0.57**
Other citations (not listed above) (3.1, 4.1)	31	0.46	31	0.45	2	0.03	41	0.60	61	0.81	5	0.07	**171**	**28.50**	**0.41**
Reviews (5,6)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	**0**	**0.00**	**0.00**

2.2.2. List of 10 most-cited publications published any time with the address of the institute, with number of citations in the assessment period (2015 – 2020)

Num.	Publication	Num. of Citations
1.	BAILEY, Michael J. - BIELY, Peter - POUTANEN, K. Interlaboratory testing of methods for assay of xylanase activity. In *Journal of Biotechnology*, 1992, vol. 23, p. 257-270. ISSN 0168-1656. DOI Link: https://doi.org/10.1016/0168-1656(92)90074-J	642
2.	KAČURÁKOVÁ, Marta - CAPEK, Peter - SASINKOVÁ, Vlasta - WELLNER, N. - EBRINGEROVÁ, Anna. FT-IR study of plant cell wall model compounds: pectic polysaccharides and hemicelluloses. In *Carbohydrate Polymers*, 2000, vol. 43, p. 195-203. (1999: 0.987 - IF). (2000 - Current Contents). ISSN 0144-8617. DOI Link: https://doi.org/10.1016/S0144-8617(00)00151-X	614
3.	BROADLEY, M.R. - WHITE, P.J. - HAMMOND, J.P. - ZELKO, Ivan - LUX, Alexander. Zinc in plants. In *New Phytologist*, 2007, vol. 173, p. 677-702. (2006: 4.245 - IF, Q1 - JCR, 2.159 - SJR, Q1 - SJR). ISSN 0028-646X. DOI Link: https://doi.org/10.1111/j.1469-8137.2007.01996.x	611
4.	KOGAN, Grigorij - ŠOLTÉS, Ladislav - STERN, Robert - GEMEINER, Peter. Hyaluronic acid: a natural biopolymer with a broad range of biomedical and industrial applications. In *Biotechnology Letters*, 2007, vol. 29, no. 1, p. 17-25. (2006: 1.134 - IF, Q3 - JCR, 0.546 - SJR, Q2 - SJR). (2007 - Current Contents). ISSN 0141-5492. DOI Link: https://doi.org/10.1007/s10529-006-9219-z	394
5.	EBRINGEROVÁ, Anna - HEINZE, T. Xylan and xylan derivatives - biopolymers with valuable properties, 1 - Naturally occurring xylans structures, procedures and properties. In *Carbohydrate Polymers: scientific and technological aspects of industrially important polysaccharides*, 2000, vol. 21, p. 542-556. (1999: 0.987 - IF). (2000 - Current Contents). ISSN 0144-8617. DOI Link: https://doi.org/10.1002/1521-3927(20000601)21:9<542::AID-MARC542>3.0.CO;2-7	283
6.	EBRINGEROVÁ, Anna - HROMÁDKOVÁ, Zdenka - HEINZE, T. Hemicellulose. In *Advances in polymer science*, 2005, vol.186, p. 1-67. (2004: 7.320 - IF). (2005 - Current Contents). ISSN 0065-3195.	258
7.	SHLEEV, S. - TKÁČ, Ján - CHRISTENSON, A. - BUZGAS, T. - YAROPOLOV, A.I. - WHITTAKER, J.W. - GORTON, L. Direct electron transfer between copper-containing proteins and electrodes. In *Biosensors and Bioelectronics*, 2005, vol. 20, p. 2517-2554. DOI Link: https://doi.org/10.1016/j.bios.2004.10.003	157
8.	STERN, Robert - KOGAN, Grigorij - JEDRZEJAS, Mark J. - ŠOLTÉS, Ladislav. The many ways to cleave hyaluronan. In *Biotechnology Advances*, 2007, vol. 25, p. 537-557. (2006: 4.943 - IF, Q1 - JCR, 1.715 - SJR, Q1 - SJR). (2007 - Current Contents). ISSN 0734-9750. DOI Link: https://doi.org/10.1016/j.biotechadv.2007.07.001	152
9.	BIELY, Peter - VRŠANSKÁ, Mária - TENKANEN, M. - KLUEPFEL, Dieter. Endo-beta-1,4-xylanase families: differences in catalytic properties. In *Journal of Biotechnology*, 1997, vol. 57, p. 151-166. ISSN 0168-1656. DOI Link: https://doi.org/10.1016/S0168-1656(97)00096-5	141
10.	DAMBORSKÝ, Pavel - ŠVITEL, Juraj - KATRLÍK, Jaroslav**. Optical biosensors. In *Essays in Biochemistry*, 2016, vol. 60, no. 1, p. 91-100. (2015: 3.378 - IF, Q2 - JCR, 2.420 - SJR, Q1 - SJR). ISSN 0071-1365. DOI Link: https://doi.org/10.1042/EBC20150010	140

2.2.3. List of 10 most-cited publications published any time with the address of the institute, with number of citations obtained until 2020

Num.	Publication	Num. of Citations
1.	BAILEY, Michael J. - BIELY, Peter - POUTANEN, K. Interlaboratory testing of methods for assay of xylanase activity. In *Journal of Biotechnology*, 1992, vol. 23, p. 257-270. ISSN 0168-1656. DOI Link: https://doi.org/10.1016/0168-1656(92)90074-J	1384
2.	BROADLEY, M.R. - WHITE, P.J. - HAMMOND, J.P. - ZELKO, Ivan - LUX, Alexander. Zinc in plants. In *New Phytologist*, 2007, vol. 173, p. 677-702. (2006: 4.245 - IF, Q1 - JCR, 2.159 - SJR, Q1 - SJR). ISSN 0028-646X. DOI Link: https://doi.org/10.1111/j.1469-8137.2007.01996.x	969
3.	KAČURÁKOVÁ, Marta - CAPEK, Peter - SASINKOVÁ, Vlasta - WELLNER, N. - EBRINGEROVÁ, Anna. FT-IR study of plant cell wall model compounds: pectic polysaccharides and hemicelluloses. In *Carbohydrate Polymers*, 2000, vol. 43, p. 195-203. (1999: 0.987 - IF). (2000 - Current Contents). ISSN 0144-8617. DOI Link: https://doi.org/10.1016/S0144-8617(00)00151-X	883
4.	KOGAN, Grigorij - ŠOLTÉS, Ladislav - STERN, Robert - GEMEINER, Peter. Hyaluronic acid: a natural biopolymer with a broad range of biomedical and industrial applications. In *Biotechnology Letters*, 2007, vol. 29, no. 1, p. 17-25. (2006: 1.134 - IF, Q3 - JCR, 0.546 - SJR, Q2 - SJR). (2007 - Current Contents). ISSN 0141-5492. DOI Link: https://doi.org/10.1007/s10529-006-9219-z	615
5.	EBRINGEROVÁ, Anna - HEINZE, T. Xylan and xylan derivatives - biopolymers with valuable properties, 1 - Naturally occurring xylans structures, procedures and properties. In *Carbohydrate Polymers: scientific and technological aspects of industrially important polysaccharides*, 2000, vol. 21, p. 542-556. (1999: 0.987 - IF). (2000 - Current Contents). ISSN 0144-8617. DOI Link: https://doi.org/10.1002/1521-3927(20000601)21:9<542::AID-MARC542>3.0.CO;2-7	466
6.	EBRINGEROVÁ, Anna - HROMÁDKOVÁ, Zdenka - HEINZE, T. Hemicellulose. In *Advances in polymer science*, 2005, vol.186, p. 1-67. (2004: 7.320 - IF). (2005 - Current Contents). ISSN 0065-3195.	445
7.	BIELY, Peter. Microbial xylanolytic systems. In *Trends in Biotechnology*, 1985, vol. 3, no. 11, p. 286-290. ISSN 0167-7799. DOI Link: https://doi.org/10.1016/0167-7799(85)90004-6	376
8.	SHLEEV, S. - TKÁČ, Ján - CHRISTENSON, A. - BUZGAS, T. - YAROPOLOV, A.I. - WHITTAKER, J.W. - GORTON, L. Direct electron transfer between copper-containing proteins and electrodes. In *Biosensors and Bioelectronics*, 2005, vol. 20, p. 2517-2554. DOI Link: https://doi.org/10.1016/j.bios.2004.10.003	330
9.	STERN, Robert - KOGAN, Grigorij - JEDRZEJAS, Mark J. - ŠOLTÉS, Ladislav. The many ways to cleave hyaluronan. In *Biotechnology Advances*, 2007, vol. 25, p. 537-557. (2006: 4.943 - IF, Q1 - JCR, 1.715 - SJR, Q1 - SJR). (2007 - Current Contents). ISSN 0734-9750. DOI Link: https://doi.org/10.1016/j.biotechadv.2007.07.001	243
10.	BIELY, Peter - VRŠANSKÁ, Mária - TENKANEN, M. - KLUEPFEL, Dieter. Endo-beta-1,4-xylanase families: differences in catalytic properties. In *Journal of Biotechnology*, 1997, vol. 57, p. 151-166. ISSN 0168-1656. DOI Link: https://doi.org/10.1016/S0168-1656(97)00096-5	221

2.2.4. List of 10 most-cited publications published during the evaluation period (2016-2021) with the address of the Institute, with number of citations obtained until 2021

Num.	Publication	Num. of Citations
1.	DAMBORSKÝ, Pavel - ŠVITEL, Juraj - KATRLÍK, Jaroslav**. Optical biosensors. In *Essays in Biochemistry*, 2016, vol. 60, no. 1, p. 91-100. (2015: 3.378 - IF, Q2 - JCR, 2.420 - SJR, Q1 - SJR). ISSN 0071-1365. DOI Link: https://doi.org/10.1042/EBC20150010	228
2.	HAMMOND, Jules L. - FORMISANO, Nello - ESTRELA, Pedro - CARRARA, Sandro - TKÁČ, Ján. Electrochemical biosensors and nanobiosensors. In *Essays in Biochemistry*, 2016, vol. 60, p. 69-80. (2015: 3.378 - IF, Q2 - JCR, 2.420 - SJR, Q1 - SJR). ISSN 0071-1365. DOI Link: https://doi.org/10.1042/EBC20150008	139
3.	BIELY, Peter** - SINGH, Suren - PUCHART, Vladimír. Towards enzymatic breakdown of complex plant xylan structures: State of the art. In *Biotechnology Advances*, 2016, vol. 34, p. 1260-1274. (2015: 9.848 - IF, Q1 - JCR, 2.915 - SJR, Q1 - SJR, karentované - CCC). (2016 - Current Contents). ISSN 0734-9750. DOI Link: https://doi.org/10.1016/j.biotechadv.2016.09.001	124
4.	LORENCOVÁ, Lenka - BERTÓK, Tomáš - CHOCHOLOVÁ, Erika - ŠEDIVÁ, Alena - PAPRČKOVÁ, Darina - VIKARTOVSKÁ, Alica - SASINKOVÁ, Vlasta - FILIP, Jaroslav - KASÁK, Peter - JERIGOVÁ, Monika - VELIČ, Dušan - MAHMOUD, Khaled A. - TKÁČ, Ján. Electrochemical performance of $Ti_3C_2T_X$ MXene in aqueous media: towards ultrasensitive H_2O_2 sensing. In *Electrochimica Acta*, 2017, vol. 235, p. 471-479. (2016: 4.798 - IF, Q1 - JCR, 1.355 - SJR, Q1 - SJR, karentované - CCC). (2017 - Current Contents). ISSN 0013-4686. DOI Link: https://doi.org/10.1016/j.electacta.2017.03.073	115
5.	LORENCOVÁ, Lenka - BERTÓK, Tomáš** - FILIP, Jaroslav - JERIGOVÁ, Monika - VELIČ, Dušan - KASÁK, Peter - MAHMOUD, Khaled A. - TKÁČ, Ján**. Highly stable $Ti_3C_2T_x$ (MXene)/Pt nanoparticles-modified glassy cyrbon electrode for H_2O_2 and small molecules sensing applications. In *Sensors and Actuators B*, 2018, vol. 263, p. 360-368. (2017: 5.667 - IF, Q1 - JCR, 1.406 - SJR, Q1 - SJR, karentované - CCC). (2018 - Current Contents). ISSN 0925-4005. DOI Link: https://doi.org/10.1016/j.snb.2018.02.124	76
6.	CHOI, Ji Won - SYNYTSYA, Andriy - CAPEK, Peter - BLEHA, Roman - POHL, Radek - PARK, Yong Il. Structural analysis and anti-obesity effect of a pectic polysaccharide isolated from Korean mulberry fruit Oddi (*Morus alba* L.). In *Carbohydrate Polymers*, 2016, vol. 146, p. 187-196. (2015: 4.219 - IF, Q1 - JCR, 1.440 - SJR, Q1 - SJR, karentované - CCC). (2016 - Current Contents). ISSN 0144-8617.	65
7.	BUČKO, Marek - GEMEINER, Peter - SCHENKMAYEROVÁ, Andrea - KRAJČOVIČ, Tomáš - RUDROFF, Florian - MIHOVILOVIČ, Marko. Baeyer-Villiger oxidations: biotechnological approach. In *Applied Microbiology and Biotechnology*, 2016, vol. 100, p. 6585-6599. (2015: 3.376 - IF, Q2 - JCR, 1.256 - SJR, Q1 - SJR, karentované - CCC). (2016 - Current Contents). ISSN 0175-7598. DOI Link: https://doi.org/10.1007/s00253-016-7670-x	63
8.	GARAJOVÁ, Soňa - MATHIEU, Yann - BECCIA, Maria Rosa - BENNATI-GRANIER, Chloé - BIASO, Frédéric - FANUEL, Mathieu - ROPARTZ, David - GUIGLIARELLI, Bruno - RECORD, Eric - ROGNIAUX, Héléne - HENRISSAT, Bernard - BERRIN, Jean-Guy. Single-domain flavoenzymes trigger lytic polysaccharide monooxygenases for oxidative degradation of cellulose. In *Scientific*	59

	Reports, 2016, vol. 6, art. no. 28276. (2015: 5.228 - IF, Q1 - JCR, 2.034 - SJR, Q1 - SJR, karentované - CCC). (2016 - Current Contents). ISSN 2045-2322. DOI Link: https://doi.org/10.1038/srep28276	
9.	DAMBORSKÁ, Dominika - BERTÓK, Tomáš - CHOCHOLOVÁ, Erika - HOLAZOVÁ, Alena - LORENCOVÁ, Lenka - KASÁK, Peter - TKÁČ, Ján. Nanomaterial-based biosensors for detection of prostate specific antigen. In *Microchimica Acta*, 2017, vol. 184, p. 3049-3067. (2016: 4.580 - IF, Q1 - JCR, 1.111 - SJR, Q1 - SJR, karentované - CCC). (2017 - Current Contents). ISSN 0026-3672. DOI Link: https://doi.org/10.1007/s00604-017-2410-1	53
10.	BUČEKOVÁ, Marcela - JARDEKOVÁ, Lucia - JURICOVÁ, Valéria - BUGÁROVÁ, Veronika - DI MARCO, Gabriele - GISMONDI, Angelo - LEONARDI, Donatella - FARKAŠOVSKÁ, Jarmila - GODOČÍKOVÁ, Jana - LAHO, Maroš - KLAUDINY, Jaroslav - MAJTÁN, Viktor - CANINI, Antonella - MAJTÁN, Juraj**. Antibacterial activity of different blossom honeys: New findings. In *Molecules*, 2019, vol. 24, no. 8, no. 1573. (2018: 3.060 - IF, Q2 - JCR, 0.757 - SJR, Q1 - SJR, karentované - CCC). (2019 - Current Contents, WOS, SCOPUS). ISSN 1420-3049. DOI Link: https://doi.org/10.3390/molecules24081573	48

2.2.5. List of most-cited authors from the Institute (at most 10 % of average FTE researchers per year) and their number of citations in the assessment period (2015– 2020). The cited papers must bear the address of the institute

Num.	Author Name	Num. of Citations
1.	Ing. Anna Ebringerová, PhD.	2599
2.	RNDr. Peter Biely, DrSc.	2307
3.	Ing. Ján Tkáč, DrSc.	1722
4.	Ing. Zdenka Hromádková, PhD.	1210
5.	Mgr. Peter Capek, PhD.	1190
6.	Ing. Peter Gemeiner, DrSc.	1155
7.	RNDr. Vlasta Sasinková	1064

2.2.6. List of most-cited authors from the Institute (at most 10 % of average FTE researchers per year) and their number of citations obtained until 2020. The cited papers must bear the address of the Institute

Num.	Author Name	Num. of Citations
1.	RNDr. Peter Biely, DrSc.	5371
2.	Ing. Anna Ebringerová, PhD.	4319
3.	Ing. Ján Tkáč, DrSc.	2338
4.	Ing. Peter Gemeiner, DrSc.	2122
5.	Ing. Zdenka Hromádková, PhD.	2042
6.	RNDr. Vlasta Sasinková	1467
7.	doc. Ing. Vladimír Farkaš, DrSc.	1408

2.2.7. List of most-cited authors from the Institute (at most 10 % of average FTE researchers per year) and their number of citations obtained until 2021 of

their papers published during the evaluation period (2016– 2021). The cited papers must bear the address of the Institute

Num.	Author Name	Num. of Citations
1.	Ing. Ján Tkáč, DrSc.	926
2.	Ing. Tomáš Bertók, PhD	580
3.	RNDr. Lenka Lorencová, PhD.	413
4.	Ing. Jaroslav Katrlík, PhD.	396
5.	Ing. Pavel Damborský, PhD.	301
6.	RNDr. Peter Biely, DrSc.	296
7.	Ing. Alica Vikartovská, PhD.	273

2.3. Research status of the institute in international and national context

- **International/European position of the institute**

2.3.1. List of the most important research activities demonstrating the international relevance of the research performed by the institute, incl. major projects (details of projects should be supplied under Indicator 2.4). Max. 10 items for institute with less than 50 average FTE researchers per year, max. 20 for institutes with 50 – 100 average FTE researchers per year and so on

1. 394 scientific papers published in journals registered in Current Contents Connect, Web of Science and Scopus (average value of Impact Factor = 3.676; one paper with IF = 14.227; 137 papers with IF higher than 4.000). In addition, 1 scientific monography published in Slovakia, 9 chapters in scientific monographs published abroad, 25 publications published in other foreign and domestic journals or proceedings.
2. 18723 citations in Web of Science and Scopus, and 409 other citations.
3. 3 international conferences organised regularly (see indicator 2.3.2)
4. 296 contributions at international conferences/symposia (among them 24 invited lectures, see indicator 2.3.7).
5. EU project FP7-IDEAS-ERC (ERC Starting Grant) - till now, the only ERC project in Slovakia and ERC Proof of concept grant.
6. International cooperation within 2 multilateral projects (FP7, H2020), 6 multilateral projects of EU COST program, 1 bilateral project of Qatar National Research Funds (QNRF) with Qatar University, 1 bilateral project of National Science Council of Taiwan (NSC) with Institute of Biological Chemistry, Academia Sinica, and 8 projects within intergovernmental and inter-academy agreements about international scientific and technical cooperation (1 USA, 1 Italy, 1 SK-France, 2 SK-Serbia, 1 SK-Korea, 1 DS-France). In addition, a lot of informal cooperations with many foreign institutions was realised.
7. 6 researchers received 9 international scientific awards (see indicator 2.3.9)
8. Several employees served as officers or national delegates of several significant foreign associations and international organisations like International Carbohydrate Organisation, European Carbohydrate Organisation, International Glycoconjugate Organisation, International Society for Mass Spectrometry, International Academy of Wood Science, COST Chemistry and Molecular Sciences and Technologies Domain Committee. International Steering Committee of the International Consortium on Anti-Virals, The Culture Collection of Yeasts is a corporate member of the European Culture Collections' Organisation and the World Federation for

Culture Collections. Individual employees are members of following societies/organisations: American Chemical Society, International Society of Heterocyclic Chemistry, Federation of European Societies of Plant Biology, International Association of Plant Tissue Cultures-Biotechnology, European Peptide Society. Bioencapsulation Research Group, Japaneese Society of Plant Roots, American Society for Mass Spectrometry, Czechoslovak Society for Microbiology, Bioelectrochemical Society, Bioencapsulation Research Group.

9. Institute of Chemistry is a member of Instruct-ERIC (European Research Infrastructure Consortium and CDG & Allies – PPAIN (Congenital Disorders of Glycosylation & Allies – Professionals and Patient Associations International Network)
10. 16 employees served as members (among them 2 editors, 1 managing editor, 2 associate editor) of editorial/editorial advisory boards of reputable foreign scientific journals (Carbohydrate Research, Molecules, Artificial Cells, Blood Substitutes and Biotechnology, Biotechnology and Applied Biochemistry, Biotechnology Letters, Open Chemistry, Arkivoc, Plant Root, Journal of Glycomics & Lipidomics, International Journal of Carbohydrate Chemistry, Trends in Carbohydrate Research, Frontiers in Plant Sciences, Yeast Newsletter, Applied Functional Materials, Molecules, South African Journal of Botany
11. 8 experts evaluated 114 international projects (see indicator 2.6.2)
12. 23 researchers served as members of the organising and/or programme committees of international conferences (see indicator 2.3.8).
13. Ownership and management of the Editorial Office of *Chemical Papers*, the only scientific periodical journal in Slovakia publishing original scientific articles in the field of chemistry in English language.
14. More than 30 researchers served as reviewers of more than 700 scientific papers, submitted to reputed international journals.
15. 52 foreign researchers completed short- or long-term scientific visits at the Institute participating on running projects and collaborative research.
16. Building and updating of the Catalog of CCY - database of the yeasts collected by the Culture Collection of Yeasts.
17. It is a great honour for the Institute of Chemistry (and for Slovak research community too) that the members of the International Carbohydrate Organisation at their meeting held on the 27th International Carbohydrate Symposium in Bangalore, India (2014) decided that the 32nd International Carbohydrate Symposium in 2026 will be organised by the Institute of Chemistry SAS in Bratislava, Slovakia. This decision was undoubtedly influenced by high quality research in area of carbohydrates and a knowledge about a very successful organisation of the 13th European Carbohydrate Symposium organised by the Institute in 2005 in Bratislava, where more than 500 scientists attended.

2.3.2. List of international conferences (co)organised by the institute

1. 43nd Annual Conference on Yeasts, May 10-13, 2016, Smolenice, Slovakia.
2. 44th Annual Conference on Yeasts, May 02-05, 2017, Smolenice, Slovakia.
3. 14th Bratislava Symposium on Saccharides, June 25-30, 2017, Smolenice, Slovakia.
4. INSRUCT-ULTRA "Structural Biology Meeting", October 18, 2017, Bratislava, Slovakia.
5. 45th Annual Conference on Yeasts, May 15-18, 2018, Smolenice, Slovakia.

6. INSRUCT-ULTRA "2nd Structural Biology Meeting", November 15-16, 2018, Bratislava, Slovakia.
7. 46th Annual Conference on Yeasts, May 7-10, 2019, Smolenice, Slovakia.
8. INSRUCT-ULTRA "3rd Structural Biology Meeting", November 14-15, 2019, Bratislava, Slovakia.
9. 15th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 2020, postponed to June 20-24, 2022
10. 8th International Symposium on Structure and Function of Roots, Horný Smokovec, Slovakia, September 2020, postponed to June 12-16, 2022
11. Chemistry towards Biology (CTB10) and INSTRUCT-ULTRA Structural Biology Meeting, Bratislava, Slovakia, September 2020, postponed to September 11-14, 2022
12. 47th Annual Conference on Yeasts, Smolenice, Slovakia, May 2020, postponed to May 16-19, 2023

2.3.3. List of edited proceedings from international scientific conferences

1. HAPALA, Ivan - BREIEROVÁ, Emília (eds). Program and Abstracts: 43rd Annual Conference on Yeasts, May 10-13, 2016, Smolenice, Slovakia: Yeast Commissiom, Institute of Chemistry SAS, Institute of Animal Biochemistry and Genetics SAS, Faculty of Chemical and Food Technology SUT, 2016. ISSN 1336-4839.
2. HRICOVÍNI, Miloš (ed.). INSTRUCT ULTRA Structural Biology Meeting, October 18, 2017, Bratislava. Slovakia: Institute of Chemistry SAS, 2017. ISBN 978-80-971156-5-4.
3. HAPALA, Ivan - BREIEROVÁ, Emília (eds). Program and Abstracts: 44th Annual Conference on Yeast, May 2-5, 2017, Smolenice, Slovakia: Yeast Commission, Institute of Chemistry SAS, Institute of Animal Biochemistry and Genetics SAS, Faculty of Chemical and Food Technology SUT, 2017. 90 p. ISSN 1336-4839
4. KATRLÍK, Jaroslav – BARÁTH, Marek (eds). Proceedings of the 14th Bratislava Symposium on Saccharides “Glycochemistry for biology and medicine”, June 25-30, 2017, Smolenice, Slovakia. Institute of Chemistry SAS, 2017. 105 p. ISBN: 978-80-971156-3-0, ISSN 1339-7036
5. BREIEROVÁ, Emília et al. (eds). Program and Abstracts: 45th Annual Conference on Yeast, May 15-18, 2018, Smolenice, Slovakia: Yeast Commission, Institute of Chemistry SAS, Institute of Animal Biochemistry and Genetics SAS, 2018. ISSN 1336-4839.
6. HRICOVÍNI, Miloš (ed.). Book of Abstracts: INSTRUCT ULTRA 2nd Structural Biology Meeting, November 15-16, 2018, Bratislava, Slovakia: Institute of Chemistry SAS, 2018. ISBN 978-80-971156-6-1. (FAI)
7. VADKERTIOVÁ, Renáta - SCHUSTEROVÁ, Hana (eds.). Programme and Abstracts: 46th Annual Conference on Yeasts, May 7-10, 2019, Smolenice, Slovakia: Institute of Chemistry, SAS and Commission on Yeasts of the Czechoslovak Society of Microbiology, 2019. ISSN 1336-4839.
8. HRICOVÍNI, Miloš (ed). INSTRUCT ULTRA 3rd Structural biology meeting, November 14 - 15, 2019, Bratislava, Slovakia. ISBN 978-80-971665-1-9.
9. BERTÓK, Tomáš (ed). Glyconanotechnology: Nanoscale approach for novel glycan analysis and their medical use. Singapore: Jenny Stanford Publishing, 2019, 328 pages. Singapore: Jenny Stanford Publishig, 2019. ISBN 978-98148000167.

2.3.4. List of journals edited/published by the institute and information on their indexing in WOS, SCOPUS, other database or no database, incl. impact factor and other metrics of journals in each year of the assessment period

Journal title: *Chemical Papers*

It is the only scientific periodical journal (12 issues per year) in Slovakia publishing original scientific articles in the field of chemistry in English language. A 50 papers per issue is published in last three years. Over 3000 manuscripts are submitted to the editorial office yearly.

ISSN: 0336-6352 (Print); 1336-9075 (Online)

Ownership, Copyright and Editorial Office: Institute of Chemistry, Slovak Academy of Sciences; Co-published with Springer Nature.

Abstracted/indexed in: Thompson Reuters databases - WOS, Science Citation Index, Science Citation Index Expanded, Journal Citation Reports/Science Edition, Current Contents/Physical, Chemical and Earth Sciences; SCOPUS, Chemical Abstracts Service (CAS); Google Scholar; ProQuest; Index Copernicus and many other abstracting/indexing databases.

Impact Factors: IF2015 - 1.326, IF2016 - 1.258, IF2017 - 0.963, IF2018 - 1.246, IF2019 - 1.680, IF2020 - 2.097.

- ## National position of the institute

2.3.5. List of selected activities of national importance

1. Several employees are members of Advisory boards of the Government of the Slovak Republic, the National Council of the Slovak Republic, Ministries of the Slovak Republic or other decision-making authorities (see indicator 2.6.2).
2. 40 researcher received 77 national scientific awards (see indicator 2.3.12).
3. 24 experts from the institute evaluated 39 VEGA and 13 APVV projects.
4. Membership in 3 Commissions VEGA.
5. Many employees served as officers of several significant domestic scientific societies and associations like Slovak Chemical Society (Hirsch, Mastihuba, Mastihubová, Lorencová), Slovak Botany Society (Kollárová), Slovak Biotechnology Society (Gemeiner), Slovak Society for Mass spectrometry (Pätoprstý).
6. Spectral analyses for diagnosis of rare diseases (for Centre of Inherited Metabolic Disorders, National Institute of Children`s Diseases, 2nd Children Clinic at Faculty of Medicine of Comenius University and Children's Faculty Hospital with Polyclinic in Bratislava and St Michael's Hospital in Bratislava).
7. Membership in the Slovak Academy of Sciences bodies: one member in Parliament of SAS, 7 memberships in various Commissions of SAS.
8. At average, each year six employees reviewed nine dissertation theses, one employee served as member of Commissions for the defence of DrSc theses, seven employees as members of Commissions for the defence of PhD theses and two employees as members of Commissions for the habilitation and inaugural process at universities.
9. Editorial activities: seven employees served as members of editorial/editorial advisory boards of three domestic scientific journals (News Lab, Chemical Papers, Acta Chimica Slovaca).
10. In average 24 PhD students are enrolled each year at the Institute.
11. Researchers and students are involved in many popularization activities at schools, exhibitions or media each year.
12. Institute collaborates with hospitals on research of diagnostic rare diseases.

13. Institute is member of OMICS4HEALTH consortia. Members are from several universities, other SAS institutes and business. Consortia collaborate on research and development of new freely available drugs.
14. The analysis of the antimicrobial potential of the royal jelly leads to the selection of hives suitable for the breeding of queen bees by a Slovak beekeeper to improve the properties of his own bee line.

Expertieses and Consultations

1. **Title of expertise:** Posúdenie rizikovosti práce s CRISP/Cas 9 technikou na myšej bunkovej línii (Eng: "Risk assessment of work with CRISP / Cas 9 technique on mouse cell line")
   Addressee of expertise: Ministry of Environment of the Slovak Republic, Department of Environmental Risks and Biological Safety
   Prepared by: RNDr. Jaroslav Klaudíny, PhD.

2. **Title of expertise:** Nové genómové techniky (Eng: "New genomic techniques")
   Addressee of the expertise: Ministry of the Environment of the Slovak Republic, Department of Environmental Risks and Biological Safety
   Brief description: Completion of a questionnaire for a European Commission study on new genomic techniques
   Prepared by: RNDr. Jaroslav Klaudíny, PhD.

3. **Title of the expertise:** Konzultácie (Eng: "Consultations")
   Addressee of the expertise: Ústredný krízový štáb SR (Eng: "Central Crisis Staff of the Slovak Republic")
   Brief description: Consultations with a member of the Central Crisis Staff Robert Mistrík. Providing information on current instrumentation and RNA testing methodologies that are applied in modern diagnostics of viral diseases.
   Prepared by: RNDr. Ján Mucha, CSc.

4. **Title of expertise:** Konzultácie a expertíza (Eng: "Consultations and expertise")
   Addressee of expertise: Regional Public Health Autorities, Bratislava
   Brief description: Consultations and assistance in the processing and analysis of samples taken from patients and in the optimization of protocols associated with the analysis of samples by method Digital Droplet PCR, as well as in assessing possible replacement of reaction components in PCR purchased from abroad with those from Slovak suppliers.
   Prepared by: Mgr. Mária Šedivá, PhD.

2.3.6. List of journals (published only in the Slovak language) edited/published by the institute and information on their indexing in WOS, SCOPUS, other database or no database, incl. impact factor and other metrics of journals in each year of the assessment period

Not applicable

- **Position of individual researchers in the international context**

2.3.7. List of invited/keynote presentations at international conferences, as documented by programme or invitation letter

1. KATRLÍK, Jaroslav - ZÁMOROVÁ, Martina - DAMBORSKÝ, Pavel - GEMEINER, Peter. Biochips for glycomics. In European Biotechnology Congress 2016, May 5-7, 2016, Riga, Latvia. (invited lecture - Dr. Katrlík) Abstract published: In Journal of Biotechnology, 2016, vol. 231S, p. S11. ISSN 0168-1656.
2. KATRLÍK, Jaroslav - ZÁMOROVÁ, Martina - DAMBORSKÝ, Pavel. Lectin and glycan-based microarrays in glycomics. In Diagnosis within Micro-fluidics & Multiplexing Micro-arrays (MMM), April 20-21, 2016, Potsdam,-Golm, Germany. (invited lecture - Dr. Katrlík) Abstract published: In Abstracts: Diagnosis within Micro-fluidics & Multiplexing Micro-arrays (MMM), April 20-21, 2016, Potsdam-Golm, Germany. Berlin: M2-Automation, 2016, p. 20.
3. LUX, Alexander. Reaction of apoplasmic barriers – endodermis and exodermis – to abiotic stress. In Plant Biology Europe EPSO/FESPB 2016 Congress, June 26-30, 2016, Prague, Czech Republic. (invited lecture - Dr. Lux) Abstract published: In Abstracts: Plant Biology Europe EPSO/FESPB 2016 Congress, June 26-30, 2016, Prague, Czech Republic. Prague: GUARANT International, 2016, T25. http://www.europlantbiology2016.org/
4. PIHÍKOVÁ, Dominika - BERTÓK, Tomáš - BELICKÝ, Štefan - TKÁČ, Ján. Glycan analysis for detection of prostate cancer. In Prosense Conference on Prostate Cancer Diagnosis: Cancer Diagnosis: Parallel Sensing of Prostate Cancer Biomarkers, September 12-13, 2016, Bath, UK. (invited lecture - Dr. Tkáč)
5. ŠUTOVSKÁ, Martina - FRAŇOVÁ, Soňa - PAWLACZYK, Izabela - PAULOVIČOVÁ, Ema - MATULOVÁ, Mária - CAPEK, Peter. Plant glycoconjugates, structure, properties and biological activity. In 2016 Annual Summer Meeting of Korean Society for Glycoscience, July 4-6, 2016, Busan, South Korea. (invited lecture - Dr. Capek) Abstract published: In Book of Abstracts: 2016 Annual Summer Meeting of Korean Society for Glycoscience, July 4-6, 2016, Busan, South Korea. Busan: Korean Society for Glycoscience, 2016, p. 18.
6. TKÁČ, Ján - BERTÓK, Tomáš - KLUKOVÁ, Ľudmila - HUSHEGYI, András - PIHÍKOVÁ, Dominika - BELICKÝ, Štefan. Integration of nanotechnology into glycomics: Construction and application of glycan and lectin biosensors. In 2nd Glycobiology World Congress, August 29-31, 2016, Atlanta, USA. (invited lecture - Dr. Tkáč) Abstract published: In Proceedings of 2nd Glycobiology World Congress, August 29-31, 2016, Atlanta, USA. In Journal of Glycobiology, 2016, vol. 4, Issue 2(Suppl), p. 55. ISSN 2168-958X.
7. TKÁČ, Ján - BERTÓK, Tomáš - KLUKOVÁ, Ľudmila - HUSHEGYI, András - PIHÍKOVÁ, Dominika - BELICKÝ, Štefan. Biosensors with nanoscale controlled architecture applicable in glycomics and diagnostics. In XXV. Biochemický sjezd (Eng: XXV. Biochemical Congress), September 13-16,.2016, Praha, Czech Republic. (invited lecture - Dr. Tkáč) Abstract published: In STIBOROVÁ, Marie (ed.). Sborník přednášek a posterů: XXV. Biochemický sjezd (Eng: Proceedings of lectures and posters: XXV. Biochemical Congress), September 13-16,.2016, Praha, Czech Republic. Praha: Venice Praha, 2016, s. 48. ISBN 978-80-270-0331-0.
8. KOZMON, Stanislav. Using the IT4I infrastructure on the enzymatic reactions studies. In 6th Annual Conference of IT4Innovations and 1st Users Conference of IT4Innovations, October 31-November 1, 2017, Ostrava, Czech Republic. Abstract published: In Programme: 6th Annual Conference of IT4Innovations and 1st Users Conference of IT4Innovations, October 31-November 1, 2017, Ostrava, Czech Republic. Ostrava: VŠB-TU Ostrava, 2017, p. 3.
9. SASINKOVÁ, Vlasta. Využitie Ramanovej spektroskopie pri charakterizácii geologických vzoriek. In Molekulová spektroskopie 2017 - IX. setkání uživatelů, 2.-4. 10. 2017, Lázně Bělohrad, Česko. (Eng: Use of Raman spectroscopy in characterization geological samples. In Molecular spectroscopy 2017 - IX. user meeting, October 2-4, 2017, Bělohrad Spa, Czech Republic)
10. KATRLÍK, Jaroslav. Glycoprofiling by lectin-based protein microarrays for biomedical applications. In Microarrays and Nanoarrays in Microfluidics and Multiplex Diagnostics within IVD and POCT (MMM), October 11-12, 2018,

Vienna, Austria. Abstract published: In Abstract Book: Microarrays and Nanoarrays in Microfluidics and Multiplex Diagnostics within IVD and POCT (MMM), October 11-12, 2018, Vienna, Austria. Berlin: M24You GmbH, 2018, p. 17.

11. TKÁČ, Ján. Specific lectin-based protein glycoprofiling for diagnostics. In Synthetic glycobiology: Theo Murphy International Scientific Meeting, October 8-9, 2018, Chicheley, UK. Abstract published: In The Royal Society: https://royalsociety.org/science-events-and-lectures/2018/10/synthetic-glycobiology/
12. TKÁČ, Ján. Glykoproteíny, biomarkery a elektrochemické senzory. In Potlach č. IV o vybraných kapitolách z (bio)elektroanalytické chemie aneb pojďme společně lépe rozumět tomu, co děláme, 5. březen 2018, Lékařská fakulta, Univerzita Palackého v Olomouci, Olomouc, Česká republika. (Eng: Glycoproteins, biomarkers and electrochemical sensors In Potlach no. IV on selected chapters from (bio) electroanalytical chemistry or let's better understand together what we do, March 5, 2018, Faculty of Medicine and Dentistry Palacký University Olomouc, Czech Republic)
13. TKÁČ, Ján - BERTÓK, Tomáš - LORENCOVÁ, Lenka - BELICKÁ, Ludmila - HOLAZOVÁ, Alena - JÁNÉ, Eduard - CHOCHOLOVÁ, Erika - KVĚTOŇ, Filip - KASÁK, Peter. Lectin and glycan biosensors applied in diagnostics. In The 43rd FEBS Congress, July 7-12, 2018, Prague, Czech Republic. (invited lecture - Dr. Tkáč) Abstract published: In FEBS Open Bio, 2018, vol. 8, suppl. S1, p. 46-47, abstract no. S.16-2.
14. BARÁTH, Peter - NEMČOVIČ, Marek - ZIBUROVÁ, Jana - PAKANOVÁ, Zuzana - ŠESTÁK, Sergej - BELLOVÁ, Jana - ŠALINGOVÁ, Anna - TEKELYOVÁ, Alexandra - SKOKŇOVÁ, Martina - BRUCKNEROVÁ, Ingrid - ŠEBOVÁ, Claudia - MUCHA, Ján. New homozygous mutation in ALG12 gene resulted in CDG-I disorder in newborn patient. In Glyco 25: XXV International Symposium on Glycoconjugates, August 25-31, 2019, Milano, Italy. (invited lecture - Dr. Baráth P.) Abstract published: In Glycoconjugate Journal, 2019, vol. 36, no. 4, p. 303. ISSN 0282-0080. (Abstracts: Glyco 25: XXV International Symposium on Glycoconjugates, August 25-31, 2019, Milano, Italy).
15. HRICOVÍNI, Michal. The spectroscopic and DFT analysis of photochemical processes of quinazolinone-derived Schiff bases. In 2nd International Conference of Photonics Research (INTERPHOTONICS 2019), November 4-9, 2019, Kemer/Antalya, Turkey. Abstract published: In KAYAHAN, Ersin - ORAL, Ahmet Yavuz- AKÖZ, Mehmet Emre - AKSAN, Onur Alp - ÇINAR, Abrahim (eds.). Book of Abstracts: 2nd International Conference of Photonics Research (INTERPHOTONICS 2019) Yeniköy: Kocaeli University, 2019, p. 107.
16. KATRLÍK, Jaroslav. Lectin-based biosensing for medicine and biotechnology. In European Biotechnology Congress, April 11-13, 2019, Valencia, Spain. Abstract published: In Journal of Biotechnology, 2019, vol. 305, Supplement, p. S2. ISSN 0168-1656. (Abstracts: European Biotechnology Congress, April 11-13, 2019, Valencia, Spain).
17. KATRLÍK, Jaroslav - KRIŽÁKOVÁ, Martina - PAŽITNÁ, Lucia - HĽASOVÁ, Zuzana - KUNDALIA, Paras - KIANIČKOVÁ, Kristína. Screening of protein glycosylation by lectin-based protein microarray. In Spot your future MMM Workshop 2019, September 30 - October 1, 2019, Vienna, Austria. (invited lecture - Dr. Katrlík) Abstract published: In Abstract Book: Spot your future MMM Workshop 2019, September 30 - October 1, 2019, Vienna, Austria. Berlin: M24You GmbH, 2019, p. 33.
18. LUX, Alexander - VACULÍK, Marek - MARTINKA, Michal - KOHANOVÁ, Jana - LUKAČOVÁ, Zuzana - BOKOR, Boris - WHITE, Philip J. - TAO, Qi - LI, Tingqiang. Checkpoints of transport processes in plants exposed to toxic levels of trace elements and/or toxic elements. In 15th International Conference on the Biogeochemistry of Trace Elements (ICOBTE), May 5-9, 2019, Nanjing, China. (invited lecture - prof. Lux) Abstract published: In Abstract Book: ICOBTE 2019,

May 5-9, 2019, Nanjing, China. Nanjing: Nanjing Agricultural University, 2019, p. S5-276.

19. BUČKO, Marek - GEMEINER, Peter. Imobilizácia živých buniek pre biokatalytickú produkciu chemických špecialít. (invited lecture - Dr. Bučko) In Mezinárodní workshop: Studium polyelektrolytových kapsul pomocí environmentálního rastrovacího elektronového mikroskopu, June 22.-26., 2020, Ústav přístrojové techniky, Akademie věd České republiky v.v.i., Brno, Česká republika. (Eng: Immobilization of living cells for biocatalytic production of chemical specialties. In International workshop: Study of polyelectrolyte capsules using an environmental scanning electron microscope. June 22-26, 2020, Institute of Scientific Instruments of the Czech Academy of Sciences Instrumentation, Brno, Czech Republic)
20. TKÁČ, Ján - BERTÓK, Tomáš - JÁNÉ, Eduard - HÍREŠ, Michal - LORENCOVÁ, Lenka - PINKOVÁ GAJDOŠOVÁ, Veronika - BLŠÁKOVÁ, Anna - KVĚTOŇ, Filip - HRONČEKOVÁ, Štefánia. Analýza glykánov v diagnostike rakoviny. In 72. sjezd českých a slovenských chemických společností, September 6-9, 2020, Prague, Czech Republic. (invited lecture - Dr. Tkáč) Abstract published: In Czech Chemical Society Symposium Series, 2020, vol. 18, issue 3, p. 63. PL-03. ISSN 2336-7202. Abstract book: 72. sjezd českých a slovenských chemických společností, September 6-9, 2020, Prague, Czech Republic. (Eng. (Glycan analysis in cancer diagnosis. In the 72nd Congress of Czech and Slovak Chemical Companies, September 6-9, 2020, Prague, Czech Republic. (invited lecture - Dr. Tkáč) Abstract published: In Czech Chemical Society Symposium Series, 2020, vol. 18, issue 3, p. 63. PL-03. ISSN 2336-7202. Abstract book: the 72nd Congress of Czech and Slovak Chemical Companies, September 6-9, 2020, Prague, Czech Republic.
21. TKÁČ, Ján - BERTOK, Tomáš - LORENCOVÁ, Lenka - HÍREŠ, Michal - JÁNÉ, Eduard - PINKOVÁ-GAJDOŠOVÁ, Veronika - BLŠÁKOVÁ, Anna. Nanotechnology - based biosensing: Application cancer diagnostics. „ Life is Biochemistry, Biochemistry is Life“ XXVI. Annual Congress of Czech and Slovak Societies for Biochemistry and Molecular Biology with cooperation of Austrian and German Biochemical Section. August 29 - September 1, 2021, České Budějovice. Czech Republic. (invited lecture - Dr. Tkáč) Abstract Book p.74. ISBN: 978-80-907779-1-0
22. TKÁČ, Ján - BERTOK, Tomáš - LORENCOVÁ, Lenka - HÍREŠ, Michal - JÁNÉ, Eduard - PINKOVÁ-GAJDOŠOVÁ, Veronika - BLŠÁKOVÁ, Anna. Nanotechnology in biosensing and bioanalysis. The 5th International Conference on Nanomaterials: Fundamentals and Applications October 10 – 13, 2021, Štrbské pleso, Slovakia. (invited lecture - Dr. Tkáč) Abstract Book p.11. Slovakia. ISBN: 978-80-574-0039-4
23. KOZMON, Stanislav - KOČA, Jaroslav. What we have learned on the carbohydrate – receptor interactions. (invited lecture - Dr. Kozmon) In Jaroslav Koča Memorial Colloquium on Computational and Structural Biology, November 30, 2021, Brno, Czech Republic. Book of Abstracts. - Brno: Masaryk University, 2021, p.13-14.
24. TVAROŠKA, Igor. Glycosyltransferases as targets for therapeutic intervention in cancer and inflammation: molecular modeling insights. In Jaroslav Koča Memorial Colloquium on Computational and Structural Biology, November 30, 2021, Brno, Czech Republic, Book of Abstracts. - Brno: Masaryk University, 2021, p. 15-16.

2.3.8. List of researchers who served as members of the organising and/or programme committees

BARÁTH, Marek (programme and organising committee)

- 14th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 25-30, 2017
- 15th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 2020, postponed to June 20-24, 2022

BIELY, Peter (programme committee)
- XXVI. Biochemical Congress, České Budějovice, Czech Republic, August 29-September 1, 2013.

BLAHUTOVÁ, Jana (organising committee)
- 14th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 25-30, 2017
- 15th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 2020, postponed to June 20-24, 2022

BREIEROVÁ, Emília (organising committee)
- 43rd Annual Conference on Yeasts, Smolenice, Slovakia, May 10-13, 2016
- 44th Annual Conference on Yeasts, Smolenice, Slovakia, May 2-5, 2017
- 45th Annual Conference on Yeasts, Smolenice, Slovakia, May 15-18, 2018

GUTHOVÁ, Jana (organising committee)
- 43rd Annual Conference on Yeasts, Smolenice, Slovakia, May 10-13, 2016
- 44th Annual Conference on Yeasts, Smolenice, Slovakia, May 2-5, 2017
- 45th Annual Conference on Yeasts, Smolenice, Slovakia, May 15-18, 2018
- 46th Annual Conference on Yeasts, Smolenice, Slovakia, May 7-10, 2019
- 47th Annual Conference on Yeasts, Smolenice, Slovakia, May 2020, postponed to May 16-19, 2023

HIRSCH, Ján (programme committee)
- 12th International Conference on Polysaccharides-Glycoscience, Prague, Czech Republic, October 19-21, 2016
- 13th International Conference on Polysaccharides-Glycoscience, Prague, Czech Republic, November 8-10, 2017
- 14th International Conference on Polysaccharides-Glycoscience, Prague, Czech Republic, November 7-09, 2018
- 15th International Conference on Polysaccharides-Glycoscience, Prague, Czech Republic, November 13-15, 2019

HRICOVÍNI, Miloš (organising and programme committee)
- 8th Central European Conference "Chemistry towards Biology", Brno, Czech Republic, August 28-September 1, 2016
- 29th International Carbohydrate Symposium (ICS 2018), Lisboa, Portugal, July 15-19,2018
- Chemistry towards Biology (CTB9) - Biomolecules as Potential Drugs, Budapest, Hungary, September 24-27, 2018
- INSRUCT-ULTRA "2rd Structural Biology Meeting", Bratislava, Slovakia, November 15-16, 2018
- INSRUCT-ULTRA "3rd Structural Biology Meeting", Bratislava, Slovakia, November 14-15, 2019
- Chemistry towards Biology (CTB10) and INSTRUCT-ULTRA Structural Biology Meeting, Bratislava, Slovakia, September 2020, postponed to September 11-14, 2022

HRICOVÍNIOVÁ, Zuzana (organising and programme committee)

- Chemistry towards Biology (CTB10) and INSTRUCT-ULTRA Structural Biology Meeting, Bratislava, Slovakia, September 2020, postponed to September 11-14, 2022

KATRLÍK, Jaroslav (programme committee)
- European Biotechnology Congress 2016, Riga, Latvia, May 5-7, 2016
- GLYCO 24: 24th International Symposium on Glycoconjugates, Jeju, South Korea, August 27- Sempember 1, 2017
- 14th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 25-30, 2017
- European Biotechnology Congress 2019, Valencia, Spain, September 25-26, 2019
- 15th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 2020, postponed to June 20-24, 2022

KOLLÁROVÁ, Karin (organising committee)
- 14th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 25-30, 2017
- 8th International Symposium on Structure and Function of Roots, Horný Smokovec, Slovakia, September 2020, postponed to June 12-16, 2022
- 15th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 2020, postponed to June 20-24, 2022

KÓŇA, Juraj (organising committee)
- 14th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 25-30, 2017
- 15th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 2020, postponed to June 20-24, 2022

KUČEROVÁ, Danica (organising committee)
- 8th International Symposium on Structure and Function of Roots, Horný Smokovec, Slovakia, September 2020, postponed to June 12-16, 2022

LUX, Alexander (programme and organising committee)
- 8th International Symposium on Structure and Function of Roots, Horný Smokovec, Slovakia, September 2020, postponed to June 12-16, 2022

PÄTOPRSTÝ, Vladimír (programme committee)
- 16th International Interdisciplinary Meeting on Biocatalysis (CECE2019), Gdańsk, Poland, September 24-26, 2019

PETRUŠ, Ladislav (programme committee)
- Chemistry towards Biology (CTB9) - Biomolecules as Potential Drugs, Budapest, Hungary, September 24-27, 2018

MASTIHUBA, Vladimír (programme committee)
- 69. Zjazd chemikov (Eng: 69th Congress of Chemists), Starý Smokovec, Slovakia, September 11-15, 2017
- 71. Zjazd chemikov (Eng: 71st Congress of Chemists), Starý Smokovec, Slovakia, September 9-13, 2019

SCHUSTEROVÁ, Hana (organising committee)
- 43rd Annual Conference on Yeasts, Smolenice, Slovakia, May 10-13, 2016
- 44th Annual Conference on Yeasts, Smolenice, Slovakia, May 2-5, 2017
- 45th Annual Conference on Yeasts, Smolenice, Slovakia, May 15-18, 2018
- 46th Annual Conference on Yeasts, Smolenice, Slovakia, May 7-10, 2019

- 47th Annual Conference on Yeasts, Smolenice, Slovakia, May 2020, postponed to May 16-19, 2023

ŠVANČAROVÁ, Oľga (organising committee)
- Chemistry towards Biology (CTB9) - Biomolecules as Potential Drugs, Budapest, Hungary, September 24-27, 2018

ŠÍPOŠOVÁ, Kristína (organising committee)
- 15th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 2020, postponed to June 20-24, 2022

SCHENKMAYEROVÁ, Andrea (organising committee)
- 14th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 25-30, 2017

UHLIARIKOVÁ, Iveta (organising committee)
- Chemistry towards Biology (CTB10) and INSTRUCT-ULTRA Structural Biology Meeting, Bratislava, Slovakia, moved to September 11-14, 2022

VADKERTIOVÁ, Renata (organising committee)
- 43rd Annual Conference on Yeasts, Smolenice, Slovakia, May 10-13, 2016
- 44th Annual Conference on Yeasts, Smolenice, Slovakia, May 2-5, 2017
- 45th Annual Conference on Yeasts, Smolenice, Slovakia, May 15-18, 2018
- 46th Annual Conference on Yeasts, Smolenice, Slovakia, May 7-10, 2019
- 47th Annual Conference on Yeasts, Smolenice, Slovakia, May 2020, postponed to May 16-19, 2023

VIVODOVÁ, Zuzana (organising committee)
- 14th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 25-30, 2017
- 8th International Symposium on Structure and Function of Roots, Horný Smokovec, Slovakia, September 2020, postponed to June 12-16, 2022
- 15th Bratislava Symposium on Saccharides, Smolenice, Slovakia, June 2020, postponed to June 20-24, 2022

2.3.9. List of researchers who received an international scientific award

BERTÓK, Tomáš
1. Danubius Young Scientist Award 2016
   Appraiser: Austrian Federal Ministry for Science, Research and Economy; Institute for the Danube Region and Central Europe (Austria)
   Description: For extraordinary results in scientific activities and outputs in relation to the Danube region
2. Diplom ΩMetrohm 2019 (Eng: Diploma ΩMetrohm 2019)
   Appraiser: Metrohm Czech Republic
   Description: For the best publication of a young electroanalytical chemist (up to 35 years).
3. Top downloaded paper 2018-2019
   Appraiser: Wiley
   Description: For the work published in ChemElectroChem, which was among the 10% most downloaded in 2018-2019. (co-authors: RNDr. Lenka Lorencová, PhD., Mgr. Erika Chocholová, RNDr. Eduard Jáné, PhD., Ing. Alica Vikartovská, PhD., Ing. Ján Tkáč, DrSc.).

BLŠÁKOVÁ, Anna
1. Emil Paleček Award 2021

Appraiser: Institute of Biophysics CAS, v.v.i.
Description: For the work presented at XXI. Workshop of Biophysical Chemists and Electrochemists.

HUSHEGYI, András

1. Diplom - Cena Metrohm 2016 (Eng: Diploma - Metrohm Award 2016)
   Appraiser: CEO Metrohm Czech Republic
   Description: For the best publication of a young electroanalytical chemist (up to 35 years).

KVĚTOŇ, Filip

1. Cena Shimadzu 2018 (Eng: Shimadzu 2018 Award)
   Appraiser: Shimadzu and Contipro a.s. in cooperation with the Czech Chemical Society
   Description: Prize for the work "Detection of tumor-associated antibody GOD3-2C4 by glycan biosensor based on Tn antigen" awarded in the field of Analytical Chemistry. 3rd place associated with a financial reward of 450 €.)
2. Oral Presentation Award - 3rd Prize 2018
   Appraiser: Czech Republic
   Description: For the presentation at the Young Scientists' Session at Conference XVIII. Workshop of Biophysical Chemists and Electrochemists, 12-13 September 2018, Brno, Czech Republic).

PIPIKOVÁ, Jana

1. The spirit of yeast 2021
   Appraiser: International Congress on Yeasts, 23 – 27 August, 2021, Vienna, Austria
   Description: First place in a creative call for a painted picture of a yeast called Candy-da).

TKÁČ, Ján

1. Top downloaded paper 2018-2019
   Appraiser: Wiley
   Description: For the work published in Electroanalysis, which was among the 10% most downloaded in 2018-2019. (co-authors: RNDr. Lenka Lorencová, PhD., RNDr. Veronika Gajdošová, Ing. Štefánia Hrončeková, Ing. Tomáš Bertók, PhD., Mgr. Jana Blahutová, PhD., Ing. Alica Vikartovská, PhD.).

- **Position of individual researchers in the national context**

2.3.10. List of invited/keynote presentations at national conferences, as documented by programme or invitation letter

1. KATRLÍK, Jaroslav - ZÁMOROVÁ, Martina - DAMBORSKÝ, Pavel. Development of lectin-based optical biochips and biosensors for determination of protein glycosylation. In XIV. medzinárodná konferencia Súčasný stav a perspektívy analytickej chémie v praxi (ACP-Analytická chémia v praxi- Stav a perspektívy 2016), May 3-6, 2016, Bratislava. (invited lecture - Dr. Katrlík) Abstract published: In HROUZKOVÁ, Svetlana - MÁJEK, Pavel - SOCHR, Jozef (eds.). Book of abstract: XIV. medzinárodná konferencia Súčasný stav a perspektívy analytickej chémie v praxi (ACP-Analytická chémia v praxi- Stav a perspektívy 2016), May 3-6, 2016, Bratislava. Bratislava: Nakladateľstvo STU, 2016, p. 41. ISBN 978-80-227-4556-7. (Eng: In XIV. International Conference Current Status and Perspectives of Analytical Chemistry in Practice (ACP-Analytical Chemistry in Practice - Status and Perspectives 2016), May 3-6,

2016, Bratislava. (invited lecture - Dr. Katrlík) Abstract published: In HROUZKOVÁ, Svetlana - MÁJEK, Pavel - SOCHR, Jozef (eds.). Book of abstract: XIV. International Conference Current Status and Perspectives of Analytical Chemistry in Practice (ACP-Analytical Chemistry in Practice - Status and Perspectives 2016), May 3-6, 2016, Bratislava. Bratislava: Nakladateľstvo STU, 2016, p. 41. ISBN 978-80-227-4556-7.

2. MASTIHUBOVÁ, Mária - KIS, Peter - POTOCKÁ, Elena - MASTIHUBA, Vladimír. Selective chemo-enzymatic strategies for synthesis of phenylpropanoid glycosides. In Conference of Organic Chemists: Advances in Organic Chemistry – Smolenice 2016, September 4-7, 2016, Smolenice, Slovakia. (invited lecture - Dr. Mastihubová) Abstract published: In ŠEBESTA, Radovan - SORÁDOVÁ, Zuzana - MEČIAROVÁ, Mária (eds.). Program and Abstracts: Advances in Organic Chemistry – Smolenice 2016, September 4-7, 2016, Smolenice, Slovakia. Bratislava: Igor Iliť-RádioPrint, 2016, p. 24, IL-03. ISBN 978-80-89867-00-4.
3. PETRUŠ, Ladislav - PETRUŠOVÁ, Mária - PRIBULOVÁ, Božena - SMRTIČOVÁ, Hana. Glykozylnitrometány - príprava, vlastnosti a využitie na syntézu glykomimetík. In 50 rokov Katedry organickej chémie, 8.-10. jún 2016, Košice. (invited lecture - Dr. Petruš) Abstract published: In KUDLIČKOVÁ, Zuzana a kol. (eds.) Zborník z konferencie: 50 rokov Katedry organickej chémie, June 8-10, 2016, Košice, Slovensko. Košice: Univerzita Pavla Jozefa Šafárika, 2016, p. 14-15. ISBN 978-80-8152-428-8. (Eng: Glycosylnitromethanes - preparation, properties and use for the synthesis of glycomimetics. In 50 years of the Department of Organic Chemistry, 8.-10. June 2016, Kosice. (invited lecture - Dr. Petruš) Abstract published: In KUDLIČKOVÁ, Zuzana a kol. (eds.) Proceedings from the conference: 50 years of the Department of Organic Chemistry, June 8-10, 2016, Košice, Slovakia. Košice: Pavol Jozef Šafárik University in Košice, 2016, p. 14-15. ISBN 978-80-8152-428-8.)
4. SASINKOVÁ, Vlasta. Chemická analýza Ramanovou mikroskopiou. In Thermo Scientific Discovery Days 2016, June 15, 2016, Bratislava. (Eng: Chemical analysis by Raman microscopy (Chemická analýza Ramanovou mikroskopiou.) In Thermo Scientific Discovery Days 2016, June 15, 2016, Bratislava.)
5. ŠALINGOVÁ, Anna - OSTROŽLÍKOVÁ, Mária - MATULOVÁ, Mária - UHLIARIKOVÁ, Iveta - KOLNÍKOVÁ, Miriam - BEHÚLOVÁ, Darina. Novinky v diagnostike porúch metabolizmu kreatínu. In 21. Kolokvium o dedičných metabolických poruchách: Neurometabolické ochorenia, December 1, 2016, Slovenská spoločnosť klinickej biochémie SLS, Bratislava. (invited lecture - Dr. Šalingová) (Eng: News in the diagnosis of creatine metabolism disorders. In 21. Colloquium on Inherited Metabolic Disorders: Neurometabolic Diseases, December 1, 2016, Slovak Society of Clinical Biochemistry, Bratislava. (invited lecture - Dr. Šalingová)).
6. BERTÓK, Tomáš - CHOCHOLOVÁ, Erika - LORENCOVÁ, Lenka - HOLAZOVÁ, Alena - DAMBORSKÁ, Dominika - HUSHEGYI, András - KASÁK, Peter - TKÁČ, Ján. Low cost, disposable, nanostructured interfaces for glycomic studies and medical diagnostics. In 14th Bratislava Symposium on Saccharides “Glycochemistry for biology and medicine”, June 25-30, 2017, Smolenice, Slovakia. (invited lecture - Dr. Bertók) Abstract published: In KATRLÍK, Jaroslav - BARÁTH, Marek (eds.). Proceedings of the 14th Bratislava Symposium on Saccharides “Glycochemistry for biology and medicine”, June 25-30, 2017, Smolenice, Slovakia. Bratislava: Institute of Chemistry SAS, 2017, p. 33, IL5. ISBN 978-80-971156-3-0. ISSN 1339-7036.
7. MASTIHUBA, Vladimír - KARNIŠOVÁ POTOCKÁ, Elena - MASTIHUBOVÁ, Mária - KIS, Peter. Use of glycosidases in the synthesis of phenylethanoid synthons of glycophenolics. In New trends in chemistry - Trends in chemistry, research and education at Faculty of Sciences of P. J. Šafárik University, November 10, 2017, Košice. (invited lecture - Dr. Mastihuba) Abstract published: In ORIŇAKOVÁ, Renáta (ed.). Book of Abstracts: New trends in chemistry - Trends in chemistry, research and education at Faculty of Sciences

of P. J. Šafárik University, November 10, 2017, Košice. Košice: Pavol Jozef Šafárik University, 2017, p. 6. ISBN 978-80-8152-553-7.

8. TKÁČ, Ján - BERTÓK, Tomáš - KLUKOVÁ, Ľudmila - DAMBORSKÁ, Dominika - BELICKÝ, Štefan - KVĚTOŇ, Filip. Diagnostic potential of biosensors in medicinal biotechnology and biomedicine. In JRC-EC – CEI – ICGEB Workshop: Smart Specialization Strategy in the Field of Biotechnologies in Europe: A Challenge for CEE Region, September 4-6, 2017, Bratislava, Slovakia. (invited lecture - Dr. Tkáč) Abstract published: In CHMELOVÁ, Daniela - ONDREJOVIČ, Miroslav (eds.). Book of Abstracts: JRC-EC – CEI – ICGEB Workshop: Smart Specialization Strategy in the Field of Biotechnologies in Europe: A Challenge for CEE Region, September 4-6, 2017, Bratislava, Slovakia. Trnava: University of SS. Cyril and Methodius in Trnava, 2017, p. 38-39. ISBN 978-80-8105-864-6.
9. PETRUŠ, Ladislav - PRIBULOVÁ, Božena - SMRTIČOVÁ, Hana - VLČKOVÁ, Silvia - HRIVNÁKOVÁ, Viera - PETRUŠOVÁ, Mária. Toward synthesis of dodeca-cavitane, sugar-based analogue of dodecahedrane possesing a cavity for hydrogen bonding. In New trends in chemistry: Trends in chemistry, research and education at Faculty of Sciences of P. J. Šafárik University in Košice, November 9, 2018, Košice. (invited lecture - Dr. Petruš) Abstract published: In ORIŇAKOVÁ, Renáta (ed.). Book of Abstracts: New trends in chemistry: Trends in chemistry, research and education at Faculty of Sciences of P. J. Šafárik University, November 9, 2018, Košice. Košice: Pavol Jozef Šafárik University, 2018, p. 6. ISBN 978-80-8152-666-4.
10. TKÁČ, Ján. Inovatívny spôsob diagnostiky rakoviny prostaty. In XIII. Kongres SSKB a SSLM s medzinárodnou účasťou, November 4-6, 2018, Piešťany, Slovakia (Eng: An innovative way to diagnose prostate cancer. In XIII. SSKB and SSLM Congress with international participation, November 4-6, 2018, Piešťany, Slovakia).
11. TKÁČ, Ján. Využitie analýzy glykánov v diagnostike rakoviny prostaty. In 25. výročná konferencia Slovenskej urologickej spoločnosti SLS, June 6-8, 2018, Tále, Slovakia (Eng: Use of glycan analysis in the diagnosis of prostate cancer. In 25th annual conference of the Slovak Urological Society SLS, June 6-8, 2018, Tále, Slovakia)
12. FRECER, Vladimír - MIERTUŠ, Stanislav - BREN, Urban - ŠEBESTA, Radovan - HĽASOVÁ, Zuzana - ONDREJOVIČ, Miroslav - KATRLÍK, Jaroslav. Design and development of potential new drugs against influenza A virus. In Trends and Prospects in Medicinal and Pharma Biotechnologies in Europe. Towards Strengthening Regional Cooperation Including CEE Countries, June 3-4, 2019, Trnava, Slovakia. (invited lecture - Dr. Katrlík) Abstract published: In CHMELOVÁ, Daniela - ONDREJOVIČ, Miroslav (eds.). Book of Abstracts: Trends and Prospects in Medicinal and Pharma Biotechnologies in Europe. Towards Strengthening Regional Cooperation Including CEE Countries, June 3-4, 2019, Trnava, Slovakia. Trnava: University of Ss. Cyril and Methodius in Trnava, 2019, p. 35-36. ISBN 978-80-8105-996-4.
13. TKÁČ, Ján - BERTÓK, Tomáš - LORENCOVÁ, Lenka - JÁNÉ, Eduard - HÍREŠ, Michal - HRONČEKOVÁ, Štefánia - GAJDOŠOVÁ, Veronika. Využitie glykánov v diagnostike rakoviny. In Biochemické dni 2019, 21.-24. september 2019, Horný Smokovec, Slovensko. (invited lecture - Dr. Tkáč) Abstract published: In GAVURNÍKOVÁ, Gabriela (ed.). Abstract book from conference Biochemické dni 2019, September 21-24, 2019, Horný Smokovec, Slovakia. Bratislava: Centre of scientific and technical informations SR, 2019, p. 64. ISBN 978-80-89965-27-4. (Eng: Use of glycans in cancer diagnosis. In Biochemical days 2019, 21.-24. september 2019, Horný Smokovec, Slovakia. (invited lecture - Dr. Tkáč) Abstract published: In GAVURNÍKOVÁ, Gabriela (ed.). Abstract book from conference Biochemical days 2019, September 21-24, 2019, Horný Smokovec, Slovakia. Bratislava: Centre of scientific and technical informations SR, 2019, p. 64. ISBN 978-80-89965-27-4.)

14. TKÁČ, Ján - BERTÓK, Tomáš - LORENCOVÁ, Lenka - JÁNÉ, Eduard - HÍREŠ, Michal - KVĚTOŇ, Filip - BLŠÁKOVÁ, Anna - HRONČEKOVÁ, Štefánia - GAJDOŠOVÁ, Veronika. New biomarkers and biosensors for early detection of cancer. In Trends and Prospects in Medicinal and Pharma Biotechnologies in Europe. Towards Strengthening Regional Cooperation Including CEE Countries, June 3-4, 2019, Trnava, Slovakia. (invited lecture - Dr. Tkáč) Abstract published: In CHMELOVÁ, Daniela - ONDREJOVIČ, Miroslav (eds.). Book of Abstracts: Trends and Prospects in Medicinal and Pharma Biotechnologies in Europe. Towards Strengthening Regional Cooperation Including CEE Countries, June 3-4, 2019, Trnava, Slovakia. Trnava: University of Ss. Cyril and Methodius in Trnava, 2019, p. 32-33. ISBN 978-80-8105-996-4.

2.3.11. List of researchers who served as members of organising and programme committees of national conferences

BLAHUTOVÁ, Jana (programme committee)

- Student scientific conference in Faculty of Chemical and Food Technology STU – Biochemistry and microbiology, online form, November 24, 2021

TKÁČ, Ján (programme committee)

- VIII. Interactive Conference of Young Scientists, online form, February 6 – June 7, 2016
- IX. Interactive Conference of Young Scientists, online form, February 8 – June 8, 2017
- X. Interactive Conference of Young Scientists, online form, February 24 – July 1, 2018
- XI. Interactive Conference of Young Scientists, online form, February 16 – July 1, 2019
- XII. Interactive Conference of Young Scientists, online form, March 2 – June 6, 2020

FARKAŠ, Pavol (organising committee)

- VIII. Interactive Conference of Young Scientists, online form, February 6 – June 7, 2016
- IX. Interactive Conference of Young Scientists, online form, February 8 – June 8, 2017
- X. Interactive Conference of Young Scientists, online form, February 24 – July 1, 2018
- XI. Interactive Conference of Young Scientists, online form, February 16 – July 1, 2019
- XII. Interactive Conference of Young Scientists, online form, March 2 – June 6, 2020
- XIII. Interactive Conference of Young Scientists, online form, March 17 – June 2, 2021

KATRLÍK, Jaroslav (programme committee)

- VIII. Interactive Conference of Young Scientists, online form, February 6 – June 7, 2016
- IX. Interactive Conference of Young Scientists, online form, February 8 – June 8, 2017
- X. Interactive Conference of Young Scientists, online form, February 24 – July 1, 2018
- XI. Interactive Conference of Young Scientists, online form, February 16 – July 1, 2019

- XII. Interactive Conference of Young Scientists, online form, March 2 – June 6, 2020
- XIII. Interactive Conference of Young Scientists, online form, March 17 – June 2, 2021

MASTIHUBA, Vladimír (programme committee)

- VIII. Interactive Conference of Young Scientists, online form, February 6 – June 7, 2016
- IX. Interactive Conference of Young Scientists, online form, February 8 – June 8, 2017
- X. Interactive Conference of Young Scientists, online form, February 24 – July 1, 2018
- XI. Interactive Conference of Young Scientists, online form, February 16 – July 1, 2019
- XII. Interactive Conference of Young Scientists, online form, March 2 – June 6, 2020
- XIII. Interactive Conference of Young Scientists, online form, March 17 – June 2, 2021

2.3.12. List of researchers who received a national scientific award

BERTÓK, Tomáš

1. 30 pod 30: Najväčšie talenty Slovenska/Veda a vzdelávanie 2016 (Eng: 30 under 30: The greatest talents of Slovakia)
   Appraiser: Forbes
   Description: Selected by Forbes magazine (Slovakia) among the 30 greatest talents of Slovakia under 30 (article: nChemik. In Forbes, 2016, March 2016, pp. 46-52).
2. Finalista Falling Walls Lab Slovakia 2017 (Eng: Finalist Falling Walls Lab Slovakia 2017)
   Appraiser: Comenius University in Bratislava (main organizer)
   Description: The selection for the pilot round (November 29, 2017, Bratislava) was made by an expert jury.
3. Mladá osobnosť vedy 2017 (Eng: Young Personality of Science 2017)
   Appraiser: Slovak Center of Scientific and Technical Information, Slovak Academy of Sciences and Association of Slovak Scientific and Technical Societies
   Description: For research and popularization activities in the field of nanostructures application (20th year of the competition - award for 2016).
4. Ocenenie Predsedníctva SAV 2018 (Presidium SAS 2018 Award)
   Appraiser: Presidium SAS
   Description: For a joint Slovak-Czech publication in an international scientific journal with the highest impact factor according to the WOS database.
5. Prémia za vedeckú a odbornú literatúru za rok 2017 v kategórii prírodné a technické vedy (Eng: Prize for scientific and professional literature for 2017 in the category of natural and technical sciences)
   Appraiser: Literary Fund, Section for scientific and professional literature and computer programs
   Description: For the work: Nanobiotechnológie alebo Od lepiacej pásky k medicínskym aplikáciám (Nanobiotechnologies or From adhesive tape to medical applications). (team of authors: Ing. Tomáš Bertók, PhD., RNDr. Anikó Bertóková, PhD., Ing. Jaroslav Filip, PhD., RNDr. Alena Holazová, PhD., Ing. Štefan Belický, PhD., RNDr. Peter Kasák, PhD., Ing. Ján Tkáč, DrSc.).

6. Finalista súťaže ESET Science Award v sekcii Výnimočný mladý vedec do 35 rokov 2020 (Eng: Finalist of the ESET Science Award Exceptional young scientist in Slovakia up to 35 years 2020)
   Appraiser: ESET Foundation
   Description: Finalist (the first 5) competitions ESET Science Award Exceptional young scientist in Slovakia up to of 35 years 2020.
7. Cena Slovenskej akadémie vied za výsledky vedeckovýskumnej práce 2021 (Eng: Prize of the Slovak Academy of Sciences for the results of scientific research work 2021)
   Appraiser: Scientific Council of Slovak Academy of Sciences
   Description: For a set of publications in the field of analysis of complex carbohydrates for medical purposes diagnostics.

BERTÓKOVÁ, Anikó

1. Prémia za vedeckú a odbornú literatúru za rok 2017 v kategórii prírodných a technických vied (Eng: Prize for scientific and professional literature for 2017 in the category of natural and technical sciences)
   Appraiser: Literary Fund, Section for scientific and professional literature and computer programs
   Description: For the work: Nanobiotechnológie alebo Od lepiacej pásky k medicínskym aplikáciám (Nanobiotechnologies or From adhesive tape to medical applications). (team of authors: Ing. Tomáš Bertók, PhD., RNDr. Anikó Bertóková, PhD., Ing. Jaroslav Filip, PhD., RNDr. Alena Holazová, PhD., Ing. Štefan Belický, PhD., RNDr. Peter Kasák, PhD., Ing. Ján Tkáč, DrSc.).

BIELY, Peter

1. Významná osobnosť SAV 2016 (Eng: Important personality of SAS 2016)
   Appraiser: Presidium of the SAS
   Description: Award for the contribution of the academy and the significance of scientific work.
2. Cena SAV za vedecko-výskumnú činnosť 2017 (Eng: SAS Award for Scientific Research 2017
   Appraiser: Presidium of the SAS
   Description: For a set of scientific research works New microbial enzymes degrading plant cell walls). Team: RNDr. M. Vršanská, DrSc., Mgr. V. Puchart, PhD., M. Cziszárová, Ing. K. Šuchová, PhD., Ing. J. Hirsch, DrSr.).
3. Ocenenie Predsedníctva SAV 2017 (Eng: SAS Presidium Award 2017)
   Appraiser: Presidium of the SAS
   Description: For a scientific publication with an extremely large number of citations.

BLŠÁKOVÁ, Anna

1. Diplom pri príležitosti XI. Interaktívnej konferencie mladých vedcov 2019 (Diploma on the occasion of XI. Interactive Conference of Young Scientists 2019)
   Appraiser: Civic association PREVEDA
   Description: For an excellent contribution in the section Use of instrumental methods in the analysis of biologically important substances.
2. Certifikát pri príležitosti podávania prihlášok grantov pre doktorandov SAV v.r. 2020 (Certificate on the occasion of submitting grant applications for doctoral students of SAS in. 2020)
   Appraiser: Evaluation Committee Grant Program for SAS PhD students
   Description: The submitted project entitled “Development of sensitive diagnostic methods for early detection of cancer“ was awarded a mark of high quality.
3. Cena Marty Sališovej 2021 (Marta Sališová Award 2021)
   Appraiser: Slovak Chemical Society at SAS

Description: For the work "Ultrasensitive detection of autoantibodies to aberrant glycans present in cancer" presented at the 73rd Congress of Chemists.

CAPEK, Peter

1. Ocenenie Predsedníctva SAV 2017 (Eng: SAS Presidium Award 2017)
   Appraiser: Presidium of the SAS
   Description: For a scientific publication with an extremely large number of citations.

DAMBORSKÁ, Dominika

1. Cena Prevedy 2016 (Eng: Award Preveda 2016)
   Appraiser: PREVEDA civic association and BASF Slovakia
   Description: Award to the overall winner VIII. Interactive conference young scientists 2016 in the section Use of instrumental methods in analysis of biologically important substances.
2. Cena Predsedníctva SAV 2017 (Eng: SAS Presidium Award 2017)
   Appraiser: Presidium of the SAS
   Description: For the 1st place in the Competition of Young Scientists of the Slovak Academy of Sciences up to 35 for II. Section SAS.

EBRINGEROVÁ, Anna

1. Ocenenie Predsedníctva SAV 2017 (Eng: SAS Presidium Award 2017)
   Appraiser: Presidium of the SAS
   Description: For a scientific publication with an extremely large number of citations.

FARKAŠ, Pavol

1. Cena SAV za popularizáciu vedy 2016 (Eng: SAS Award for Popularization of Science 2016)
   Appraiser: Presidium of the SAS
   Description: For promoting the importance of science and promoting its development (together with Ing. Miroslav Ferko, PhD.).
2. Cena SAV za popularizáciu vedy 2018 (Eng: SAS Award for Popularization of Science 2018)
   Appraiser: Presidium of the SAS
   Description: For promoting the importance of science and promoting its development, especially for activities related to the organization of the project "Find a scientist in yourself". (as a member of the team: Miroslav Ferko, PhD., Martin Nosko, PhD., Silvia Podhradská, PhD., Alena Šišková, PhD.)

FARKAŠ, Vladimír

1. Cena za vedu a techniku 2018 v kategórii celoživotné zásluhy v oblasti vedy a techniky (Eng: Award for Science and Technology 2018 in the category of lifelong merit in the field of science and technology)
   Appraiser: Ministry of Education, Science, Research and Sport of the Slovak Republic
   Description: For the original results of research into the metabolism of fungal and plant polysaccharides and biological plant protection and their use in practice.
2. Ocenenie významných publikácií 2020 (Eng: Awards for major publications 2020)
   Appraiser: Presidium of the SAS
   Description: For the publication "Mechanisms of redundancy and specificity of the *Aspergillus fumigatus* Crh transglycosylases" published in Nature Communications.
3. Cena Jána Bahýľa 2020 (Eng: Ján Bahýl Award 2020

Appraiser: Industrial Property Office of the Slovak Republic
Description: For exceptional technical or design solutions in the category "Universities and research centers". For patent P288023 "Strains of microorganisms *Trichoderma atroviride* and *Trichoderma harzanium* and a plant protection product containing them" (owner: Institute of Chemistry of the Slovak Academy of Sciences; originator: doc. Ing. Vladimír Farkaš, DrSc., Ing. Marek Nemčovič, PhD., Ing. Lucia Jakubíková, PhD., Valéria Šubíková, CSc., Anton Janitor, PhD., Andrej Kunca, PhD., Roman Leontovyč, PhD.). In practice, the invention is implemented by the Slovak company AZOTER Trading, s. r. o.

GEMEINER, Peter

1. Medaila SAV za podporu vedy 2016 (Eng: SAS Medal for Science Support 2016)
   Appraiser: Scientific Council of Slovak Academy of Sciences
   Description: Nummum Academiae Memorialem Tribuit pro singularibus meritis de studii scientiarum provehendis.

HAKAROVÁ, Marietta

1. Diplom pri príležitosti XI. Interaktívnej konferencie mladých vedcov 2019 (Eng: Diploma on the occasion of XI. Interactive Conference of Young Scientists 2019)
   Appraiser: Civic association PREVEDA
   Description: For an excellent contribution in the section Biotechnology and food technology.

HIRSCH, Ján

1. Významná osobnosť SAV 2019 (Eng: Important personality of SAS 2019)
   Appraiser: Presidium of the SAS
   Description: For the contribution to the SAS credit.

HOLAZOVÁ, Alena

1. Prémia za vedeckú a odbornú literatúru za rok 2017 v kategórii prírodných a technických vied (Eng: Prize for scientific and professional literature for 2017 in the category of natural and technical sciences
   Appraiser: Literary Fund, Section for scientific and professional literature and computer programs
   Description: For the work: Nanobiotechnológie alebo Od lepiacej pásky k medicínskym aplikáciám. (Nanobiotechnologies or From adhesive tape to medical applications.) (team of authors: Ing. Tomáš Bertók, PhD., RNDr. Anikó Bertóková, PhD., Ing. Jaroslav Filip, PhD., RNDr. Alena Holazová, PhD., Ing. Štefan Belický, PhD., RNDr. Peter Kasák, PhD., Ing. Ján Tkáč, DrSc.)

HROMÁDKOVÁ, Zdenka

1. Čestná plaketa SAV Dionýza Štúra za zásluhy v prírodných vedách 2016 (Eng: Honorary Plaque of Dionýz Štúr, SAS for merits in the natural sciences 2016)
   Appraiser: Presidium of the SAS
   Description: For the benefits of polysaccharide and glycomaterial research.

HUSHEGYI, András

1. Cena Predsedníctva SAV 2016 (Eng: SAS Presidium Award 2016)
   Appraiser: Presidium of the SAS
   Description: For 2nd prize in the Competition of Young Scientists of the Slovak Academy of Sciences.

HRONČEKOVÁ, Štefánia

1. Cena Ernesta Šturdíka 2019 (Eng: Ernest Šturdík Award 2019)
   Appraiser: The Slovak Society for Biochemistry and Molecular Biology
   Description: For the best work in biotechnology (Drobnicov Memorial 10th year).
2. Čestné uznanie v Súťaži doktorandov SAV 2021 (Eng: Honorable mention in the Competition of Ph.D. Students of SAS 2021)
   Appraiser: Presidium of the SAS
   Description: Award in the SAS Competition Ph.D. students.
3. Diplom pri príležitosti XIII. Interaktívnej konferencie mladých vedcov 2021 (Eng: Diploma on the occasion of XIII. Interactive Conference of Young Scientists 2021)
   Appraiser: Občianske združenie PREVEDA (Civic association PREVEDA)
   Description: For an excellent contribution in the section Cell Metabolism, Physiology, Molecular Biology and Genetics - Clinical Studies.

CHOCHOLOVÁ, Erika

1. Študentská osobnosť Slovenska za akademický rok 2018/2019 (Eng: Student personality of Slovakia for the academic year 2018/2019)
   Appraiser: Junior Chamber International – Slovakia (JCI)
   Description: Winner in the category "Natural sciences, chemistry" for the academic year 2018/2019.

KALNÍK, Martin

1. Diplom pri príležitosti XII. Interaktívnej konferencie mladých vedcov 2020 (Eng: Diploma on the occasion of XII. Interactive Conference of Young Scientists 2020)
   Appraiser: Civic association PREVEDA
   Description: For an excellent contribution in the section Organic, Bioorganic and Pharmaceutical Chemistry, Pharmacology.

KATRLÍK, Jaroslav

1. Cena Slovenskej akadémie vied za výsledky medzinárodnej vedeckotechnickej spolupráce za rok 2019 (Eng: SAS Prize for the results of international scientific and technical cooperation in 2019)
   Appraiser: Scientific Council of Slovak Academy of Sciences
   Description: The award given to the team of Ing. Jaroslav Katrlík, PhD. composed of: Ing. Peter Baráth, PhD., Ing. Marek Nemčovič, PhD., Mgr. Martina Križáková, PhD., Ing. Zuzana Pakanová, PhD., Ing. Lucia Pažitná, Ing. Kristína Kianičková a MSc. Paras Kundalia for scientific research "Analysis of protein glycoforms as potential biomarkers for medicine and diagnostics of biomarkers".

KIANIČKOVÁ, Kristína

1. Diplom pri príležitosti XII. Interaktívnej konferencie mladých vedcov 2020 (Eng: Diploma on the occasion of XII. Interactive Conference of Young Scientists 2020)
   Appraiser: Civic association PREVEDA
   Description: For an excellent contribution in the section Use of instrumental methods in the analysis of biologically important substances.

KOÓŠ, Miroslav

1. Medaila Daniela Belluša 2017 (Eng: Daniel Belluš Medal 2017)
   Appraiser: Slovak Chemical Society at SAS
   Description: For exceptional merits in the development of chemistry and the Society.
2. Zlatá medaila SAV 2018 (Eng: Gold medal SAS 2018)
   Appraiser: Scientific Council of Slovak Academy of Sciences

Description: For the contribution in the field of organic chemistry as well as for the dimensions of humanity.

KVĚTOŇ, Filip

1. Diplom pri príležitosti X. Interaktívnej konferencie mladých vedcov 2018 (Eng: Diploma on the occasion of X. Interactive Conference of Young Scientists 2018)
   Appraiser: Civic association PREVEDA
   Description: For an excellent contribution in the section Use of instrumental methods in the analysis of biologically important substances.
2. Diplom za 3. miesto v slovenskej súťaži Metrohm Young Chemist Award 2018 (Eng: Diploma for 3rd place in the Slovak competition Metrohm Young Chemist Award 2018)
   Appraiser: Metrohm Slovakia
   Description: For the work "Optimization of the small glycan presentation for binding a tumor-associated antibody: application to the construction of an ultrasensitive glycan biosensor".
3. Diplom: Absolútny víťaz – ročník 2019 (Eng: Diploma: Absolute winner - year 2019)
   Appraiser: Open Academy of SAS, Young Scientists of SAS
   Description: For achieving extraordinary success in the presentation: ”How can sugar save lives and expose major diseases?" at Science Slam SAV: Scientists to the point.
4. Cena Shimadzu 2019 (Eng: Shimadzu Award 2019)
   Appraiser: Shimadzu Slovakia
   Description: For work "Electrochemical detection of tumor-associated antibody 2C4 using a glycan biosensor".
5. Študentská osobnosť Slovenska akad. r. 2019/2020 - 1. miesto v kategórii Lekárske vedy (Eng: Student personality of Slovakia academic year 2019/2020 - 1st place in category the Medical Sciences)
   Appraiser: Junior Chamber International - Slovakia
   Description: For extraordinary results in the field of study as well as scientific research.
6. Cena rektora STU 2020 (Eng: STU Rector's Prize 2020)
   Appraiser: Rector of the Slovak University of Technology in Bratislava
   Description: For excellent fulfillment of study obligations during the entire study of the doctoral study program in biotechnology.

LABANCOVÁ, Eva

1. Cena Pavla Sillingera 2021 (Eng: Pavel Sillinger Award 2021)
   Appraiser: Slovak Botanical Society SAS
   Description: Pavel Sillinger Award for young botanists and plant physiologists up to 30 years – SAS

LORENCOVÁ, Lenka

1. Diplom za 2. miesto v slovenskej súťaži Metrohm Young Chemist Award 2018 (Eng: Diploma for 2nd place in the Slovak competition Metrohm Young Chemist Award 2018)
   Appraiser: Metrohm Slovakia
   Description: For the work Electrochemical performance of Ti3C2TxMXene in aqueous media: towards ultrasensitive H2O2 sensing".
2. Cena dekana Prírodovedeckej fakulty Univerzity Pavla Jozefa Šafárika v Košiciach 2019 (Eng: Dean's Award of the Faculty of Science of the Pavel Jozef Šafárik University in Košice 2019)
   Appraiser: Dean of the Faculty of Science, Pavol Jozef Šafárik University in Košice Description: For the most original contribution of doctoral students and young researchers to the 71st Congress of Czech and Slovak Chemical Companies.

3. Cena za 1. miesto v súťaži mladých vedeckých pracovníkov SAV 2020 (Eng: Prize for 1st place in the competition of young scientists of SAS 2020)
   Appraiser: Presidium of the SAS
   Description: 1st prize in the competition of young scientists of the Slovak Academy of Sciences.

LUX, Alexander

1. Prémia za vedeckú a odbornú literatúru za rok 2017 v kategórii biologické a lekárske vedy (Eng: Prize for scientific and professional literature for 2017 in the category biological and medical sciences)
   Appraiser: Literary Fund, Section for scientific and professional literature and computer programs
   Description: For the work: Embryology of flowering plants. (team of authors: RNDr. Oľga Erdelská, DrSc., Mgr. Renáta Švubová, PhD., RNDr. Lenka Mártonfiová, PhD., prof. RNDr. Alexander Lux, CSc.).
2. Ocenenie Predsedníctva SAV 2017 (Eng: SAS Presidium Award 2017)
   Appraiser: Presidium of the SAS
   Description: For a scientific publication with an extremely large number of citations
3. Pamätná medaila pri príležitosti 100. výročia založenia UK v Bratislave 2019 (Eng: Commemorative medal on the occasion of the 100th anniversary of the founding of Charles University in Bratislava 2019)
   Appraiser: Rector of Comenius University Bratislava
   Description: For the contribution he has made as the leader of a top scientific team.

MASTIHUBA, Vladimír

1. Medaila Slovenskej chemickej spoločnosti pri SAV 2017 (Eng: Medal of the Slovak Chemical Society at SAS 2017)
   Appraiser: Slovak Chemical Society at SAS
   Description: For creative contribution to working in the Company's Board of Directors.

MASTIHUBOVÁ, Mária

1. Čestná plaketa SAV Dionýza Štúra za zásluhy v prírodných vedách 2018 (Eng: Honorary Plaque of SAS Dionýz Štúr for merits in natural sciences 2018)
   Appraiser: Presidium of the SAS
   Description: For the results of research in the field of chemoenzymatic methods in the synthesis of important products.

MUCHA, Ján; PÄTOPRSTÝ, Vladimír

1. Cena SAV za budovanie infraštruktúry pre vedu 2016 (Eng: SAS Award for Building Infrastructure for Science)
   Appraiser: Presidium of the SAS
   Description: For a significant contribution to the acquisition and operation of state-of-the-art instrumentation for studies in the field of glycomics.

PAKANOVÁ, Zuzana

1. Cena Shimadzu za rok 2017 (Eng: Shimadzu Award 2017)
   Appraiser: Shimadzu in cooperation with Slovak Chemical Society at SAS
   Description: Prize awarded in the field of Analytical Chemistry. 1st place is associated with a financial reward of 2000 €.
2. Cena za najlepšiu publikáciu Slovenskej fyziologickej spoločnosti za rok 2017 (Award for the best publication of the Slovak Physiological Society in 2017)
   Appraiser: Slovak Physiological Society

Description: Award for publication: MAJZÚNOVÁ, Miroslava - PAKANOVÁ, Zuzana - KVASNIČKA, Peter - BALIŠ, Peter - ČAČÁNYIOVÁ, Soňa - DOVINOVÁ, Ima. Age-dependent redox status in the brain stem of NO-deficient hypertensive rats. In Journal of Biomedical Science, 2017, vol. 24, article 72.

PAULOVIČOVÁ, Ema

1. Bronzová medaila SLS 2017 (Eng: Bronze medal of Slovak Medical Association 2017)
   Appraiser: Slovak Medical Association
   Description: For services to the Slovak Medical Society.
2. Čestná plaketa SAV za zásluhy v biologických vedách 2018 (Eng: Honorary Plaque of the SAS for Merit in Biological Sciences 2018)
   Appraiser: Presidium of the SAS
   Description: For professional and pedagogical work in the immunochemistry of glycoconjugates and scientific work in the field of immunobiological

PAŽITNÁ, Lucia

1. Cena Prevedy (Eng: Award Preveda)
   Appraiser: Civic association PREVEDA and BASF Slovakia 2021
   Description: For the best contribution XIII. Interactive Conference of Young Scientists 2021.

PETRUŠ, Ladislav

1. Bronzová medaila Prírodovedeckej fakulty UPJŠ 2018 (Eng: Bronze medal of the Faculty of Science Pavol Jozef Šafárik University in Košice 2018)
   Appraiser: Scientific Board of the Faculty of Science, Pavol Jozef Šafárik University in Košice
   Description: For a contribution to the development of the faculty.
2. Významná osobnosť SAV 2020 (Eng: Important personality of SAS 2020)
   Appraiser: Presidium of the SAS
   Description: For the contribution to the credit of SAS.

PINKOVÁ GAJDOŠOVÁ, Veronika

1. Cena dekana PriF UK pre študentov doktorandského štúdia za rok 2020 v kategórii Biologické vedy (Eng: Dean's Award of the Faculty of Science, Comenius University Bratislava for doctoral students 2020 in the category of Biological Sciences)
   Appraiser: Dean of the Faculty of Science, Comenius University in Bratislava
   Description: For excellent published scientific results that significantly contribute to building a prestigious reputation for doctoral studies at the Faculty of Science, Comenius University in Bratislava.
2. Cena v Súťaži doktorandov SAV 2021 (Eng: 2nd prize in the Competition of Ph.D. Students of SAS 2021)
   Appraiser: Presidium of the SAS
   Description: Award in the SAS Competition Ph.D. students.

SASINKOVÁ, Vlasta

1. Cena SAV v oblasti medzinárodnej vedecko-technickej spolupráce 2016 (Eng: SAS Award in the field of international scientific and technical cooperation 2016)
   Appraiser: Presidium of the SAS
   Description: For the first discovery of diamond and moissanite (SiC) in the southeastern Alps (awarded as a co-researcher in the team of RNDr. Marián Janák, DrSc.).
2. Ocenenie Predsedníctva SAV 2017 (Eng: Presidium SAS Award 2017)

Appraiser: Presidium of the SAS
Description: For a scientific publication with an extremely large number of citations.

SIVÁKOVÁ, Barbara

1. Diplom pri príležitosti XIII. Interaktívnej konferencie mladých vedcov 2021 (Eng: Diploma on the occasion of XIII. Interactive Conference of Young Scientists 2021)
   Appraiser: Civic association PREVEDA
   Description: For an excellent post in the section "Omiky"

SLÁDEK, Vladimír

1. Cena Predsedníctva SAV 2018 (Eng: SAS Presidium Award 2018)
   Appraiser: Presidium of the SAS
   Description: For the 2nd place in the Competition of Young Scientists of the Slovak Academy of Sciences up to 35 years for Scientific section 2 of SAS

SPIŠÁKOVÁ, Mária

1. Diplom - v sekcii Organická, bioorganická, farmaceutická chémia, farmakológia a toxikológia 2016 (Eng: Diploma - in the section Organic, Bioorganic, Pharmaceutical Chemistry, Pharmacology and Toxicology 2016)
   Appraiser: Civic association PREVEDA
   Description: Valuation of the contribution to VIII. Interactive Young Scientists Conference 2016

TKÁČ, Ján

1. Vedec roka SR (Eng: Scientist of the Year SR)
   Appraiser: Slovak Centre of Scientific and Technical Information SR, Slovak Academy of Sciences and Association of Slovak Scientific and Technological Societies
   Description: For the results of research that can be described as "Scientific deed of the year" (19th year of the competition - award for 2015).
2. Ocenenie Predsedníctva SAV 2018 (Eng: Presidium SAS Award 2018)
   Appraiser: Presidium of the SAS
   Description: For a joint Slovak - Czech publication in an international scientific journal with the highest impact factor according to the WOS database.
3. Cena za vedu a techniku 2018 v kategórii "Vedecko-technický tím roka" (Eng: Award for Science and Technology 2018 in the category "Science and Technology Team of the Year")
   Appraiser: Ministry of Education, Science, Research and Sport of the Slovak Republic
   Description: For scientific research, publishing, business and popularization activities in the field of nanostructured (bio) sensor technologies and medical diagnostics.
4. Prémia za vedeckú a odbornú literatúru za rok 2017 v kategórii prírodných a technických vied (Eng: Prize for scientific and professional literature for 2017 in the category of natural and technical sciences)
   Appraiser: Literary Fund, Section for scientific and professional literature and computer programs
   Description: For the work: "Nanobiotechnológie alebo Od lepiacej pásky k medicínskym aplikáciám" (Eng: Nanobiotechnologies or From adhesive tape to medical applications). (team of authors: Ing. Tomáš Bertók, PhD., RNDr. Anikó Bertóková, PhD., Ing. Jaroslav Filip, PhD., RNDr. Alena Holazová, PhD., Ing. Štefan Belický, PhD., RNDr. Peter Kasák, PhD., Ing. Ján Tkáč, DrSc.)
5. Cena SAV 2019 (Eng: SAS Award 2019)

Appraiser: Scientific Council of SAS 2019
Description: The team led by Ing. Ján Tkáč, DrSc.v composition: Ing. Alica Vikartovská, PhD., Mgr. Jana Blahutová, PhD., Ing. Tomáš Bertók, PhD., RNDr. Lenka Lorencova, PhD., RNDr. Alena Holazová, PhD., Ing. Michal Híreš, PhD., RNDr. Eduard Jáné, PhD., Mgr. Erika Chocholová, Ing. Filip Květoň, Ing. Anna Blšáková, Ing. Štefánia Hrončeková and Mgr. Veronika Gajdošová for scientific research work, innovative bioanalytical methods for medical diagnostics of selected diseases, based on glycan analysis and the use of nanotechnologies

6. ESET Science Award, laureát kategórie Výnimočná osobnosť slovenskej vedy za rok 2019 (Eng: ESET Science Award, laureate of the category Outstanding individual contributor to Slovak science in 2019)
   Appraiser: ESET Foundation
   Description: For research on early diagnosis of prostate cancer. The winner was selected by an international commission based on a demanding evaluation process
7. Ocenenie významných publikácií 2020 (Eng: Awards for major publications 2020)
   Appraiser: Presidium of the SAS
   Description: For the publication "Polyzwitterionic hydrogels in engines based on the antipolyelectrolyte effect and driven by the salinity gradient" published in Environmental Science & Technology.

TVAROŠKA, Igor

1. Významná osobnosť SAV 2019 (Eng: Important personality of SAS 2019)
   Appraiser: Presidium of the SAS
   Description: For the contribution to the credit of SAS.

ZÁMOROVÁ, Martina

1. Diplom v súťaži 10 rokov s Prevedou – podporujeme tímových hráčov! 2016 (Eng: Diploma in the competition of 10 years with PREVEDA – we support team players! 2016)
   Appraiser: Civic association PREVEDA
   Description: For contribution in the section Cell metabolism, physiology, molecular biology and genetics (clinical studies) on VIII. Interactive Young Scientists Conference 2016.

2.4. Research grants and other funding resources

(List type of project, title, grant number, duration, total funding and funding for the institute, responsible person in the institute and his/her status in the project, e.g. coordinator "C", work package leader "W", investigator "I". Add information on the projects which are interdisciplinary, and also on the joint projects with several participating SAS institutes)

- ### International projects

2.4.1. List of major projects of Framework Programmes of the EU (which pilar), NATO, COST, etc.

Interinstitutional agreement
2016
Project title: O-Specific polysaccharide responses and cholera
Type / Project number: 5R01AI106878-02
Duration: 10/2014-03/2019
Total funding (EUR): 12 181

Funding for the IC (Institute of Chemistry) (EUR): 12 181
Role of the Institute / Responsible person: I/ Slavomír Bystrický

2018
Project title: Isolation of recalcitrant acetylxylan structures and enzymes of their hydrolysis
Type / Project number: -
Duration: 12/2017 – 12/2020
Total funding (EUR): 0
Funding for the IC (EUR): 0
Role of the Institute / Responsible person: I/ Peter Biely

Project title: Comparison of the yields of AcGX from different beechwood sources (*Fagus sylvatica*)
Type / Project number: -
Duration: 07/2018 – 06/2019
Total funding (EUR): 0
Funding for the IC (EUR): 0
Role of the Institute / Responsible person: I/ Peter Capek

Intergovernmental agreements
2016
Project title: Determination of glycosylation changes of proteins related to colorectal carcinoma using modern sensitive lectin biochips with impact to cancer research, diagnostics and therapy
Type / Project number: APVV-SK-SRB-2013-0028
Duration: 01/2016 – 12/2017
Total funding (EUR): 4 860
Funding for the IC (EUR): 4 860
Role of the Institute / Responsible person: C/ Jaroslav Katrlík

Project title: Production of biosurfactants by cloud microorganisms: Impact on cloud microphysics and application in biotechnology
Type / Project number: SK-FR-2015-0020
Duration: 01/2016 – 12/2017
Total funding (EUR): 5 300
Funding for the IC (EUR): 5 300
Role of the Institute / Responsible person: C/ Mária Matulová

2017
Project title: Glycan biomarkers analysis as a tool for biomedicinal research, follow-up and diagnosis of tumor diseases
Type / Project number: SK-SRB-2016-0023
Duration: 01/2017 – 12/2018
Total funding (EUR): 4 700
Funding for the IC (EUR): 4 700
Role of the Institute / Responsible person: C/ Jaroslav Katrlík

2018
Project title: Development of bioanalytical systems based on novel lectins with enhanced specificity for application in diagnostics
Type / Project number: SK-KR-18-0004
Duration: 09/2018 – 12/2019
Total funding (EUR): 8 000
Funding for the IC (EUR): 8 000
Role of the Institute / Responsible person: C/ Jaroslav Katrlík

2019

Project title: Analysis of transferrin glycoforms as potentially strong biomarkers in medicine
Type / Project number: SK-SRB-18-0028
Duration: 02/2019 – 12/2021
Total funding (EUR): 4 700
Funding for the IC (EUR): 4 700
Role of the Institute / Responsible person: C**/** Jaroslav Katrlík

2020
Project title: Analysis of nucleic acids, proteins and metabolites as potential circulating biomarkers of pregnancy diabetes
Type / Project number: DS-FR-19-0034
Duration: 03/2020 – 12/2022
Total funding (EUR): 10.000
Funding for the IC (EUR): 10.000
Role of the Institute / Responsible person: C**/** Jaroslav Katrlík

COST
2016
Project title: European network to advance carotenoid research and applications in agro-food and health (EUROCAROTEN)
Type / Project number: CMST COST Action CA15136
Duration: 04/2016 – 04/2020
Total funding (EUR): 15 199
Funding for the IC (EUR): 15 199
Role of the Institute / Responsible person: I**/** Emília Breierová, Hana Schusterová

Project title: Colloidal aspects of nanoscience for innovative processes and materials)
Type / Project number: CMST COST Action CM1101
Duration: 06/2011 – 01/2016
Total funding (EUR): 14 933
Funding for the IC (EUR): 14 933
Role of the Institute / Responsible person: I**/** Peter Gemeiner

Project title: Food waste valorisation for sustainable chemicals, materials & fuels (EUBis)
Type / Project number: FA COST Action TD1203
Duration: 11/2012 – 11/2016
Total funding (EUR): 15 875
Funding for the IC (EUR): 15 875
Role of the Institute / Responsible person: I**/** Zdenka Hromádková

Project title: Valorisation of lignocellulosic biomass side streams for sustainable production of chemicals, materials & fuels using low environmental impact technologies
Type / Project number: FPS COST Action FP1306
Duration: 05/2014 – 05/2018
Total funding (EUR): 12 349
Funding for the IC (EUR): 12 349
Role of the Institute / Responsible person: I**/** Vladimír Mastihuba

Project title: Challenging organic syntheses inspired by nature – from natural products chemistry to drug discovery
Type / Project number: CMST COST Action CM1407
Duration: 03/2015 – 03/2019
Total funding (EUR): 15 246
Funding for the IC (EUR): 15 246

Role of the Institute / Responsible person: I/ Mária Mastihubová

Project title: Systems biocatalysis
Type / Project number: CMST COST Action CM1303
Duration: 11/2013 – 11/2017
Total funding (EUR): 15 055
Funding for the IC (EUR): 15 055
Role of the Institute / Responsible person: I/ Jozef Nahálka

Project title: Chemical approaches to targeting drug resistance in cancer stem cells
Type / Project number: CMST COST Action CM1106
Duration: 03/2012 – 03/2016
Total funding (EUR): 15 875
Funding for the IC (EUR): 15 875
Role of the Institute / Responsible person: I/ Igor Tvaroška

2017
Project title: European Network of Vaccine Adjuvants
Type / Project number: CA COST Action CA16231
Duration: 11/2017 – 11/2021
Total funding (EUR): 14 348
Funding for the IC (EUR): 14 348
Role of the Institute / Responsible person: I/ Pavol Farkaš

Project title: CliniMARK: 'good biomarker practice' to increase the number of clinically validated biomarkers
Type / Project number: CA COST Action CA16113
Duration: 03/2017 – 03/2021
Total funding (EUR): 15 060
Funding for the IC (EUR): 15 060
Role of the Institute / Responsible person: I/ Jaroslav Katrlík

2018
Project title: Functional glyconanomaterials for the development of diagnostics and targeted therapeutic probes (GLYCONanoPROBES)
Type / Project number: CA COST Action CA18132
Duration: 12/2018 – 11/2022
Total funding (EUR): 7833
Funding for the IC (EUR): 7 833
Role of the Institute / Responsible person: I/ Jaroslav Katrlík

Project title: Establishment of a Pan-European network on the sustainable valorisation of lignin
Type / Project number: CA COST Action CA17128
Duration: 10/2018 – 10/2022
Total funding (EUR): 11 862
Funding for the IC (EUR): 11 862
Role of the Institute / Responsible person: I/ Vladimír Mastihuba

2019
Project title: European transdisciplinary networking platform for marine biotechnology (Ocean4Biotech)
Type / Project number: COST Action CA18238
Duration: 10/2019 – 10/2023
Total funding (EUR): 7 752
Funding for the IC (EUR): 7 752
Role of the Institute / Responsible person: I/ Peter Capek

Project title: Innovation with Glycans: new frontiers from synthesis to new biological targets
Type / Project number: COST Action CA18103
Duration: 04/2019 – 04/2023
Total funding (EUR): 19 065
Funding for the IC (EUR): 19 065
Role of the Institute / Responsible person: I/ Miloš Hricovíni

Project title: Functional glyconanomaterials for the development of diagnostics and targeted therapeutic probes (GLYCONanoPROBES)
Type / Project number: COST Action CA18132
Duration: 03/2019 – 03/2023
Total funding (EUR): 7 327
Funding for the IC (EUR): 7327
Role of the Institute / Responsible person: I/ Jaroslav Katrlík

Project title: SOURDOugh biotechnology network towards novel, healthier and sustainable food and bIoproCesseS
Type / Project number: COST Action CA18101
Duration: 04/2019 – 04/2023
Total funding (EUR): 6 568
Funding for the IC (EUR): 6 568
Role of the Institute / Responsible person: I/ Zuzana Košťálová

Project title: Green Chemical Engineering Network towards upscaling sustainable processes (GREENERING)
Type / Project number: COST Action CA18224
Duration: 10/2019 – 10/2023
Total funding (EUR): 16 401
Funding for the IC (EUR): 16 401
Role of the Institute / Responsible person: I/ Mária Mastihubová

Project title: Non-conventional yeasts for the production of bioproducts (YEAST4BIO)
Type / Project number: COST Action CA18229
Duration: 11/2019 – 11/2023
Total funding (EUR): 6 883
Funding for the IC (EUR): 6 883
Role of the Institute / Responsible person: I/ Katarína Šuchová

7RP
2016
Project title: Study of reaction mechanism of glycosyl transferases using ab initio molecular dynamics as a tool for design of inhibitors
Type / Project number: SASPRO 0005/01/02
Duration: 07/2015 – 06/2018
Total funding (EUR): 191 199
Funding for the IC (EUR): 191 199
Role of the Institute / Responsible person: C/ Stanislav Kozmon

Project title: Nanostructured hybrid organic-inorganic solar cells
Type / Project number: KONNECT 007
Duration: 09/2016 – 08/2018
Total funding (EUR): 50 000
Funding for the IC (EUR): 50 000
Role of the Institute / Responsible person: C/ Júlia Mičová

Project title: Cancer diagnosis: Parallel sensing of prostate cancer biomarkers

Type / Project number: FP7-317420
Duration: 10/2012 – 09/2016
Total funding (EUR): 4 006 853
Funding for the IC (EUR): 261 862
Role of the Institute / Responsible person: I/ Ján Tkáč

Project title: Electrochemical LEctin and glycan biochips integrated with NAnostructures
Type / Project number: FP7-311532
Duration: 01/2013 – 12/2017
Total funding (EUR): 1 155 970
Funding for the IC (EUR): 1 155 970
Role of the Institute / Responsible person: C/ Ján Tkáč

Other
2016
Qatar National Research Fund
Project title: Preparation, characterisation and application of lectin biochips in cancer diagnosis and in discovery of cancer biomarkers
Type / Project number: NPRP 6-381-1-078
Duration: 01/2014 – 12/2016
Total funding (USD): 353 740
Funding for the IC (USD): 354 740
Role of the Institute / Responsible person: I/ Ján Tkáč

2017
Horizont 2020
Project title: Releasing the full potential of Instruct to expand and consolidate infrastructure services for integrated structural life science research
Type / Project number: Grant agreement No 731005
Duration: 01/2017 – 12/2020
Total funding (EUR): 3 950 000
Funding for the IC (EUR): 100 000
Role of the Institute / Responsible person: I/ Miloš Hricovíni

2018
Project title: A Novel Detection protocols for REliable prostate cancer assays
Type / Project number: ERC PoC grant agreement ID: 825586
Duration: 12/2018 – 05/2020
Total funding (EUR): 149 500
Funding for the IC (EUR): 87 500
Role of the Institute / Responsible person: C/ Ján Tkáč

Horizont 2020
Project title: Synthetic biology of carbohydrate-binding proteins: engeneering protein-carbohydrate interactions for diagnostics and cell targeting
Type / Project number: MSCA-ITN-ITN grant agreement ID: 814029
Duration: 10/2018 – 09/2022
Total funding (EUR): 4 093 660
Funding for the IC (EUR): 419 934
Role of the Institute / Responsible person: I/ Ján Tkáč

Bilateral
2021
Project title: Mode of action of novel types of xylanolytic enzymes and their role in hydrolysis of recalcitrant structures in plant xylans
Type / Project number:

Duration: 05/2021 – 04/2022
Total funding (EUR): 10 000
Funding for the IC (EUR): 10 000
Role of the Institute / Responsible person: C/ Peter Biely

Project title: O-Specific polysaccharide responses and cholera.
Type / Project number: 5R37AI106878-07
Duration: 04/2021 – 03/2022
Total funding (EUR): 4 150
Funding for the IC (EUR): 4 150
Role of the Institute / Responsible person: I/ Slavomír Bystrický

Mobility:
Project title: Synthesis of transition metal oxide nanoparticles, their plasma treatment and study of photoelectrical and photocatalytic properties
Type / Project number: SAV-AV ČR-21-09
Duration: 01/2021 – 12/2022
Total funding (EUR): 3 000
Funding for the IC (EUR): 3 000
Role of the Institute / Responsible person: C/ Júlia Mičová

Add information on your activities in international networks

- **National projects, incl. international projects with only national funding**

2.4.2. List of ERA-NET projects funded from SAS budget

2.4.3. List of projects of the Slovak Research and Development Agency, APVV

2016
Project title: Study of regulation of radical and cellular signaling during hypertension and influence of novel therapies on this signaling
Type / Project number: APVV-0348-12
Duration: 10/2013 – 09/2017
Total funding (EUR): 118 600
Funding for the IC (EUR): 19 600
Role of the Institute / Responsible person: I/ Jozef Nahálka
Participating SAS institute: Institute of Normal and Pathological Physiology SAS

Project title: Immobilized recombinant microorganisms forthe biotechnological production of chemical specialties using biocatalytic cascade reactions
Type / Project number: APVV-15-0227
Duration: 07/2016 – 06/2020
Total funding (EUR): 249 509
Funding for the IC (EUR): 107 192
Role of the Institute / Responsible person: C/ Marek Bučko
Participating SAS institute: Polymer Institute SAS

Project title: New opinions on pharmacological modulation of allergic asthma
Type / Project number: APVV-0305-12
Duration: 10/2013 – 09/2017
Total funding (EUR): 195 536
Funding for the IC (EUR): 43 700

Role of the Institute / Responsible person: I**/** Peter Capek

Project title: Research and development of silicon carbide thin film technologies for applications in solar cells and thin film devices
Type / Project number: APVV-0443-12
Duration: 10/2013 – 12/2016
Total funding (EUR): 248 106
Funding for the IC (EUR): 16 385
Role of the Institute / Responsible person: I**/** Vlasta Sasinková
Participating SAS institute: Polymer Institute SAS

Project title: Biochips and biosensors for glycorecognition, their development, preparation and application in cancer research
Type / Project number: APVV-14-0753
Duration: 07/2015 – 06/2019
Total funding (EUR): 250 000
Funding for the IC (EUR): 172 000
Role of the Institute / Responsible person: C**/** Jaroslav Katrlík

Project title: Synthetic biology for the production of new biologically active compounds in streptomycetes
Type / Project number: APVV-15-0410
Duration: 07/2016 – 06/2020
Total funding (EUR): 199 544
Funding for the IC (EUR): 39 987
Role of the Institute / Responsible person: I/ Mária Matulová

Project title: Post-translation modifications in mitochondria and their role in pathological processes
Type / Project number: APVV-15-0375
Duration: 07/2016 – 06/2020
Total funding (EUR): 246 000
Funding for the IC (EUR): 86 000
Role of the Institute / Responsible person: I/ Ján Mucha

Project title: Preparation of model subcellular vaccine from mannooligomer structures of Candida albicans yeast
Type / Project number: APVV-15-0161
Duration: 07/2016 – 06/2020
Total funding (EUR): 195 000
Funding for the IC (EUR): 195 000
Role of the Institute / Responsible person: C/ Eva Machová, Pavol Farkaš

Project title: Developing new theoretical tools for prediction and interpretation of EPR and NMR parameters
Type / Project number: APVV-15-0726
Duration: 07/2016 – 06/2020
Total funding (EUR): 178 800
Funding for the IC (EUR): 18 000
Role of the Institute / Responsible person: I/ Miloš Hricovíni

Project title: Chemoenzymatic synthesis and evaluation of biological activities of natural glycophenolics and their analogues
Type / Project number: APVV-0846-12
Duration: 10/2013 – 09/2017
Total funding (EUR): 173 500
Funding for the IC (EUR): 90 100
Role of the Institute / Responsible person: C/ Mária Mastihubová

Participating SAS institute: Cancer Research Institute SAS, Institute for Heart Research SAS

Project title: Structural design, synthesis and evaluation of selective inhibitors of glycoside hydrolases from the family 38
Type / Project number: APVV-0484-12
Duration: 10/2013 – 09/2017
Total funding (EUR): 192 528
Funding for the IC (EUR): 170 155
Role of the Institute / Responsible person: C/ Monika Poláková

Project title: Structure, properties and biotechnological potential of novel microbial enzymes degrading plant biomass
Type / Project number: APVV-0602-12
Duration: 10/2013 – 09/2017
Total funding (EUR): 168 300
Funding for the IC (EUR): 109 550
Role of the Institute / Responsible person: C/ Vladimír Puchart
Participating SAS institute: Institute of Molecular Biology SAS

Project title: Possible dual function of P-glycoprotein in leukemia cells: efflux pump and regulatory protein
Type / Project number: APVV-14-0334
Duration: 07/2015 – 10/2018
Total funding (EUR): 294 950
Funding for the IC (EUR): 19 000
Role of the Institute / Responsible person: I/ Jaroslav Katrlík
Participating SAS institute: Institute of Experimental Endocrinology SAS, Institute for Heart Research SAS

Project title: Culture Collection of Yeasts as a biobank for future generations
Type / Project number: APVV-15-0744
Duration: 07/2016 – 06/2020
Total funding (EUR): 127 587
Funding for the IC (EUR): 127 587
Role of the Institute / Responsible person: C/ Renáta Vadkertiová

2017
Project title: P Regulation of pericellular proteolysis: From molecular mechanisms to novel immune cell subsets and therapeutic tools
Type / Project number: APVV-16-0452
Duration: 07/2017 – 06/2021
Total funding (EUR): 193 000
Funding for the IC (EUR): 86 000
Role of the Institute / Responsible person: I/ Peter Baráth

2018
Project title: Computational design, synthesis, testing and disposition of inhibitors of neuraminidases of influenza A virus as potential antiviral compounds
Type / Project number: APVV-17-0239
Duration: 07/2018 – 06/2022
Total funding (EUR): 220 000
Funding for the IC (EUR): 41 249
Role of the Institute / Responsible person: I/ Jaroslav Katrlík

Project title: Potential of silicon for mitigation of arsenic and antimony toxicity in agricultural crops
Type / Project number: APVV-17-0164

Duration: 07/2018 – 06/2022
Total funding (EUR): 250 000
Funding for the IC (EUR): 40 000
Role of the Institute / Responsible person: I/ Karin Kollárová
Participating SAS institute: Plant Science and Biodiversity Center SAS

Project title: Glycan bionanosensors and bioanalytical devices - their construction, validation and application for cancer diagnostics
Type / Project number: APVV-17-0300
Duration: 07/2018 – 06/2022
Total funding (EUR): 249 803
Funding for the IC (EUR): 225 788
Role of the Institute / Responsible person: C/ Ján Tkáč
Participating SAS institute: Polymer Institute SAS

Project title: Novel Detection protocols for REliable prostate cancer assays
Type / Project number: PP-H2020-18-0043
Duration: 11/2018 – 12/2018
Total funding (EUR): 2 000
Funding for the IC (EUR): 2 000
Role of the Institute / Responsible person: C/ Ján Tkáč

Project title: PROgnosis of Cancer via Efficient Screening Strategies
Type / Project number: PP-H2020-18-0042
Duration: 11/2018 – 12/2018
Total funding (EUR): 2 000
Funding for the IC (EUR): 2 000
Role of the Institute / Responsible person: C/ Ján Tkáč

Project title: Synthetic biology of carbohydrate-binding proteins: engeneering protein-carbohydrate interactions for diagnostics and cell targeting
Type / Project number: PP-H2020-18-0041
Duration: 11/2018 – 12/2018
Total funding (EUR): 2 000
Funding for the IC (EUR): 2 000
Role of the Institute / Responsible person: C/ Ján Tkáč

2019
Project title*:* Protein Dbl2 as a novel regulator of genome stability and dynamics in fission yeast
Type / Project number: APVV-18-0219
Duration: 07/2019 – 06/2023
Total funding (EUR): 230 000
Funding for the IC (EUR): 37 801
Role of the Institute / Responsible person: I/ Peter Baráth
Participating SAS institute: Institute of Animal Biochemistry and Genetics CBs SAS, Cancer Research Institute BMC SAS

Project title*:* Support for young researchers in the form of reimbursement of eligible costs incurred in 2019
Type / Project number: MVP-2019-0044
Duration: 11/2019 - 12/2019
Total funding (EUR): 4 357
Funding for the IC (EUR): 4 357
Role of the Institute / Responsible person: C/ Tomáš Bertók

Project title*:* Co-transcriptional folding of pre-mRNA, model of structural motifs required for exon definition

Type / Project number: APVV-18-0096
Duration: 07/2019 – 06/2023
Total funding (EUR): 178 954
Funding for the IC (EUR): 45 024
Role of the Institute / Responsible person: I/ Peter Baráth

Project title*:* Support for young researchers in the form of reimbursement of eligible costs incurred in 2019
Type / Project number: MVP-2019-0043
Duration: 11/2019 - 12/2019
Total funding (EUR): 4 738
Funding for the IC (EUR): 4 738
Role of the Institute / Responsible person: C/ Lenka Lorencová

Project title*:* Chemoenzymatic synthesis of substances with pharmaceutical potential: Optimization of processes of phenylethanoid glycosides production
Type / Project number: APVV-18-0188
Duration: 07/2019 – 06/2023
Total funding (EUR): 249 980
Funding for the IC (EUR): 126 615
Role of the Institute / Responsible person: C/ Vladimír Mastihuba

Project title*:* Production of bacterial inclusion bodies for biocatalysis and biomedicine (BIB-scale up)
Type / Project number: APVV-18-0361
Duration: 07/2019 – 06/2023
Total funding (EUR): 113 563
Funding for the IC (EUR): 113 563
Role of the Institute / Responsible person: C/ Jozef Nahálka

Project title*:* Innovative approaches in toxicology of ageing
Type / Project number: APVV-18-0336
Duration: 07/2019 – 06/2023
Total funding (EUR): 248 432
Funding for the IC (EUR): 101 288
Role of the Institute / Responsible person: I/ Peter Baráth

2020
Project title*:* Analysis of causes of death of patients and optimization of differential diagnosis in connection with SARS-CoV-2 infection in the Slovak Republic
Type / Project number: PP-COVID-20-0051
Duration: 09/2020 – 12/2021
Total funding (EUR): 399 490
Funding for the IC (EUR): 49 562
Role of the Institute / Responsible person: I/ Jaroslav Katrlík

Project title*:* New antiviral drugs: Design, synthesis and activity evaluation of specific inhibitors of viral proteases of coronavirus SARS-CoV-2
Type / Project number: PP-COVID-20-0010
Duration: 09/2020 – 12/2021
Total funding (EUR): 396 841
Funding for the IC (EUR): 56 006
Role of the Institute / Responsible person: I/ Jaroslav Katrlík

Project title*:* Preparation of new antibiotics and antitumor agents by manipulations of secondary metabolite genes and synthetic biology methods
Type / Project number: APVV-19-0009
Duration: 07/2020 – 06/2024

Total funding (EUR): 200 000
Funding for the IC (EUR): 34 086
Role of the Institute / Responsible person: I/ Mária Matulová

Project title*:* Interaction between proteases, chaperones and kinases in stress condition cause by pathological conditions
Type / Project number: APVV-19-0298
Duration: 07/2020 – 06/2024
Total funding (EUR): 244 000
Funding for the IC (EUR): 84 000
Role of the Institute / Responsible person: I/ Peter Baráth
Participating SAS institute: Institute of Molecular Biology SAS

Project title*:* Multidrug resistance of leukemia cells - Phenotype caused by interference of multimodal molecular reasons
Type / Project number: APVV-19-0093
Duration: 07/2020 – 06/2024
Total funding (EUR): 230 000
Funding for the IC (EUR): 15 300
Role of the Institute / Responsible person: I/ Jaroslav Katrlík
Participating SAS institute: Institute of Molecular Physiology and Genetics SAS, Institute of Experimental Endocrinology SAS

2021
Project title*:* Chronic ionizing radiation compromises resistance to pests in wild aquatic plants: Discovery and validation of biochemical mechanisms
Type / Project number: APVV-20-0545
Duration: 08/2021 – 06/2025
Total funding (EUR): 196 000
Funding for the IC (EUR): 48 000
Role of the Institute / Responsible person: I/ Peter Baráth
Participating SAS institute: Plant Science and Biodiversity Center SAS

Project title*:* Immobilization and co-immobilization of viable whole-cell biocatalysts with enzyme cascades for production of chemical specialties, development of methods for their characterization and bioreactor engineering
Type / Project number: APVV-20-0272
Duration: 08/2021 – 06/2025
Total funding (EUR): 236 712
Funding for the IC (EUR): 0
Role of the Institute / Responsible person: C/ Marek Bučko
Participating SAS institute: Polymer Institute SAS

Project title*:* Calibration of the authigenic10Be/9Be dating method for geochronological models of the latest Cenozoic of the Carpathian- Pannonian region
Type / Project number: APVV-20-0120
Duration: 08/2021 – 06/2025
Total funding (EUR): 250 000
Funding for the IC (EUR): 40 000
Role of the Institute / Responsible person: I/ Andrej Chyba

Project title*:* Biochip systems for targeted glycan analysis of biomarkers for biomedical and biotechnological applications
Type / Project number: APVV-20-0243
Duration: 08/2021 – 06/2025
Total funding (EUR): 220 000
Funding for the IC (EUR): 0
Role of the Institute / Responsible person: C/ Jaroslav Katrlík

Participating SAS institute: Institute of Molecular Physiology and Genetics SAS**,** Institute of Virology, Biomedical Reasearch center SAS

Project title*:* Computer-aided design of novel antituberculosis compounds and their experimental evaluation
Type / Project number: APVV-20-0230
Duration: 08/2021 – 06/2025
Total funding (EUR): 176 616
Funding for the IC (EUR): 0
Role of the Institute / Responsible person: C/ Stanislav Kozmon

Project title*:* Microbial enzymes degrading complex structures of plant xylans
Type / Project number: APVV-20-0591
Duration: 08/2021 – 06/2025
Total funding (EUR): 236 810
Funding for the IC (EUR): 236 810
Role of the Institute / Responsible person: C/ Vladimír Puchart

2.4.4. List of projects of the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education, VEGA (for funding specify only total sum obtained from all VEGA grants in particular year)

2016 Funding: 173 286 EUR

1. Investigation of the stability of potential inhibitors of human glycosyltransferases
2. Development of novel immobilized biocatalysts utilizing recombinant microorganisms for biocatalytic cascade reactions
3. Biopolymers of microalgae, production, structural diversity and properties
4. Study of protective potential of synthesized phenylethanoid glycosides in the systems of mammalian cells and plasmid DNA
5. Study of structure and properties of biologically active saccharides using methods of NMR spectroscopy and theoretical chemistry
6. Bioactive polysaccharides from non-utilized plants and plant wastes: structural and functional diversity
7. Development of lectin, protein and glycan biochips using modern technologies and nanotechnologies for applications in biology, biomedicine and for biomarkers detection
8. Investigation of honeybee larval jelly antimicrobial potential to bee brood pathogens
9. Galactoglucomannan oligosaccharides signaling in plant growth processes and their protective potential against toxic metals
10. Preparation of subcellular vaccines from oligomannoside epitopes of *Candida albicans* yeast and their immunomodulation properties
11. Antibacterial and immunomodulatory properties of bee defensin-1 in chronic wound healing process
12. Synthetic potential of marginal glycosidases
13. NMR study of biosurfactants produced by bacteria isolated from cloud water and arctic snow
14. Structural analysis of N-linked oligosaccharides in special diagnostics of congenital metabolic disorders of glycosylation
15. Novel technology for synthesis of sialo and a-Gal derivatives needed for development of vaccines, antibiotics and humanized plastics
16. Structural design, synthesis and evaluation of selective inhibitors of glycoside hydrolases from the family 38
17. Microbial enzymes for plant hemicellulose utilization

18. Multi-scale modelling of transition metal interactions with heterocyclic and sugar-like compounds
19. Structure, function and mechanism of action of plant and fungal transglycosylases
20. The diversity, properties and activities of soil yeasts

2017 Funding: 160 548 EUR

1. Identification and characterization of *V. cholerae* isolates from rivers, dams and thermal waters in Slovakia
2. Functional carbohydrates from plant waste as a potential food supplement: extraction, characterization and therapeutic potentials
3. Enzymatic production of economically valuable oligosaccharides and opiates
4. Immunological effectivity of new synthetic immunogens mimicking fungal pathogen associated molecular patterns in prospective design of subcellular anti-fungal vaccine formulae
5. Redox homeostasis, proteostasis and inflammation as potential targets for influencing ageing and age-related diseases: Modulation by the compounds of natural and synthetic origin
6. Structural and functional adaptations of selected extremophiles and agricultural crops to abiotic stressors

2018 Funding: 180 397 EUR

1. Polysaccharides of lower and higher plants
2. Role of protein kinases in processes involved in maintenance of genome stability
3. New glycoconjugate-based precursors of pharmaceuticals: structure-activity relationship analysis
4. Analysis of glycan markers by innovative methods based on biochips and biosensors using nanotechnologies
5. Participation of molecules with biological activity and plant cell wall in defence processes of plants induced by abiotic stress
6. Analyses of allele-specific regulation of CD33 expression
7. Effect of honeybee glucose oxidase on honey antibacterial properties and characterisation its production and activity in hypopharyngeal glands of honeybee (*Apis mellifera*)
8. MALDI-TOF-MS and ESI-MSn glycoprofiling of clinically important proteins
9. Development of new biomedical and environmental sample processing techniques for advanced combined analytical methods
10. Enzymatic decomposition of the most recalcintrant epitopes of plant polysaccharides
11. Yeasts and yeast-like organisms associated with flowering plants and grasses

2019 Funding: 208 326 EUR

1. Design, synthesis and study of structure-activity-selectivity relationship of inhibitors against enzymes from GH38 family
2. Identification and properties of biologically active compounds isolated in the framework of phytochemical studies
3. Chemo-enzymatic preparation of glycosylated opiates and their analogues
4. Antimicrobial substances in honeybee larval food and their effect against American foulbrood pathogen
5. Diglycosidases in biocatalysis

2020 Funding: 198 521 EUR

1. Intensification of the development, production and non-invasive characterization of new immobilized whole-cell biocatalysts based on enzyme cascades for the production of chemical specialities

2. Virtual screening, synthesis and study of the interactions of the potential glycosyltransferases inhibitors
3. Preparation and characterization of the multifunctional Fe_3O_4-ZnO-biopolymer nanocomposite with a focus on water purification

2021 Funding: 186 463 EUR

1. Functionalized yeast polysaccharides – a prospective category of biocompatible substances with antimicrobial effectiveness.
2. Interaction of mannan epitopes of epidemiologically interesting *Candida* species with Ctype lectins.
3. Metabolic changes associated with protein glycosylation disorders.

2.4.5. List of projects supported by EU Structural Funds

2016

Project title: Integrating multiomics study results and biotechnological production of biologically important substances
Type / Project number: 313010T560
Duration: 06/2016 – 06/2021
Total funding (EUR): 1 574 583
Funding for the IC (EUR): 1 574 583
Role of the Institute / Responsible person: I/ Ján Mucha

2020

Project title: CEMBAM - Center of Medical Bio-additive Research and Production
Type / Project number: 313011V358
Duration: 09/2020 – 06/2023
Total funding (EUR): 9 071 646
Funding for the IC (EUR): 1 194 417
Role of the Institute / Responsible person: I/ Jaroslav Katrlík

Project title: Center for advanced therapies for chronic inflammatory diseases of the musculoskeletal system
Type / Project number: 313011W410
Duration: 06/2020 – 06/2023
Total funding (EUR): 5 788 811
Funding for the IC (EUR): 428 251
Role of the Institute / Responsible person: I/ Jaroslav Katrlík

Project title: Center for Biomedical Research - BIOMEDIRES - II. phase
Type / Project number: 313010W428
Duration: 01/2020 – 06/2023
Total funding (EUR): 5 895 947
Funding for the IC (EUR): 250 624
Role of the Institute / Responsible person: I/ Ján Mucha
Participating SAS institute: Centre of Experimental Medicine SAS

Project title: Long-term strategic research and development focused on the occurrence of Lynch syndrome in the Slovak population and possibilities of prevention of tumors associated with this syndrome
Type / Project number: 313011V578
Duration: 01/2020 – 06/2023
Total funding (EUR): 9 205 044
Funding for the IC (EUR): 602 252
Role of the Institute / Responsible person: I/ Ján Mucha

Participating SAS institute: Institute of Molecular Biology SAS

Project title: Study of structural changes of complex glycoconjugates in the process of hereditary metabolic and civilization diseases
Type / Project number: 313021Y920
Duration: 01/2020 – 06/2023
Total funding (EUR): 770 696
Funding for the IC (EUR): 547 698
Role of the Institute / Responsible person: C/ Ján Mucha
Participating SAS institute: Centre of Experimental Medicine SAS

2021
Project title: Development of nanostructured coatings with inactivating effect on viruses and bacteria for various types of flexible materials
Type / Project number: 313011AUH4
Duration: 01/2021 – 06/2023
Total funding (EUR): 248 5354
Funding for the IC (EUR): 280 000
Role of the Institute / Responsible person: I/ Ján Mucha

Project title: Development of products by modification of natural substances and study of their multimodal effects on COVID-19
Type / Project number: 313011ATT2
Duration: 01/2021 – 06/2023
Total funding (EUR): 3 217 226
Funding for the IC (EUR): 1 021 948
Role of the Institute / Responsible person: I/ Ján Mucha
Participating SAS institute: Centre of Experimental Medicine SAS

2.4.6. List of other projects funded from national resources

2017
JRP
Project title: Microelectrophoretic tools for bioanalysis
Type / Project number: V4-Korea/JRP/2017/69/MTB
Duration: 10/2017 – 09/2020
Total funding (EUR): 120 000
Funding for the IC (EUR): 120 000
Role of the Institute / Responsible person: I/ Vladimír Pätoprstý

2018
Project title*:* Early diagnostics of colorectal and testicular cancer by glycoprofiling
Type / Project number: 2018/23-SAV-1
Duration: 12/2018 – 12/2020
Total funding (EUR): 299 825
Funding for the IC (EUR): 299 825
Role of the Institute / Responsible person: C/ Ján Tkáč

2019
Project title*:* New approaches in the diagnostics of glycoconjugate metabolism disorders
Type / Project number: 2019/7-CHÚSAV-4
Duration: 11/2019 – 12/2021
Total funding (EUR): 282 620
Funding for the IC (EUR): 282 620

Role of the Institute / Responsible person: C/ Zuzana Pakanová

Project title*:* Glycoprofiling of proteins present in serum and exosomes for early prostate cancer diagnostics
Type / Project number: 2019/68-CHÚSAV-1
Duration: 12/2019 – 12/2021
Total funding (EUR): 251 552
Funding for the IC (EUR): 251 552
Role of the Institute / Responsible person: C/ Ján Tkáč
Participating SAS institute: Biomedical center SAS

2020
JRP
Project title: Design, synthesis and characterization of efficient mannosidase inhibitors related to iminosugars and glycoconjugates
Type / Project number: SAS-MOST/JRP/2019/882/GM-INHIB
Duration: 01/2020 – 12/2022
Total funding (EUR): 75.000
Funding for the IC (EUR): 75.000
Role of the Institute / Responsible person: C/ Miroslav Kóóš, Maroš Bella

2.4.7. List of projects funded from private funds

Not applicable.

2.4.8. List of projects funded from other competitive funds

DOKTOGRANT
2020
Project title: Glycan analysis of gestational diabetes mellitus by lectin-based microarray
Type / Project number: APP0061
Duration: 01/2020 – 12/2020
Total funding (EUR): 2000
Funding for the IC (EUR): 2000
Role of the Institute / Responsible person: C/ Lucia Pažitná

Project title: Diagnosis of breast cancer with use of detection biomarkers through protein glycoprofiling analysis
Type / Project number: APP0044
Duration: 01/2020 – 12/2020
Funding for the IC (EUR): 2000 EUR
Role of the Institute / Responsible person: C/ Veronika Pinková Gajdošová

Project title: Study of barley endotransglycosylases
Type / Project number: APP0075
Duration: 01/2020 – 12/2020
Total funding (EUR): 2000
Funding for the IC (EUR): 2000
Role of the Institute / Responsible person: C/ Barbora Stratilová

2021
Project title: Synthesis of biologically active swainsonin analogues
Type / Project number: APP0201

Duration: 01/2021 – 12/2021
Total funding (EUR): 2000
Funding for the IC (EUR): 2000
Role of the Institute / Responsible person: C/ Martin Kalník

2.5. PhD studies and educational activities

2.5.1. List of accredited programmes of doctoral studies, period of validity, source of funding

1. Organic chemistry (supervised by: PriF UK and FCHPT STU)
2. Physical chemistry (supervised by: PriF UK and FCHPT STU)
3. Macromolecular chemistry (supervised by: FCHPT STU)
4. Biochemistry (supervised by: PriF UK and FCHPT STU)
5. Microbiology (supervised by: PriF UK)
6. Biotechnologies (supervised by: PriF UK and FCHPT STU)
7. Plant physiology (supervised by: PriF UK)

Note: PriF UK = Faculty of Natural Sciences, Comenius University in Bratislava; FCHPT STU = Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava).

All above mentioned programmes are accredited for 4-year internal and for 5-year external studies. Studies are funded by student stipend from national budget or EU project.

2.5.2. Summary table on doctoral studies (number of internal/external PhD students at the end of the year; number of foreign PhD students, number of students who successfully completed their theses during the year, number of PhD students who quit the programme during the year*)*

PhD study	2016			2017			2018			2019			2020			2021		
Number of potential PhD supervisors	49			46			46			46			48			47		
PhD students	number, end of year	defended thesis	students quitted	number, end of year	defended thesis	students quitted	unumber, end of yea	defended thesis	students quitted	number, end of year	defended thesis	students quitted	number, end of year	defended thesis	students quitted	number, end of year	defended thesis	students quitted
Internal total	23	5	0	19	4	2	17	5	2	22	5	0	20	4	0	23	3	0
from which foreign citizens	2	0	0	0	2	0	0	0	0	2	0	0	2	0	0	3	0	0
External	1	0	1	0	0	0	0	0	0	1	0	0	2	1	0	3	1	0
Other supervised by the research employees of the institute	0	1	0	1	0	0	3	0	0	3	0	0	4	0	0	2	2	0

2.5.3. PhD carrier path – Information on the next career steps of the PhD graduates who received their degree from the institute

The 79% of graduated PhD students are employed in research (SAS, universities, departmental research institutes) or are employed in practice outside research, where they apply their qualifications. 55% of these graduated PhD students are

employed at the Institute of Chemistry. 21% of graduated PhD students are employed in practice where they do not utilize their qualification.

2.5.4. Summary table on educational activities

Teaching	2016	2017	2018	2019	2020	2021
Lectures (hours/year)*	28	39	20	32	7	32
Practicum courses (hours/year)*	1 055	481	350	679	796	715
Supervised diploma and bachelor thesis (in total)	19	34	17	23	19	11
Members in PhD committees (in total)	10	10	7	10	11	8
Members in DrSc. committees (in total)	4	3	3	3	3	2
Members in university/faculty councils (in total)						
Members in habilitation/inauguration committees (in total)	1	0	1	3	3	3

2.5.5. List of published university textbooks

Not applicable

2.5.6. Number of published academic course books

Not applicable

2.5.7. List of joint research laboratories/facilities with universities

1. *Joint Laboratory of Fourier Transform Infrared Spectroscopy*
   Joint research laboratory of Institute of Inorganic Chemistry SAS, Institute of Chemistry SAS, Faculty of Chemical and Food Technology (Slovak University of Technology), and Faculty of Natural Sciences (Comenius University) has been situated at Institute of Chemistry SAS. The Laboratory serves for basic service and special measurements for individual research projects and pedagogical purposes, as well. Nicolet 6700 spectrometer with several additional accessories, new IR Nicolet iS50 spectrometer with Raman and GC-IR modules, Infrared Microscopy Nicolet iN10 and DXR Raman microscope are available.
2. *National NMR Centre*
   The Centre has been established at Faculty of Chemical and Food Technology (Slovak University of Technology). In the framework of the state research and development programme, this Centre joints NMR laboratories of Faculty of Chemical and Food Technology (Slovak University of Technology in Bratislava), Faculty of Natural Sciences, (Comenius University in Bratislava), Faculty of Natural Sciences (P. J. Šafárik University in Košice) and the Institute of Chemistry SAS. The NMR laboratory at the Institute of Chemistry SAS is equipped with two NMR instruments (Bruker Avance III D 600 MHz and 400 MHz) and serves for basic service and special

measurements for individual research projects and pedagogical purposes, as well.

3. *Joint Facility of Metabolics of Plants, Plant Materials and Foods of Plant Origin*

   This facility joints Institute of Chemistry SAS and Faculty of Biotechnology and Food Sciences of the Slovak University of Agriculture in Nitra. It was established in 2009 in Nitra with the aim to perform scientific projects of basic and applied research in the field of food sciences and biotechnologies. In addition, it should serve as a training base for education of master, doctoral and postdoctoral students as well as for visiting research and pedagogic scientists. In the framework of implementation of two projects supported by EU Structural Funds (3.23 mil. € and 2.80 mil. €) during 2011–2015, this facility was equipped with unique instrumental technique.

2.5.8. Supplementary information and/or comments on doctoral studies and educational activities – focused on what changes have occurred since the last evaluation in 2016

Although the Institute has the capacity for education of more PhD students, the increase of their number is problematic due to existing competences and financing. According to effective legislative, all PhD students at the Institute are postgraduate students of corresponding university. Therefore, finances from Ministry of Education are allocated to the university and the Institute has a status of external educational organisation. Financial support from Presidium of SAS and from institutional budget is limited. The quota for the Institute is four new PhD students *per* year. Despite this problem, about 24 PhD students in average *per* year are educated at the Institute. During this assessment period, an increased interest in PhD study was noticed for accredited programmes of Biotechnology and Biochemistry. But there is still deficiency in the field of Organic Chemistry, Macromolecular Chemistry and Physical Chemistry.

During the evaluated period, 21 PhD students took part in research fellowships at respected foreign institutions. Reciprocally, 9 PhD students from abroad visited the Institute of Chemistry SAS. PhD students, after defending their theses, frequently leave for postdoctoral scholars (2-3 years) at remarkable universities abroad. This indicates a high quality of the PhD education at the Institute.

It is beneficial that existing joint laboratories with universities (Joint Laboratory of FTIR Spectroscopy, National NMR Centre, Joint Facility of Metabolics of Plants, Plant Materials and Foods of Plant Origin; see indicator 2.5.7.) serve, in addition to basic research, also as training bases for pedagogic purposes.

2.6. Societal impact

2.6.1. The most important case studies of the research with direct societal impact, max. 4 for institute with up to 50 average FTE researchers per year, 8 for institutes with 50 – 100 average FTE researchers per year and so on. Structure: Summary of the impact; Underpinning research; References to the research; Details of the impact; Sources to corroborate the impact. One page per one case study

Case Study 1

Summary of the impact

Restoration of various kinds of art-historic items is many times limited by the efficient, yet non-destructive disassembly into original pieces that have been glued together during their construction. The animal glues are primarily composed of proteins like casein (milk) or collagen (skin, connective tissue, cartilage, and bones). For example, casein was used for wood binding in ancient Egypt, Greece, Rome, and China. Apart from cheese making, it was used in Europe for gluing pieces of wood to construct large panels for painting, for durable decorative coatings as well as a painting medium. Even at present time, animal glues are widely used in the conservation and restoration of historical and artistic objects as adhesives, binders, and consolidators of organic and inorganic materials.

Currently, the removal of animal glue is carried out using dry or hot steam, hot air, or other chemical solvents. These techniques may negatively affect the shape stability of the material. In the past, various studies have described the use of microorganisms and microbial enzymes to remove animal glue from the surfaces of different kinds of art-historic items. The study was based on observation that *Exiguobacterium undae* grown in glue-containing media secreted protein degradation enzymes into its environment. This led to production of biopreparate from such conditioned media that was free of bacterial contamination but retained high proteolytic activity. The biopreparate was able to degrade skin and bone animal glue quickly and completely *in situ* on various materials, including sandstone, glass and wood. The biopreparate was also successfully used in the restoration of historical and contemporary organ pipes. Application of the biopreparate allowed to dismantle the necessary parts of wooden organ pipes in a non-abrasive manner.

Underpinning research

E. undae strain was isolated from the air inside the castle of Krásna Hôrka (Slovakia). It was identified by 16S rRNA gene amplification and subsequent sequencing. *E. undae* microbial culture was incubated on solid animal glue agar creating large hydrolytic zone. For protein analysis by SDS-PAGE, LC-MS and other biochemical techniques, the *E. undae* was grown in liquid animal glue medium with subsequent concentration. To investigate the protein content of the secretome, SDS-PAGE and LC-MS analytical approaches were employed. Among 12 identified extracellular proteins there were identified several hydrolytic enzymes, including proteases. Sensitivity to known proteolytic inhibitors and determination of the proteolytic cleavage specificity using casein as substrate strongly suggested that bacillolysin from the biopreparate is responsible for the observed proteolytic activity. Testing of the biopreparate was performed using a replica of a period wooden pipe, which was subjected to sound frequency spectrum analysis before and after the treatment. The results of these measurements show that the application of the prepared biopreparation from *E. undae* does not have a real effect on the quality of the frequency spectrum of wooden organ pipes. Subsequently, the biopreparation was successfully applied to the historic organ pipes (wooden organ in Mokrá Lúka, 17th century, Revúca district), were exchange of insect-destroyed pipes for replicas was performed.

References to the research

- JESZEOVÁ, Lenka - BAUEROVÁ-HLINKOVÁ, Vladena** - BARÁTH, Peter - PUŠKÁROVÁ, Andrea - BUČKOVÁ, Mária - KRAKOVÁ, Lucia - PANGALLO, Domenico**. Biochemical and proteomic characterization of the extracellular enzymatic preparate of *Exiguobacterium undae*, suitable for efficient animal glue removal. In *Applied Microbiology and Biotechnology*, 2018, vol. 102, p. 6525-6536. (2017: 3.340 - IF, Q2 - JCR, 1.182 - SJR, Q1 - SJR). (2018 - Current Contents). ISSN 0175-7598. DOI Link: https://doi.org/10.1007/s00253-018-9105-3
- PANGALLO, Domenico - BAUEROVÁ, Vladena - JESZEOVÁ, Lenka - BUČKOVÁ, Mária - PUŠKÁROVÁ, Andrea - KRAKOVÁ, Lucia - BARÁTH, Peter - ŠTAFURA, Andrej - NAGY, Štefan - ČULÍK, Martin. Biopreparát z

Exiguobacterium undae, spôsob jeho výroby a jeho použitie. (Biopreparation from *Exiguobacterium undae*, method of its production and its use) Číslo prihlášky: PP 50012-2018 v Slovenskej republike: Prihlasovateľ/majiteľ: Ústav molekulárnej biológie SAV, Chemický ústav SAV, Ústav hudobnej vedy SAV, Technická univerzita vo Zvolene. Dátum podania prihlášky: 6.3.2018. Dátum zverejnenia prihlášky: 2.10.2019. In: *Vestník Úradu priemyselného vlastníctva Slovenskej republiky*, 2019, č. 10, s. 10. Banská Bystrica: Úrad priemyselného vlastníctva SR. ISSN 2453-7551

Details of the impact

We have demonstrated that using biopreparate as novel approach significantly changes technological process of restoration of historical organs both from the point of view of reversibility, as well as sound properties that were not affected by the biopreparate application. The main advantage of the biopreparate is targeted application in the process of restoration of organ pipes, which could not be achieved with the techniques available so far. Thus, the properties of the biopreparate and the mode of its use significantly contribute to the preservation of Europe's cultural heritage.

Sources to corroborate the impact

https://www.sav.sk/?lang=sk&doc=services-news&source_no=20&news_no=9909
https://wbr.indprop.gov.sk/WebRegistre/Patent/Detail/50012-2018

Case Study 2

Summary of the impact

Results obtained during work on the ERC Starting grant (https://cordis.europa.eu/project/id/311532) using electrochemical biosensors for analysis of glycan changes associated with development and progression of various diseases were very promising. During discussion with experts in the field of glycomics who tried to commercially exploit their results we learnt that it is important to transfer glycan based analysis into an ELISA-like format. Such format is fully compatible with current clinical practise and can be easily transferred onto fully automatic machines working at high assay throughput.

This is why we needed to transform our sensing platform from electrochemical to ELISA-like assays to be closer to clinical requirements. With the aid of magnetic particles we developed an ELISA based assay protocol termed MELLA (Magnetic Enzyme Linked Lectin Assays) for glycoprofiling of cancer biomarkers. The method is based on a unique amplification step, which not only enhances sensitivity of detection 37.5-fold (requirement of just 0.04 mL of sample compared to the state of the art technique requiring 1.5 mL), but also shortens analysis time avoiding several washing steps. For further commercial exploitation of such sensing approach based on glycan analysis for cancer diagnostics, the start-up company Glycanostics (www.glycanostics.com) was established in 2017 as a spin-off company from the Institute of Chemistry, Slovak Academy of Sciences.

Underpinning research

The biological heterogeneity of prostate cancer (PCa), as well as the fact that the prostatic specific antigen (PSA) is not cancer-specific, motivates researchers in their continuing search for new biomarkers. Here we compared the clinical performance of a new PCa serum biomarker based on free PSA (fPSA) glycoprofiling to the percentage of free PSA (fPSA%) and the PHI (Prostate Health Index test developed by Beckman Coulter). Serum samples from men who underwent prostate biopsy due to increased PSA were used. A comparison between two equal groups (with and without histologically confirmed PCa) was used for the clinical validation of a new glycan-based PCa oncomarker using the

multiparametric analyses of the receiver operating curve (ROC) and for genetic algorithm metaheuristics. When comparing the non-cancer and PCa cohorts, the combination of 4 fPSA glycoforms with 2 clinical parameters (PGI, Prostate Glycan Index) showed an AUC (area under receiver operating curve) value of 0.821. AUC values were 0.517 for PSA, 0.683 for fPSA% and 0.737 for PHI. A glycan analysis was also applied to discriminate low grade tumours (GS = 6) from significant tumours (GS ≥ 7) with AUC = 0.632. Compared to PSA on its own, or fPSA% and the PHI, PGI showed improved discrimination between presence and absence of PCa and in predicting clinically significant PCa. In addition, the use of PGI would help practitioners avoid 63.5% of unnecessary biopsies, while use of fPSA% and PHI, would help to avoid 17.5% and 33.3% biopsies respectively, while missing 4 significant tumours (9.5%).

References to the research

We did extensive literature survey to identify glycan changes, which could be associated with development and progression of prostate cancer in two invited review papers. Based on such survey we identified glycan changes, which can be applied for prostate cancer diagnostics. Output from the clinical validation study was published in the journal Cancers with high impact factor by the consortium of experts from several EU countries.

- BERTÓK, Tomáš - JÁNÉ, Eduard - BERTÓKOVÁ, Anikó - LORENCOVÁ, Lenka - ZVARA, Peter - SMOLKOVÁ, Božena - KUČERA, Radek - KLOCKER, Helmut - TKÁČ, Ján**. Validating fPSA glycoprofile as a prostate cancer biomarker to avoid unnecessary biopsies and re-biopsies. In *Cancers*, 2020, vol. 12, no. 10, art. no. 2988 [10] p. (2019: 6.126 - IF, Q1 - JCR, 1.938 - SJR, Q1 - SJR). ISSN 2072-6694. DOI Link: https://doi.org/10.3390/cancers12102988
- TKÁČ, Ján** - BERTÓK, Tomáš - HÍREŠ, Michal - JÁNÉ, Eduard - LORENCOVÁ, Lenka - KASÁK, Peter. Glycomics of prostate cancer: updates. In *Expert Review of Proteomic*, 2019, vol. 16, p. 65-76. (2018: 2.963 - IF, Q2 - JCR, 0.946 - SJR, Q2 - SJR). ISSN 1478-9450. DOI Link: https://doi.org/10.1080/14789450.2019.1549993
- TKÁČ, Ján** - PINKOVÁ GAJDOŠOVÁ, Veronika - HRONČEKOVÁ, Štefánia - BERTÓK, Tomáš - HÍREŠ, Michal - JÁNÉ, Eduard - LORENCOVÁ, Lenka - KASÁK, Peter. Prostate-specific antigen glycoprofiling as diagnostic and prognostic biomarker of prostate cancer. In *Interface Focus*, 2019, vol. 9, art. no. 20180077. (2018: 3.092 - IF, Q1 - JCR, 1.138 - SJR, Q1 - SJR). ISSN 2042-8898. DOI Link: https://doi.org/10.1098/rsfs.2018.0077

Details of the impact

Potential impact of the prostate cancer diagnostic test can be estimated based on number of biopsies (~2.6 million every year) performed in the EU and US with 76% of them are avoidable since are negative. The technology based on the results published in the journal *Cancers* shows that 63% of unnecessary biopsies can be avoided with a potential to lower financial and socioeconomic burden associated with it.

Sources to corroborate the impact

In order to verify commercial potential of the invention we have received ERC Proof of Concept grant (https://cordis.europa.eu/project/id/825586) in cooperation with Glycanostics start up company,

Case Study 3

Summary of the impact

Up to this date, more than 6,000 unique rare diseases were described worldwide. Overall, rare diseases may affect 30 million European Union citizens.

80% of these disorders are of genetic origin, and are often chronic and life-threatening. Disorders of glycoconjugate metabolism include defects in their synthesis - congenital disorders of glycosylation (CDG); and their degradation - some lysosomal disorders (LSD). Despite the fact that the incidence of PMM2-CDG, the most common CDG subtype, is estimated as 1:20,000, up to this date there is still not a single case identified in Slovakia. Traditional selective screening of metabolic disorders offers a fast and robust diagnostic pathway, however, it does not specify the molecular basis of the disease and further investigations, based on personalized approach, are essential. Almost 10 years ago, the Institute of Chemistry started the collaboration with the Centre of Inherited Metabolic Disorders, National Institute of Children's Diseases and up to this date, hundreds of samples from patients were analyzed by modern analytical multi-OMICs approaches to help the comprehensive diagnostic process.

Underpinning research

The heterogeneity of clinical symptoms, as well as the rarity of both CDG and LSD, classifies these disorders as difficult to diagnose. For the diagnostics of CDG, 5-10 µL of serum is subjected to *N*-glycoprofiling of serum proteome or determination of *O*-glycoprofile of apolipoprotein CIII glycobiomarker. Comprehensive *N*- and *O*-glycopropfiles are characterized by the combination of mass spectrometry and liquid chromatography (LC-MS), and obtained data are compared to respective negative controls. To confirm the suspected diagnosis, next generation sequencing of whole exome is performed. For the diagnostics of LSD, patient's urine is subjected to 1-D and 2-D (HSQC) NMR spectrometry and quantities of specific glycobiomarkers are determined. This approach of biomarker determination was applied also in the monitoring of therapy efficacy of LSDs when the therapy was available. Approaches mentioned above represent the combined multi-OMICs platform, based on glycomics, proteomics, genomics and metabolomics.

References to the research

During the last years, several studies have been published. Based on multi-OMICs platform, the first Slovak ALG12-CDG patient was described. In this case, a novel homozygous mutation in *ALG12* gene was identified after the comprehensive glycomic analysis of serum *N*-glycoprofile by mass spectrometry. By 1H NMR spectroscopy, changes in the levels of Glc4 biomarker were determined in samples of four patients with Pompe disease as an effective tool for monitoring of therapy efficacy.

- PAKANOVÁ, Zuzana** - MATULOVÁ, Mária - UHLIARIKOVÁ, Iveta - BEHÚLOVÁ, Darina - ŠALINGOVÁ, Anna - HLAVATÁ, Anna - JURÍČKOVÁ, Katarína - NEMČOVIČ, Marek - PÄTOPRSTÝ, Vladimír - MUCHA, Ján. Case study: monitoring of Glc4 tetrasaccharide in the urine of Pompe patients, use of MALDI-TOF MS, and 1H NMR. In *Chemical Papers*, 2019, vol. 73, no. 3, p. 701-711. (2018: 1.246 - IF, Q3 - JCR, 0.274 - SJR, Q2 - SJR). (2019 - Current Contents). ISSN 0366-6352. DOI Link: https://doi.org/10.1007/s11696-018-0623-3
- ZIBUROVÁ, Jana - NEMČOVIČ, Marek - ŠESTÁK, Sergej - BELLOVÁ, Jana - PAKANOVÁ, Zuzana - SIVÁKOVÁ, Barbara - ŠALINGOVÁ, Anna - ŠEBOVÁ, Claudia - OSTROŽLÍKOVÁ, Mária - LEKKA, Dimitra-Evanthia - BRUCKNEROVÁ, Jana - BRUCKNEROVÁ, Ingrid - SKOKŇOVÁ, Martina - MCCULLOUGH, Alexandra - HRČKOVÁ, Gabriela - HLAVATÁ, Anna - BZDÚCH, Vladimír - MUCHA, Ján - BARÁTH, Peter**. A novel homozygous mutation in the human *ALG12* gene results in an aberrant profile of oligomannose *N*-glycans in patient's serum. In *American Journal of Medical Genetics, Part A*, 2021, vol. 185A, p. 3494-3501. (2020: 2.802 - IF, Q3 - JCR, 1.064 - SJR, Q2 - SJR). (2021 - Current Contents). ISSN 1552-4825. DOI Link: https://doi.org/10.1002/ajmg.a.62474

Details of the impact

The most important societal impact of the research includes the successful development and establishment of approaches to help the diagnostics of rare disorders of glycoconjugate metabolism. Through the close collaboration between physicians, clinical biochemists, geneticists, and research scientists, the specific nature of the disease was determined in many individual patients and their families.

Sources to corroborate the impact

In 2019 we have received the grant from Ministry of Health of the Slovak Republic to support the research and development of new approaches in diagnostics of glycoconjugate metabolism disorders (https://www.crp.gov.sk/data/att/110836.pdf). Several on-line popularization activities to raise the public awareness about rare diseases and personalized medicine were published (*e.g.* https://www.aktuality.sk/clanok/850789/sacharidy-su-neoddelitelnou-sucastou-imunitneho-systemu-zdoraznuju-vedci/).

Case Study 4

Summary of the impact

The project was aimed to designing and promotion of environmentally friendly methods of plant protection against fungal diseases. An alternative to chemical pesticides is the biological control using microorganisms antagonizing the disease-causing plant pathogens. Generally, as the most effective antagonist of phytopathogenic fungi is considered the micromycete *Trichoderma sp.* One of the objectives of our study was to isolate and characterize Trichoderma strains endemic to habitats in Slovakia, hoping that such strains would be best accommodated to soil and weather conditions in the Central-European area. The project covered the broad area of problems related to biological control of plant diseases with *Trichoderma*. The final goal of the project was the introduction of plant protecting techniques based on the biological control into practice. Wide application of methods of biological control would largely improve the environmental conditions by reducing the need for chemical pesticides and, at the end, would contribute to improvement of human health.

Underpinning research

The potential of *Trichoderma* to antagonize most phytopathogenic fungi has been recognized and exploited for over 30 years. The key obstacle in practical use of biocontrol with *Trichoderma* is the availability of the inocula (spores) depending on their effective production. It was therefore important to learn the biochemical mechanism of *Trichoderma* sporulation before we started to investigate the more practical aspects of the project. Particularly, we focused our attention to light-induced sporulation in *Trichoderma*. The stimulatory effect of light on *Trichoderma* sporulation is a known phenomenon but the biochemical changes underlying this process were marginal. We have found that a short pulse of light of 350 to 500 nm to the dark-grown mycelium causes an abrupt increase in the intracellular concentration of adenine nucleotides ADP, ATP and cyclic AMP. These changes were accompanied by fluctuations of the membrane potential, phosphorylation of proteins and an oxidative burst. The import of sugars by the mycelium is switched off and further development of the mycelium proceeds at the expense of intracellular carbohydrate reserves (glycogen). The results from these studies were published in the impacted international journals and several patents were filled (see below the list of publications).

References to the research

- FARKAŠ, Vladimír - NEMČOVIČ, Marek - JAKUBÍKOVÁ, Lucia - ŠUBÍKOVÁ, Valéria - JANITOR, Anton - KUNCA, Andrej - LEONTOVYČ, Roman. *Kmene*

mikroorganizmov Trichoderma atroviride a Trichoderma harzanium a prostriedok na ochranu rastlín, ktorý ich obsahuje. Číslo patentu 288023. Bratislava, Úrad priemyselného vlastníctva Slovenskej Republiky, 9. 10. 2012 (Eng: Strains of microorganisms *Trichoderma atroviride* and *Trichoderma harzanium* and a plant protection product containing them. Patent No. *288023*)

- FARKAŠ, Vladimír - SULOVÁ, Zdena - LEHOTSKÝ, Ján. Effect of light on the concentration of adenine nucleotides in *Trichoderma viride*. In *Journal of General Microbiology*, 1985, vol. 131, p. 317-320. DOI Link: https://doi.org/10.1099/00221287-131-2-317
- SULOVÁ, Zdena - HRMOVÁ, Mária - FARKAŠ, Vladimír. Photostimulated oxygen uptake in *Trichoderma viride*. In *Journal of General Microbiology*, 1990, vol. 136, p. 2287. DOI Link: https://doi.org/10.1099/00221287-136-11-2287
- GREŠÍK, Miroslav - KOLAROVA, Nadežda - FARKAŠ, Vladimír. Hyperpolarization and intracellular acidification in *Trichoderma viride* as a response to illumination. In *Journal of General Microbiology*, 1991, vol. 137, p. 2605-2609. DOI Link: https://doi.org/10.1099/00221287-137-11-2605
- JAKUBÍKOVÁ, Lucia - FARKAŠ, Vladimír - KOLAROVA, Nadežda - NEMČOVIČ, Marek. Conidiation of *Trichoderma atroviride* isolate during submerged cultivation in a laboratory stirred-tank fermenter. In *Folia microbiologica*, 2006, vol. 51, p. 209-213. (2005: 0.918 - IF, Q3 - JCR, 0.428 - SJR, Q2 - SJR, Current Contents - CCC). (2006 - Current Contents). ISSN 0015-5632. DOI Link: https://doi.org/10.1007/BF02932124
- NEMČOVIČ, Marek - FARKAŠ, Vladimír. Cell-wall composition and polysaccharide synthase activity changes following photoinduction in *Trichoderma viride*. In *Acta biologica Hungarica*, 2001, vol. 52, p. 281-288. ISSN 0236-5383. DOI Link: https://doi.org/10.1556/ABiol.52.2001.2-3.12
- NEMČOVIČ, Marek - JAKUBÍKOVÁ, Lucia - VÍDEN, I. - FARKAŠ, Vladimír. Induction of conidiation by endogenous volatile compounds in *Trichoderma sp*. In *FEMS Microbiology Letters*, 2008, vol. 284, p. 231-236. (2007: 2.274 - IF, Q3 - JCR, 1.103 - SJR, Q2 - SJR, Current Contents - CCC). (2008 - Current Contents). ISSN 0378-1097. DOI Link: https://doi.org/10.1111/j.1574-6968.2008.01202.x

Details of the impact

The most important societal impact of the research includes the successful establishment of the complex procedure for production and practical use of *Trichoderma* fungi in plant protection. The procedure was patented and licensed to a Slovak biotechnological company "Azoter, s. r. o.", Bratislava, Slovakia). The commercialized product has been distributed to agricultural companies under the name Azoter F.

Fig. Remediation of the turf grass attacked by the brown rotting fungus on the football stadium in Trnava by the preparation containing spores of *Trichoderma harzianun*. A, before remediation; B, after 4 weeks of treatment.

Pilot experiments

We have designed a special process for large-scale production of *Trichoderma* spores. The availability of large quantities of spores enabled testing

of the isolated strains of *Trichoderma* in the field conditions for their effectivity to protect potatoes against *Rhizosporidium solani* and in turf protection against *Sclerotinium* and *Mucor sp.* with good results. As an example, was as the successful remediation of the grass carpet in the football stadium of Anton Malatinský in the city of Trnava. A great part of the procedure was patented.

2.6.2. List of the most important studies and/or other activities commissioned for the decision-making authorities, the government and NGOs, international and foreign institutes (title, name of institution, contract value, purpose (max 20 words))

BIELY, Peter
Expert evaluating the project NWO Open Competition Domain Science - KLEIM-1 (2020)

BYSTRICKÝ, Slavomír; GEMEINER, Peter; HRICOVÍNI, Miloš; MATULOVÁ, Mária
External members of Commission for decision making in objections at Public Procurement Office (2007–)

HROMÁDKOVÁ, Zdenka
Member of Sector Council for Food Processing Industry in the programme of Ministry of Education, Science, Research and Sport and Ministry of Labour, Social Affairs and Family of the Slovak Republic "National System of Professions" (2012–2021)

MATULOVÁ, Mária
Member of Sector Council for Chemistry and Pharmacy in the programme of Ministry of Education, Science, Research and Sport and Ministry of Labour, Social Affairs and Family of the Slovak Republic "National System of Professions" (2012–)

HRICOVÍNI, Miloš; TVAROŠKA, Igor
Members of Council of National NMR Centre (2008–)

HRICOVÍNI, Miloš; VADKERTIOVÁ, Renáta
Member of Commission for the coordination of activities of the SR in ESFRI research infrastructures in the field of health, food and the environment at the Ministry of education, science, research and sports of the Slovak Republic (2018–)

HRICOVÍNI, Miloš
Expert evaluating the projects of Poland National Science Centre - POLONEZ, CIISB4Health (2017), CEITEC Application (2019, 2020)

PETRUŠ, Ladislav
Member of the jury for Administration of the Literary Fund Prices (2015–)
Member of the jury in Junior Chamber International Jury for the Student Personality of Slovakia Award (2016)
Expert evaluating the projects of Austrian Science Fund - FWF (2018) and COST (2018)

KATRLÍK, Jaroslav
Expert evaluating the projects of ERA.Net RUS Plus (2017), REPRISE PRIN (2018), H2020-FET-Open RIA (2018), H2020-ICT-07-2018 (2018), FIL-Quota Incentivante (2019) H2020-FETOPEN (2017, 2019, 2020), H2020-MSCA-IF-2020 (2020),

H2020-MSCA-RISE (2016, 2018, 2019, 2020), H2020-WIDESPREAD-Twinning (2017, 2019, 2020), ERA.Net RUS Plus (2020), CINECA-FISR (2020, 2021), HORIZON-EIC-2021-PATHFINDEROPEN-01 (2021), Junior project of University of Insubria (2021), PRIN 2020 (2021)

KLAUDINY, Jaroslav
Member of Biosafety Commission and its Board of Experts at the Ministry of the Environment of the Slovak Republic (2018–)
Expert evaluating the project of Austrian Science Fund – FWF (2016)

LUX, Alexander
Expert evaluating the project NWO Innovational Incentives Scheme/Talent Programme (2019)

MASTIHUBA, Vladimír
Attestation Commission of the Slovak University of Technology in Bratislava (2019–)

PAULOVIČOVÁ, Ema
Working group of experts for alternative methods (evaluation of toxicity, effects and safety of substances in science, research, industry and education) at the Ministry of Agriculture and Rural Development of the Slovak Republic (2018–)

TKÁČ, Ján
Expert evaluating the projects of Canadian Glycomics Network (GlycoNet) and Canadian Networks of Centres of Excellence (2016), Program KONTAKT II (LH) – VES 15 (2019), ANR, AAP Genérique, France (2020), ERA.Net RUS Plus (2020), KWF Unique High Risk Project (2019, 2020)

VADKERTIOVÁ, Renáta
Expert evaluating the project PRIN 2020

2.6.3. List of contracts and research projects with industrial and other commercial partners, incl. revenues (study title, name of institution, contract value, country of partner, purpose (max 20 words))

1. Novozymes A/S, Bagsvaerd, Denmark
   Action of different types of endoxylanases on native plant cell walls
   Revenues: 20 000 €
2. ELMAX Žilina, Žilina, Slovakia
   MS analyses and evaluation of results
   Revenues: 36 000 €
3. Novozymes A/S, Bagsvaerd, Denmark
   Isolation of recalcitrant acetylxylan structures and enzymes of their hydrolysis
   Revenues: 30 000 €
4. AH - Slovakia s.r.o., Bratislava, Slovakia
   LC-MS analyses and chemical and microbiological analyses and evaluation of results
   Revenues: 2 803 €
5. Slovak MAK s.r.o., Leopoldov, Slovakia
   LC-MS analyses and evaluation of results
   Revenues: 10 150 €
6. MIKROCHEM s.r.o, Pezinok, Slovakia
   LC-MS analyses and evaluation of results

Revenues: 790 €

7. KSZ - Fortis, spol. s r.o. Dunajská Streda, Slovakia
   LC-MS analyses and evaluation of results
   Revenues: 2 870 €
8. Seederium s.r.o., Dunajská Streda, Slovakia
   LC-MS analyses and evaluation of results
   Revenues: 1680 €
9. Saneca Pharmaceuticals, a.s., Hlohovec, Slovakia
   LC-MS analyses and evaluation of results
   Revenues: 3 920 €
10. GEMINI, Bratislava, Slovakia
    LC-MS analyses and evaluation of results
    Revenues: 1 100 €
11. Pulp and Paper Research Institute, a.s., Bratislava, Slovakia
    Determination of the elemental composition of samples
    Revenues: 1510 €
12. Bratislava Drilling Company s.r.o., Bratislava, Slovakia
    Chemical and microbiological analyses and evaluation of results
    Revenues: 770 €
13. TRUMPF Slovakia, s.r.o, Košice, Slovakia
    Chemical and microbiological analyses and evaluation of results
    Revenues: 667 €
14. Welldrilling, s.r.o., Bratislava, Slovakia
    Chemical and microbiological analyses and evaluation of results
    Revenues: 2 857 €
15. SN AGRO, s.r.o., Malacky, Slovakia
    Chemical and microbiological analyses and evaluation of results
    Revenues: 165 €
16. INTECH SLOVAKIA, s.r.o., Slovakia
    Chemical and microbiological analyses and evaluation of results
    Revenues: 383 €
17. XIMEA s.r.o., Marianka, Slovakia
    Chemical and microbiological analyses and evaluation of results
    Revenues: 533 €
18. A1SYNTH, s. r. o. Skalica, Slovakia
    NMR analyses and evaluation of results
    Revenues: 2 500 €
19. Qatar University, Qatar
    NMR analyses and evaluation of results
    Revenues: 1 200 €
20. Lemkowie, s.r.o., Bratislava, Slovakia
    Sample analyses and evaluation of results
    Revenues: 7 403 €
21. Particle, s.r.o., Lučenec, Slovakia
    Sample analyses and evaluation of results
    Revenues: 1 900 €
22. TAU-CHEM, s.r.o. Bratislava, Slovakia
    Sample analyses and evaluation of results
    Revenues: 220 €
23. Spoľahni sa, s.r.o., Bernolákovo, Slovakia
    Chemical and microbiological analyses and evaluation of results
    Revenues: 623 €

2.6.4.1 List of intangible fixed assets (internally registered IP (confidential know-how), patent applications, patents granted, trademarks registered) denoting background IPR

Trademark registered: CHEMICKÉ ZVESTI
Registration Number: 218088
Registered organisation: Institute of Chemistry, SAS

Trademark registered: CHEMICAL PAPERS
Registration Number: 218089
Registered organisation: Institute of Chemistry, SAS

2.6.4.2 List of licences sold abroad and in Slovakia, incl. revenues (background IPR identification, name of institution, contract value, country of partner, purpose (max 20 words))

IPR identification: SK Patent No.: 288023; Granted: 09. 10. 2012; Name: Kmene mikroorganizmov *Trichoderma atroviride* a *Trichoderma harzanium* a prostriedok na ochranu rastlín, ktorý ich obsahuje. (Eng: Strains of the microorganisms *Trichoderma atroviride* and *Trichoderma harzanium* and plant protection product containing them.)
Name of Institution: Azoter Trading, s.r.o., Bratislava
Contract Value: 15 000 Eur
Country of Partner: Slovakia
Purpose: The institute sold to Azoter Trading, s.r.o., Bratislava, an exclusive license to use the patented strain of the micromycete *Trichoderma atroviride* I2

2.6.5. Summary of relevant activities, max. 300 words (describe the pipeline of valorization in terms of Number of disclosure, Number of registered IP internally, number of CCR/LIC contracts and their respective summary values, the support you are receiving in specific points internally at the institute, at SAS, externally – also the limitations and drawbacks.

Not applicable

2.7. Popularisation of Science (outreach activities)

2.7.1. List of the most important popularisation activities, max. 20 items

Num.	Name	Title	Year	Place
1.	Farkaš Vladimír doc. Ing., DrSc.	Úlohou vedy je nielen poznávať, ale aj slúžiť (Eng: The task of science is not only to know but also to serve)	2016	internet
2.	Kóóš Miroslav Ing., DrSc.	Objavovanie budúcnosti (Eng: Discovering of the future)	2016	print
3.	Mucha Ján RNDr., CSc.	Mapujú molekuly človeka (Eng: The molecules map the human)	2016	multimedia
4.	Pätoprstý Vladimír Ing., PhD.	Slovenský vedec zjednodušil výskum (Eng: The Slovak scientist has simplified research)	2016	multimedia
5.	Schusterová Hana Ing., PhD.	Úžasný svet kvasiniek (vedecký stánok) (Eng: The Amazing World of Yeast (Science	2016	exhibition

		Booth))		
6.	Biely Peter RNDr., DrSc.	Výskum využitia bioodpadu na SAV je svetový (Eng: Research into the use of biowaste at SAS is world's)	2017	multimedia
7.	Breierová Emília Ing., PhD.	Úloha karotenoidov v agropotravinárstve (Eng: The role of carotenoids in agro - food industry)	2018	internet
8.	Klaudiny Jaroslav RNDr., PhD.	Včela medonosná (Eng: Honey bee)	2018	chat
9.	Krajčovič Tomáš Ing., PhD.	Roadshow mladých vedcov po školách (Eng: Roadshow of young scientists around schools)	2018	lecture
10.	Mastihuba Vladimír Ing., PhD.	Ako využiť biomasu na produkciu chemikálií, materiálov a palív (Eng: How to use biomass to produce chemicals, materials and fuels)	2018	internet
11.	Tkáč Ján Ing., DrSc.	Dostal európskeho „vedeckého Oscara“ (Eng: Receives European "Science Oscar")	2018	print
12.	Tkáč Ján Ing., DrSc.	J. Tkáč o projekte diagnostiky rakoviny prostaty (Eng: J. Tkáč about a prostate cancer diagnosis project)	2018	TV
13.	Bertók Tomáš Ing., PhD.	Valuácia nápadu (Eng: Valuation of an idea)	2019	lecture
14.	Květoň Filip Ing., PhD.	How sugar can save lives and discover diseases	2019	lecture
15.	Lorencová Lenka RNDr., PhD.	Vedecký stánok: Cukry v diagnostike ochorení (Eng: Science Booth Sugars in the diagnosis of diseases)	2019	exhibition
16.	Vadkertiová Renáta Ing., PhD.	Kváskovanie (Eng: Sourdoughing)	2019	radio
17.	Bučko Marek Ing., PhD.	Brněnští vědci představili unikátní elektronový mikroskop, který umí zobrazit kapsule s živými buňkami (Eng: Brno scientists have presented a unique electron microscope that can view capsules with living cells)	2020	radio
18.	Chocholová Erika Mgr., PhD.	Úspešná mladá vedkyňa Erika Chocholová: Rakovinu chcem zistiť z krvi (Eng: Successful young scientist Erika Chocholová: I want to find out cancer from my blood)	2020	internet
19.	Farkaš Pavol Ing., PhD.	Rozvoju kritického myslenia detí pomôže aj zážitkové vzdelávanie (Eng: Experiential education will also help the development of children's	2021	internet

critical thinking)

20.	Katrlík Jaroslav Ing., PhD.	Nanočipy a biosenzory (Eng: Nanochips and biosensors)	2021	TV

2.7.2. Table of outreach activities according to institute annual reports

Outreach activities	2016	2017	2018	2019	2020	2021	total
Articles in press media/internet popularising results of science, in particular those achieved by the Organization	45	16	31	26	29	20	167
Appearances in telecommunication media popularising results of science, in particular those achieved by the Organization	8	7	12	6	4	3	40
Public popularisation lectures	16	18	15	13	1	7	70

2.8. Background and management. Infrastructure and human resources, incl. support and incentives for young researchers

2.8.1. Summary table of personnel

Num.	Name
Senior researches with DrSc.	
1.	RNDr. Peter Biely, DrSc.
2.	Ing. Slavomír Bystrický, DrSc.
3.	doc. Ing. Vladimír Farkaš, DrSc.
4.	Ing. Peter Gemeiner, DrSc.
5.	Ing. Ján Hirsch, DrSc.
6.	RNDr. Mária Matulová, DrSc.
7.	doc. Ing. Ladislav Petruš, DrSc.
8.	Ing. Ivan Šimkovic, DrSc.
9.	Ing. Ján Tkáč, DrSc.
10.	Ing. Igor Tvaroška, DrSc.
Independent researchers	
1.	RNDr. Marek Baráth, PhD.
2.	Mgr. Peter Baráth, PhD.
3.	Ing. Maroš Bella, PhD.
4.	Ing. Tomáš Bertók, PhD.
5.	Mgr. Jana Blahutová, PhD.

6.	Ing. Marek Bučko, PhD.
7.	Mgr. Peter Capek, PhD.
8.	Ing. Alžbeta Čížová, PhD.
9.	Mgr. Maksym Danchenko, PhD.
10.	Ing. Pavol Farkaš, PhD.
11.	RNDr. Alena Holazová, PhD.
12.	Ing. Eva Hrabárová, PhD.
13.	Ing. Miloš Hricovíni, PhD.
14.	RNDr. Zuzana Hricovíniová, PhD.
15.	Ing. Zdenka Hromádková, PhD.
16.	Ing. Jaroslav Katrlík, PhD.
17.	RNDr. Jaroslav Klaudiny, PhD.
18.	RNDr. Karin Kollárová, PhD.
19.	Mgr. Juraj Kóňa, PhD.
20.	Ing. Zuzana Košťálová, PhD.
21.	Mgr. Stanislav Kozmon, PhD.
22.	Ing. Ľubomír Kremnický, PhD.
23.	Mgr. Danica Kučerová, PhD.
24.	RNDr. Lenka Lorencová, PhD.
25.	prof. RNDr. Alexander Lux, CSc.
26.	Ing. Vladimír Mastihuba, PhD.
27.	Ing. Mária Mastihubová, PhD.
28.	Ing. Júlia Mičová, PhD.
29.	RNDr. Ján Mucha, CSc.
30.	Ing. Jozef Nahálka, PhD.
31.	Ing. Marek Nemčovič, PhD.
32.	Ing. Ema Paulovičová, CSc.
33.	Ing. Lucia Paulovičová, PhD.
34.	Ing. Vladimír Pätoprstý, PhD.
35.	Ing. Monika Poláková, PhD.
36.	Mgr. Vladimír Puchart, PhD.
37.	Ing. Hana Schusterová, PhD.
38.	Ing. Vladimír Sládek, PhD.
39.	Ing. Eva Stratilová, PhD.
40.	Ing. Sergej Šesták, PhD.
41.	Ing. Michal Šoral, PhD.

42.	Ing. Katarína Šuchová, PhD.
43.	Ing. Renáta Vadkertiová, PhD.
44.	Ing. Alica Vikartovská, PhD.
45.	Mgr. Zuzana Vivodová, PhD.
Researchers	
1.	Mgr. Gábor Beke, PhD.
2.	RNDr. Jana Bellová, PhD.
3.	RNDr. Sandra Bieliková, PhD.
4.	Mgr. Viera Dujnič, PhD.
5.	Ing. Michal Híreš, PhD.
6.	Mgr. Ágnes Horváthová, PhD.
7.	Ing. Michal Hricovíni, PhD.
8.	Ing. Andrej Chyba, PhD.
9.	RNDr. Eduard Jáné, PhD.
10.	RNDr. Anna Kaliňáková, PhD.
11.	Mgr. Elena Karnišová Potocká, PhD.
12.	Ing. Peter Kis, PhD.
13.	Mgr. Tomáš Klunda, PhD.
14.	Mgr. Lenka Kohútová, PhD.
15.	Ing. Romana Köszagová, PhD.
16.	RNDr. Ján Kozák, PhD.
17.	Ing. Tomáš Krajčovič, PhD.
18.	Mgr. Martina Križáková, PhD.
19.	Ing. Filip Květoň, PhD.
20.	Mgr. Eva Labancová, PhD.
21.	Mgr. Maroš Laho, PhD.
22.	Ing. Soňa Malric, PhD.
23.	Mgr. Jana Mečárová, PhD.
24.	Ing. Zuzana Pakanová, PhD.
25.	RNDr. Klaudia Palenčárová, PhD.
26.	MVDr. Jana Pipiková, PhD.
27.	prof. Ing. Milan Polakovič, PhD.
28.	Ing. Božena Pribulová, PhD.
29.	Ing. Miroslav Rajninec, PhD.
30.	Ing. Andrea Smith, PhD.
31.	Mgr. Mária Šedivá, PhD.

32.	RNDr. Iveta Uhliariková, PhD.
33.	Ing. Kristína Vadinová, PhD.
34.	Mgr. Romana Vrzoňová, PhD.
35.	RNDr. Jana Ziburová, PhD.
Employees with university education involved in research	
1.	MSc. Juvissan Medalith Aguedo Ariza
2.	Ing. Viera Bedrichová
3.	Ing. Matej Cvečko
4.	Ing. Lucia Černáková
5.	Ing. Erika Farkašová
6.	Ing. Peter Haluz
7.	Mgr. Ľuboš Hudák
8.	Ing. Kristína Kianičková
9.	Mgr. Rebeka Kodríková
10.	Ing. Mária Kopáčová
11.	Ing. Hana Kováčová
12.	Mgr. Maroš Krchňák
13.	MSc. Paras Harendra Kundalia
14.	Ing. Peter Magdolen
15.	Ing. Filip Pančík
16.	Ing. Lucia Pažitná
17.	Mgr. Jaroslav Polák
18.	Mgr. Barbara Siváková
19.	Mgr. Barbora Stratilová
20.	Mgr. Kristína Šípošová
21.	Ing. Jozef Švec
22.	Ing. Jozef Turjan
Employees with university education	
1.	Bc. Barbora Alföldyová
2.	Bc. Katarína Koňušiaková
3.	Ing. Bc. Mária Lindorová
4.	Mgr. Ondrej Penzeš
5.	Ing. Ema Podobová
6.	Bc. Jaroslav Valášik
7.	Mgr. Jana Žabková
Other employees	

1.	Mária Bednáriková
2.	Veronika Bencová
3.	Alena Bordáčová
4.	Eva Filipková
5.	Ľudmila Gažíková
6.	Dominik Gúth
7.	Jana Guthová
8.	Beáta Chválová
9.	Beáta Kalivodová
10.	Eva Morháčová
11.	Milan Novosad
12.	Margita Plšková
13.	Milan Rudolf
14.	Kvetoslava Sabová
15.	Zdena Smolková
16.	Radoslava Šályová
17.	Alena Šoltésová
18.	Oľga Švančarová
19.	Vojtech Tóth
20.	Matej Vaš
21.	Mariana Vlčeková
22.	Erika Voleková
23.	Rebeca Voleková
24.	Scarlett Weinzettlová
25.	Ladislav Baláži
26.	Peter Cagáň
27.	Anna Fehérová
28.	Juraj Kozmon
29.	Marcela Kozmonová
30.	Elena Masarovičová
31.	Miroslav Pír
32.	Ing. Viliam Podoba
33.	Peter Simandl
34.	Albína Ščepánová
35.	František Špetko
36.	Veronika Voleková

2.8.1.1. Professional qualification structure (as of 31 December 2021)

	Degree/rank				Research position		
	DrSc./DSc	CSc./PhD.	professor	docent/ assoc. prof.	I.	II.a.	II.b.
Male	9	37	2	2	9	24	13
Female	1	43	0	0	1	21	22

I. – director of research with a degree of doctor of science/DrSc.

II.a – Senior researcher

II.b – PhD holder/Postdoc

2.8.1.2. Age and gender structure of researchers (as of 31 December 2021)

Age structure of researchers	< 31		31-35		36-40		41-45		46-50		51-55		56-60		61-65		> 65	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Male	7.0	3.0	7.0	6.5	4.0	3.5	4.0	4.0	5.0	4.6	3.0	3.0	1.0	1.0	5.0	5.0	11.0	2.4
Female	10.0	5.6	10.0	8.8	8.0	8.0	3.0	3.0	5.0	5.0	3.0	3.0	1.0	1.0	7.0	7.0	1.0	1.0

A – number

B – FTE

2.8.2. Postdoctoral fellowships (list of positions with holder name, starting date, duration. Add brief information about each fellow's career path before and after receiving PhD degree, etc.)

Ing. Júlia Mičová, PhD.

PhD Study: 1.10.1999 – 30. 9. 2002

Employment: 1. 10. 2002 – till now

Post-Doc Position: 30. 3. 2011 – 31. 7. 2016; Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences, Prague, Czech Republic

Career Path: She carried out the PhD study at the Institute. After PhD study she got post-doc position at the Institute. She absolved long term post-doc stay within years 2011 – 2016 in Prague at Czech Academy of Sciences. After returning she is continuing in her work at the Institute.

Ing. Soňa (Garajová) Malric, PhD.

PhD Study: 1. 9. 2005 – 31. 8. 2008

Employment: 1. 9. 2008 – 31. 12. 2021

Post-Doc Position: 21. 10. 2010 – 31. 7. 2011; Masaryk University, Brno, Czech Republic

	2. 8. 2011 – 9. 1. 2016; Australian Centre for Plant Functional Genomics, The University of Adelaide, Adelaide, Australia
	10. 1. 2016 – 31. 12. 2021; Biodiversité et Biotechnologie Fongiques, INRA, Marseille, France
Career Path:	She carried out the PhD study at the Institute. After PhD study she got post-doc position at the Institute. She absolved three long term post-doc stays within years 2010 – 2021 in Czech Republic, Australia and France. She quit the position at the Institute in 2021 and start the employment in France.

Ing. Andrea (Schenkmayerová) Smith, PhD.

PhD Study:	1. 9. 2009 – 26. 8. 2013
Employment:	30. 8. 2013 – 31. 12. 2021
Post-Doc Position:	1. 3. 2015 – 28. 2. 2017; Claude Leon Foundation scholarship, Department of Biochemistry, Faculty of Science, University of Stellenbosch, Stellenbosch, South Africa
	1. 4. 2017 – 30. 6. 2021; Loschmidt Laboratories, Masaryk University, Brno, Czech Republic
	1. 7. 2021 – till now; Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences, Prague, Czech Republic
Career Path:	She carried out the PhD study at the Institute. After PhD study she got post-doc position at the Institute. She absolved three long term post-doc stays within years 2015 – 2021, one is South Africa and two in Czech Republic. She quit the position at the Institute in 2021 and start the employment in Czech Republic.

Ing. Vladimír Sládek, PhD.

PhD Study:	1. 9. 2010 – 31. 8. 2014
Employment:	15. 10. 2014 – till now
Post-Doc Position:	1. 4. 2016 – 15. 3. 2017; Rikkyo University, Tokyo, Japan
	1. 9. 2018 – 30. 11. 2018; Center for Computational Sciences, University of Tsukuba, Tsukuba, Japan
Career Path:	He carried out the PhD study at the Slovak Technical University. After PhD study he got post-doc position at the Institute. He absolved two long term post-doc stays within years 2016 – 2018, both in Japan. After returning she is continuing in her work at the Institute.

Ing. Jaroslav Filip, PhD.

PhD Study:	1. 9. 2009 – 26. 8. 2013
Employment:	1. 9. 2013 – 31. 12. 2016
Post-Doc Position:	1. 1. 2016 – 31. 12. 2016; Qatar University; Doha, Qatar
Career Path:	He carried out the PhD study at the Institute. After PhD study he got post-doc position at the Institute. He absolved long term post-doc stay in years 2016 in Qatar. He quit the

position at the Institute in 2016 and start work outside the research.

Ing. Peter Kis, PhD.

PhD Study:	1. 9. 2014 – 31. 8. 2018
Employment:	1. 4. 2015 – till now
Post-Doc Position:	Position: 1. 10. 2021 -31. 5. 2024; Instituto de Tecnologia Química e Biológica António Xavier, Universidade Nova de Lisboa, Lisbon, Portugal
Career Path:	He carried out the PhD study at the Institute. After PhD study he got post-doc position at the Institute. He is on long-term post-doc stay since 2021 u to 2024 in Portugal. He plans to continue in work at the Institute after finishing the stay.

2.8.2.1. MoRePro and SASPRO fellowships

Mgr. Stanislav Kozmon, PhD. - SASPRO – 01. 07. 2016 – 31. 12. 2018

2.8.2.2. Stefan Schwarz fellowships

Ing. Ľudmila Belická (Kluková), PhD. - 01. 01. 2017 – 30. 04. 2018

Ing. Maroš Bella, PhD. - 01. 05. 2014 – 30. 04. 2018

Ing. Vladimír Sládek, PhD. - 01. 06. 2018 – 31. 05. 2021

2.8.2.3. Postdoctoral positions from other resources (specify)

National Stipendia Programme:

RNDr. Petr Kulhánek, PhD; Central European Institute of Technology Masaryk University Brno, Brno, Czech Republic; 01. 03. 2018 – 30. 06. 2018

2.8.3. Important research infrastructure introduced during the evaluation period with the information about the sources of funding *(max. 2 pages)*

i) Major instrumentation

none

ii) Other instrumentation

Easy-Spray - nano Ion Source for Orbitrap Elite mass spectrometer (Thermo Scientific);

SampleCASE Cooled - automated sample rack with cooling for Bruker Avance III HD 600 MHz NMR spectrometer;

Biacore X100 - analysis system to determine affinity and kinetics of protein-protein interactions;

NanoSight NS300 - determination of size and count of nanoparticles with high resolution results

2.9. Supplementary information and/or comments on all items 2.1 – 2.8 (max. 2 pages in total for the whole section)

Unlike previous accreditation, when more than 25 major pieces of equipment and more than 40 other instruments were obtained, during the monitored period (Chapter 2.8.3), we have suffered from a complete lack of opportunities to modernize our research infrastructure. It was caused by a combination of incompetence of responsible Slovak state agencies to deliver European Funds to our research environment, lack of funds dedicated to the Bratislava region and non-existent/insufficient support for research infrastructure from the state/public sources.

3. *Implementation of the recommendations from the previous evaluation period*

Comments and recommendations for further improvement of the institute from previous acreditation:

Comments from the previous acreditation:

1. The large number of expensive new sophisticated instruments obtained from the structural funds is seen as problematic, because follow up costs for management. maintenance and staff training that will be required to operate the instruments efficiently and at their full capacity will be a considerable burden on the budget of the institute . This is particularly important as many of the instruments will be out-dated in a few years due to continuing technical developments, so that operating the instruments at their full capacity should be a near-term priority. A strategy for optimal use of this infrastructure within the SAS should be developed.
2. An international scientific advisory board should be established.
3. Hosting an ERC starting grant is a highlight of the institute. the research direction opened by this project should be continued at the institute after the ending of the grant period.
4. Further improving output in high-level scientific journal publications and hiring younger personnel as scientific staff to decrease average age of scientists should be achieved.
5. Eight scientific and two more service-oriented departments is a rather high number of departments. possibilities to consolidate different departments should be considered.

Add 1: Acquisition of a large number of sophisticated instruments in the previous reporting period appeared to be a very good strategy for the Institute. Under normal conditions, funding of the research infrastructure is a continuous process allowing instrument upgrades, training personnel and maintaining acquired skills and knowledge within the research groups. This is not the case in Slovakia. As mentioned in the section 2.9, there were very few, if any, opportunities to apply for infrastructural funds during the reporting period creating a wide gap in available research infrastructure for the future.
Obtained instruments in question allowed us to apply and participate in many domestic and foreign research projects that raised enough resources to cover necessary maintenance costs. At the same time, we are aware of the responsibility arising from the unique instruments' ownership towards Slovak science in general. As can be demonstrated at the Laboratory of Proteomics, we have created a proteomic core facility using our own resources that collaborates not only with the institutes of SAS but also with universities and private companies. This also represents an additional source of funds that can contribute to covering the running costs, however, it is insufficient to renew the infrastructure on the large scale.

Add 2: An international scientific advisory board has been established. List of the board members is in paragraph 1.4.1.

Add 3: The principal investigator Ing. Ján Tkáč, DrSc. of the mentioned ERC starting grant has been awarded by successor ERC proof of concept grant. He is the only ERC grant holder at the Institute for now. The research in this filed is continuing at the Institute with great success. We encourage another young perspective people in submitting ERC proposals.

Add 4: In the last years the slight increase in the publication activity has been noticed. Altogether over 390 scientific papers have been published over the monitored period. One third of the published papers have impact factor higher than 4, in selected publications in paragraph 2.1.5. the average impact factor reaches value of 6.40. There is also increasing trend in the employment of young post-docs. Hearing of young post-docs from abroad is quite challenging mainly because of very low salary and lack of grant money in comparison to the neighboring countries. If it is possible, we will plan to support a few post-docs positions from the institutional money in future.

Add5: The whole organization structure of the Institute has not been changed yet. The reorganization leading to establishment of the interdisciplinary research groups across current department structure is in process.

4. ***Research strategy and future development of the institute for the nextfive years*** (Recommended 3 pages, max. 5 pages)

Research strategy of the institute in the national and international contexts, objectives, and methods (including the information on when the strategy was adopted)

The Institute of Chemistry of the Slovak Academy of Sciences, a public research institution (the IC SAS), has a successful, almost 70-year-old history in research, mainly in the field of structure, chemistry, biochemistry, and carbohydrate biology. As of 1st January 2022, it transformed into a public research institution. During its existence, the IC SAS has become a globally recognized institution in the field of glycochemistry, glycobiochemistry, and glycobiology, and it has also achieved many unique results in these areas. The organizational structure of the IC SAS currently includes eight scientific departments, plus an analytical department and an implementation department. Historically, research at the IC SAS specilised in several primary areas of research, which include the following areas:

- Synthesis and structure of important carbohydrates and oligosaccharides and their derivatives;
- Glycobiotechnology;
- Physico-chemical methods for determining the structure of carbohydrates, oligosaccharides, and glycans;
- Structure, function, biochemical characterisation and mechanism of action of glycosylhydrolases and glycosyltransferases;
- Structure and function of polysaccharides and their glycoconjugates;
- Ecology, taxonomy, and phylogeny of yeast microorganisms;
- Development of rare carbohydrate syntheses and isolation of natural substances for commercial purposes.

SWOT analysis

The SWOT analysis will serve very well to clarify the current strengths and weaknesses, opportunities, and threats of the IC SAS.

Strengths

The strengths of the IC SAS include:

- Stable working environment
- Executive Implementation Department
- Very good instrumentation
- Top scientific groups

Weaknesses

Weaknesses may include:

- Insufficient funding from the state budget
- Low success in APVV and international grant schemes
- Low mobility of foreign doctoral and post-doctoral students
- Insufficient publishing activity
- A low number of Doctors of Sciences of the working age
- Relatively high age average
- The Institute's website does not reflect the present

Opportunities

The strengths and weaknesses described create the following opportunities:

- Visibility of commercial products of the implementation department on the website
- Obtaining a certificate (certificate) on the implementation of a quality system according to the standards of the ISO 9000 series or the principles of good laboratory practice, GLP (Good Laboratory Practice, GLP) from official institutions
- Creation of a certified analytical laboratory for commercial analyses
- Better promotion of possible bachelor's, diploma and doctoral theses
- Better cooperation with universities
- Attracting foreign scientists (SASPRO 2, National Scholarship Programme, IMPULSE, ...)

Threats

The following options pose the greatest threats to the Institute:

- Reduction of the accreditation level due to low publishing activity
- Loss of some accredited fields of doctoral study
- Strong competition for implementation products, mainly from China
- Change of the economic enviroment of the Institute after its transformation to public research institution

As can be seen from the SWOT analysis, the IC SAS has great potential; the biggest problems could be the insufficient funding, the inclusion of the economy of the Institute in non-profit organisations after its transformation to the public research institution, and low publishing activity. Currently, the remuneration of authors of publications is provided by the Institute, which does not seem to be a sufficient motivation to increase publishing activity. For this reason, it is planned to introduce regular evaluations of researchers and groups and to introduce performance funding based on regular evaluations of research groups and staff (additional support for excellent groups and staff), but new updated evaluation rules need to be developed in collaboration with the Governing Board and the Scientific Council of the Institute.

In order to increase the credibility of the Institute, it is also necessary to better promote the research carried out at the Institute, the products of the implementation department, and the possibility of elaborating bachelor's, diploma and doctoral theses. This could be achieved through the creation of a modern, clear, and multiplatform website of the Institute, as well as greater promotion of the Institute and the products of the implementation department at scientific conferences abroad. The promotion of vacant student positions, from bachelor's to doctoral, through social media and the Internet would also help to expand the cooperation of the Institute as an external educational institution with other Slovak universities. We consider greater cooperation between the Institute and universities crucial, whether in student education or joint scientific projects.

An increase in international scientific credit can be achieved by promoting international mobility, for example by requiring doctoral students to complete their internships at foreign workplaces, by engaging in international cooperation, and by increasing the mobility of young researchers.

To retain excellent doctoral students and support their research, we plan to introduce an internal grant scheme to support excellent doctoral students.

The increased age average is also related to the low number of researchers with a DrSc degree, because many existing doctors of sciences have already left or will soon retire. In this case, it is important to increase support for researchers who meet or are close to meeting the criteria for the award of a DrSc. Along with that, the credit of the Institute would also increase significantly.

Last but not least, we consider it important to support the *Production department* by transferring the acquired new commercially interesting products and procedures from basic research at the Institute to the department's offer. The credit of the *Production department* would also increase significantly by obtaining a certificate of compliance with the principles of good laboratory practice (GLP) and possibly also good manufacturing practice (GMP). Obtaining such certificates will open the possibility of direct cooperation with large companies dealing with the sale of chemicals or with pharmaceutical companies that need to have a certified origin of the chemicals used, which may ultimately lead to an increase in sales profits.

Other areas included in the development plan are as follows:

A. Increasing the quantity and quality of research outputs

- Modify the existing incentive model for rewarding individuals' publication outputs, which will, in addition to the impacted publications registered in Current Contents, also take into account publications in impacted non-CC journals according to WOS and SCOPUSand the journal quartile;
- On the basis of regular annual evaluation of publishing activities of individuals (average for the previous 4 years) to adjust personal evaluation and classification into salary classes;
- When allocating new postdoctoral and doctoral positions, the publishing activities of the supervisors will be taken into account.

B. Improving the quality of doctoral studies

- Develop internal criteria of the IC SAS for selection of supervisors; the condition is active and high-quality publishing activities and the existence of a project within which the PhD study is carried out;
- Pay more attention to the topics of doctoral theses in terms of content, timeliness, and experimental support;
- Continue to evaluate the results of doctoral students and the status of doctoral studies on a regular basis;
- Increase the number of foreign doctoral students; to enable internships of our doctoral students in prestigious laboratories and reciprocally enable internships of foreign doctoral students at the IC SAS in connection with the concluded agreements on the cooperation of the SAS with research universities.

C. Career growth of postdoctoral students and researchers

- Develop conditions for the career growth of postdoctoral students;
- Develop conditions for obtaining a permanent position.

D. Increasing success in project activities

- Initiate and stimulate the submission of ERC, ERA, Horizon Europe projects etc., especially in the category of starting and consolidator grant, to identify potential applicants, and work with them;
- Analyze the organization's project submission activity on an annual basis;
- Make the allocation of PhD students conditional on obtaining grants from potential trainers.

E. Institute management

- Develop multidisciplinary research in cooperation with other scientific organisations of the SAS and outside the SAS;
- Re-evaluate the activities of individual departments and optimise the composition of research teams.

F. Intellectual Property Management

- Prepare the rules for dealing with intellectual property (patents, etc.) or apply the rules common to the entire SAS and stimulate patent activities of researchers.

G. Funding and management of research infrastructures

- Carry out a regular audit of the use of the research infrastructure acquired over the last 10 years and remedy the shortcomings identified;
- Update regularly the information on the possible use of major facilities for external interested parties both from the SAS and outside the SAS;
- Participate in the development of a strategy of involvement with the infrastructure in the so-called core facility within the SAS premises, or within the EU funds.

Bratislava, June 30th 2022

Mgr. Stanislav Kozmon, PhD.

Director