Questionnaire

Summary of the main activities of a scientific Organization of the Slovak Academy of Sciences

Period: January 1, 2003 - December 31, 2006

I. Formal information on the assessed Organization:

1. Legal name and address

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

2. Executive body of the Organization and its composition

Directoriat	name	age	years in the position
director	Igor TVAROŠKA Ján HIRSCH	62 62	2004 - 1996 - 2003
deputy director	Miroslav KOÓŠ	54	1992 -
scientific secretary	Mária MASTIHUBOVÁ Mária MATULOVÁ Nadežda KOLAROVA	39 53 61	2006 - 2005 2000 - 2004

3. Head of the Scientific Board

Grigorij KOGAN (2006 -)
Peter BIELY (2004 - 2005)
Igor TVAROŠKA (2003)

4. Basic information about the research personnel

i. Number of employees with a university degree (PhD students excluded) engaged in research and development and their full time equivalent work capacity (FTE) in 2003, 2004, 2005, 2006 and average number during the assessment period

ii. Organization units/departments and their FTE employees with the university degree engaged in research and development

Research staff	2003		2004		2005		2006		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
Organization in whole	69	59	68	61	66	65	71	69	68,5	63,5
Enzymology of Saccharides	5	5	6	5	5	5	5	5	5,25	5
Glycobiology	10	10	11	10	10	10	11	11	10,5	10,25
Glycobiotechnology	7	6	10	8	9	9	11	10	9,25	8,25
Glycochemistry	11	10	11	10	11	11	12	12	11,25	10,75
Glycomaterials	4	4	4	4	4	3	4	3	4	3,5
Immunochemistry of Glycoconjugates	7	6	8	8	8	8	9	9	8	7,75
Structure and Function of Saccharides	10	9	10	8	11	11	11	11	10,5	9,75
Culture Collection of Yeasts	3	3	3	3	3	3	3	3	3	3
Analytical Department	3	3	2	2	2	2	2	2	2,25	2,25
Production Department	3	3	3	3	3	3	3	3	3	3

5. Basic information on the funding

i. Total salary budget[1] of the Organization allocated from the institutional resources of the Slovak Academy of Sciences (SAS) in 2003, 2004, 2005, 2006, and average amount for the assessment period

Salary budget	2003	2004	2005	2006	average
total salary budget (millions of SKK)	23,820	24,611	24,623	25,723	24,694

[1] Sum of the brutto salaries without the fund contributions.

6. URL of the Organization's web site

http://www.chem.sk/

II. General information on the research and development activity of the Organization:

1. Mission Statement of the Organization as presented in its Foundation Charter

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:
-synthesis, biosynthesis, structure, and transformation of biologically important mono- and oligosaccharides and their derivatives;
-structure and functional properties of polysaccharides, their derivatives, and conjugates with other polymers;
-structure, function, and mechanism of action of glycanases;
-development of physicochemical methods for structural analysis of carbohydrates;
-gene engineering and nutritional and biologically active proteins;
-glycobiotechnology, biotechnological potential of microorganisms;
-ecology, taxonomy, and phylogenesis of yeasts and yeasts-like fungi;
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 realizes 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, co-operations, know-how, licences, and consulting and expert's services. For popularization of its outputs, the Institute takes part in specialized 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 and distributed by Springer Verlag.
f) The Institute organizes regularly international scientific conferences and symposia (Bratislava Symposium on Carbohydrates, European Carbohydrate Symposium, 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, and biotechnology. In these fields, doctoral and

postdoctoral studies, including also foreign students, respectively, are organized. The Institute provides also participation on pedagogic process at universities.

2. Summary of R&D activity pursued by the Organization during the assessed period, from both national and international aspects and its incorporation in the European Research Area (max. 10 pages)

Department of Enzymology of Carbohydrates

After cellulose, the polysaccharide xylan, represents the second most abundant polymer in nature. Similarly as other components of plant biomass, xylan is annually renewed. In contrast to cellulose, it is not sufficiently utilized and its large portion is lost in the process of cellulose isolation from wood or annual plants. Hemicelluloses, in general, require more attention for rational and more complete utilization. In nature, xylan is destroyed in the process of carbon cycle with participation of microorganisms. In the last years xylanases attracted a great attention due to discovery of possibilities of their applications in the pulp and paper industry, food industry, and animal diet. The enzymatic treatment of dissolving pulp leads to partial hydrolysis of lignin-xylan complexes, which facilitates lignin extraction resulting in important reduction of toxic chemicals used for the pulp bleaching.

The members of the Department of Enzymology of Carbohydrates contributed significantly to current knowledge of the xylanolytic enzymes. They elucidated in detail the mode of action and stereochemistry of hydrolysis of glycosidic linkage by these enzymes. They pointed to diversity of these enzymes in microbial kingdom. They showed that members of individual families of endoxylanases differ in catalytic properties. For instance, endoxylanases of family 10 hydrolyze xylans to a much higher degree than endoxylanases of family 11. They also contributed to discovery of new types of endoxylanases and understanding of the reasons for production of multiple enzymes by the same microorganism. Number of experimental methods which they introduced for screening and detection of enzyme activities are used all over the world. Some of the substrates are marketed by Sigma company. The research group belongs to the most frequently cited in Slovakia.

The members of the Department have the main merit on the discovery of new components of hemicellulolytic enzyme systems represented by carbohydrate esterases. Their discovery of acetylxylan esterase in 1985 led to recognition of series of other types of esterases participating in plant cell wall hydrolysis, such as acetylgalactoglucomannan esterase, feruloyl and cumaroyl esterase. Last year (2006) they published a discovery of another carbohydrate esterase, called glucuronoyl esterase that might be involved in hydrolysis of ester linkages between hemicellulose and lignin, found in plant cell walls. In recent years, the group contributed maily to the current knowledge of catalytic properties of acetylxylan esterases.

All these achievements contributed significantly to current understanding of microbial degradation of plant biomass and development of processes of its bioconversion. The impact of the research of carbohydrate esterases can be

expected in future in view of partial or full replacement of alkaline processes of disintegration of plant biomass by enzymes.

The Department of Enzymology of Carbohydrates has been for years involved in several types of international collaboration and networking.

Department of Immunochemistry of Glycoconjugates

Thanks to APVT grant from the first call, we managed to create a laboratory focused on a new perspective research at the Institute of Chemistry. More specifically, it is immunochemistry of carbohydrates as dominant surface antigens of yeasts and bacteria. We began to engage in special chemistry of semi-synthetic glycoconjugate preparation based on natural microbial isolates. We have published new procedures for modification of polysaccharide antigens, means of binding them to protein carriers, as well as newly prepared linkers. We prepared, characterized and published reports on the glycoconjugates based on surface carbohydrates of *Candida albicans, Saccharomyces cerevisiae, Cryptococcus laurentii*, and *Vibrio cholerae* O1. We obtained antisera that showed elevated levels of specific class IgM, IgG, and IgA antibodies upon immunization of the experimental animals with our glycoconjugates. The raise of IgG antibody levels with all mentioned glycoconjugates considerably surpassed the effect of immunization with whole cell microbes. Th1 domination, which is important for vaccination, was verified by subclass IgG analysis. We published a report on the protective effect of *C. albicans* and *Cr. laurentii* antisera demonstrated by inhibition of microbial growth. The results obtained show high efficiency of combination of purposely aimed syntheses, exact chemical and physico-chemical analyses of glycoconjugates and final monitoring of immune response.

The results of the research in the area of lignin confirm that its products derived from chemical wood treatment for paper production represent important renewable raw material for preparation of the antigenotoxic compounds capable to reduce DNA damage induced by oxidation and/or alkylation in various cell lines. The development of novel lignin-based anticarcinogenic and antimutagenic preparations indicating high degree of valorization of lignin waste products from pulp and paper industry was recognized by Ministry of Environment of Slovak Republic at the International Conferences TOP 2003 and 2006.

Investigations in the area of biologically active fungal polysaccharides was focused on the cell wall β-D-glucan was isolated from the cell walls of baker's yeast *Saccharomyces cerevisiae* and glucomannan isolated from the cell walls of the industrial yeast strain *Candida utilis*, as well as chitin-glucan complex prepared from the mycelium of filamentous fungus *Aspergillus niger* used for the production of citric acid.

A systematic study of antioxidant, antimutagenic, and antigenotoxic activities of the studied fungal polysaccharides and their derivatives carried out on different organisms including yeasts, bacteria, plants, algae, flagellates, as well as mammalian cells and isolated DNA proved that these polysaccharide revealed pronounced protective effects in all tested model systems. Antioxidant activity of the polysaccharides was also corroborated by Spin-trap Electron Paramagnetic Resonance spectroscopy that revealed their radical scavenging activity. Water soluble derivatives of β-D-glucan prevented growth and metastasis of Lewis lung carcinoma and lymphosarcoma tumors, showed synergistic antitumor effect with a known cytostatic drug cyclophosphamide, and moreover suppressed its toxic side-effects. Carboxymethyl glucan also acted as a potent stimulant of tumor

necrosis factor α from macrophages. Besides, carboxymethyl glucan revealed protective anti-arthritic activity in an experimental model of adjuvant arthritis in rats.

Fungal polysaccharides also showed plant-protective activity against fungal pathogens and acted as mycotoxin adsorbents.

A complex study of the processes of degradation of hyaluronic acid due to free radical action or other oxidative agents resulted in a series of publications and reviews on this topic and led to a suggestion of a novel advantageous procedure for application of hyaluronan in therapeutic treatment of arthritis.

Department of Glycobiology

Plant cell wall remodeling enzyme xyloglucan endotransglycosylase/hydrolase (XTH) is the subject of study of two projects. The enzyme plays an important role in plant cell wall expansion and growth. Understanding its structure and function will enable rational regulation of plant development and growth. Individual isoforms of the enzyme are being purified and characterized.
Pectolytic enzymes are another group of enzymes that traditionally have been studied in our Department. The studies are aimed at preparation of homogenous fractions of individual enzyme forms and study of relation between their structure and function.

Development of new selective antifungal drugs largely depends on the knowledge of structure and biosynthesis of fungal cell walls. We are using the yeast *Saccharomyces cerevisie* to study the role of the enzyme transglutaminase (EC 2.3.2.13) in the incorporation of proteins into the cell wall structure. Pathogenic yeast *Cryptococcus neoformans* is used to study the metabolic stability of the major virulence factor the polysaccharide capsule.

The research is oriented toward selection and characterization of strains of the soil fungus *Trichoderma* effective in biocontrol of different phytopathogenic fungi. Within this frame, the role of various environmental factors in regulation of sporulation of the fungus is being studied. Obtained knowledge is used in optimization of spore production in submerged fermentations.

The aim of the further project is to study relationship between structure and function of fucosyltransferases (FuTs) and utilization of this knowledge in elucidation of molecular basis of catalysis and their substrate specificity as the main prerequisite in preparation of new generation of inhibitors. As prime target are “core type” fucosyltransferases – recently cloned from plant *Vigna radiata* and *Arabidopsis thaliana*. These enzymes catalyze forming an immunogenic epitope on the region of N-linked glycans, also found in some cell lines of biotechnological importance. So far, the 3D structure of core type fucosyltransferase is not solved yet, as well as little is known about the molecular basis of their enzyme specificity. In order to predict structural similarities within the large super family members a PC assisted work has been done. Protein structural similarities, peptide motifs and protein domains of fucosyltransferase homologous have been elucidated. In order to delineate the minimal catalytic domain we have engineered enzymes (lacking N - and C-terminal regions) into plasmid vector for heterologous expression in *Pichia pastoris* and *Drosophila* S2 *cells*.

Laboratory of Glycobiology participates in the institute project, leading into development, synthesis and testing of new generation of TS-inhibitors of glycosyltransferases (GnTs). Our prime task was to establish *in vitro* detection system to screen potency of newly synthesized inhibitors toward the

glycosyltransferase catalyzing transfer of GlcNAc to an appropriate specific acceptor substrate. Engineered *Drosophila* expression system (DES) was capable of secreting of recombinant rabbit GnTI for initial inhibition studies. Furthermore DES was engineered for expressing of human GnTV. In the first attempt we have screened the reaction intermediates of the synthetic pathway of TS analogues, which does not fully mimics the dissociate transition state when bound to the glycosyltransferase yet. Preliminary examination of compounds showed an inhibition effect toward recombinant GnTI ranging in uM concentration.

Antimicrobial peptides have important role in the protection of animal and plants against bacterial and fungal pathogens. In our research, we study the role of antimicrobial peptides defensins in the defense and the resistance of honeybee colonies against most serious honeybee larval disease - American foulbrood disease. It causes big losses to beekeepers, because sick honeybee colonies and whole hives have to be burned according to veterinary regulations.

Department of Glycobiotechnology

Research and development (R&D) activities pursued at the Department of Glycobiotechnology (DGBT) were directed towards immobilization biotechnologies as cell factories, biosensors, lectinology, microbial and plant biotechnology.

Research interests included R&D of novel and universal immobilization techniques for improvement of efficiency of microbial cells and enzymes as biocatalysts in enantioselective syntheses of chiral compounds and prodrugs as well as multienzyme preparation of synthetic receptors for cells. A novel immobilization technique for *Nocardia tartaricans* cells as a model biocatalyst in uniform polyelectrolyte complex capsules utilizing a continuous encapsulation process was developed. This technique improved the production of L-(+)-tartaric acid as compared with conventional gelled beads. Novel modular enzymes containing cellulose-binding module from mesophilic organism *Clostridium cellulovorans* and catalytic module from thermophilic organism *Pyrococcus furiosus* were produced. The latter cells were utilized for development of thermoswitched immobilization technique.

Biosensor activity was oriented towards fabrication of amperometric biosensors using either different enzymes or microbial cells. The method of an efficient solubilization of carbon nanotubes followed by fabrication of a robust amperometric biosensor for selective detection of galactose in blood plasma in the presence of interfering compounds was developed. A flow injection analysis system equipped with enzyme biosensors based on amperometric or calorimetric principles (FIA system) was constructed for on-line monitoring and controlling of glycerol bioconversion to 1,3-propanediol. On-line sample analyses were successfully performed by FIA system in laboratory (1.5 L) and industrial scale (300 L) fermentors.

R&D activity regarding lectinology included evaluation of exogenous lectins in biorecognition studies of glycoenzymes and glycoproteins. Lectins with different saccharide specificities were used for characterization of native and recombinant glycoenzymes and for detection of P-glycoprotein developed multidrug resistance (MDR) progress against cytostatic drug vincristine in mouse leukemic cells L1210. The utilization of lectins in immobilization techniques was oriented on study and evaluation of biospecific binding of industrially important enzymes synthetically (mannan-penicillin G acylase) and naturally glycosylated (glucose oxidase) as well as recombinant enzyme glucoamylase on Concanavalin A.

Plant biotechnology studied the activity of galactoglucomannan oligo-saccharides (GGMOs) in plant model systems during the elongation growth, differentiation and protection. It was found that GGMOs inhibition of elongation growth induced by auxins, or gibberellin, is connected with changes in the activity of some enzymes (glycosidases, glycanases, XET, peroxidase) modifying physical and chemical properties of the plant cell wall. GGMOs affected the induction, growth, morphology and structure of advetitious and lateral roots, as well as of roots treated with cadmium. Increasing cell density and alteration of the protoxylem/metaxylem tracheary element (TE) ratio by GGMOs in zinnia cells was observed. Mannans seem to act as signaling molecules naturally present in cells involved in TE differentiation. Several genes had rapidly modified transcript levels during TE formation in the presence of GGMOs. Production of pharmaceutically important secondary metabolites by elicitation *in vitro* utilising abiotic factors in *Mellisa officinalis* L. and *Rubia tinctorum* L. was studied. Cellobiose, D-galactose and D-mannose significantly increased *in vitro* production and secretion of the main antitumoral substance of *Taxus baccata* L., paclitaxel, into the medium.

Department of Structure and Function of Saccharides

Research at the Department of structure and function of saccharides is aimed at understanding structure-function relationships. Wide range of biologically active saccharides has been studied by NMR spectroscopy. Considerable efforts were focused on glycosaminoglycans (di-, tetra- and pentasaccharides, polysaccharide heparin and their derivatives) in solution and in the complex with growth factors (FGF-1 and FGF-2). It is assumed that the analysis will enable synthesis of pharmaceuticals with anti-angiogenic properties. Further analyses were focused on the metabolism of anaerobic bacteria *Fibrobacter succinogenes* 85 and *Ruminococcus albus* 20. NMR spectroscopy helped to analyze the structure of biologically active mannan isolated from human pathogen *Candida dubliniensis*. Results of these studies will be used in immunological studies. In the synthetic part, 8-carbon aldoses, ketoses (e.g. D-glycero-L-galacto-octulose, which affects intracellular communication in plants), and alditols were prepared using the catalytic effect of molybdate ions.

Theoretical methods were focused on the catalytic mechanism of glycosyl-transferases, glycosylhydrolases and characterization of the structures that are produced during the enzymatic reactions. Studies of structures of transition state using molecular modeling and simulation methods enabled proposals of new types of inhibitors of these enzymes. These inhibitors have a potential of being an efficient pharmaceuticals in prevention of various diseases. Quantum-chemical methods were used to analyze NMR parameters of glycosaminoglycans (mono- and disaccharides). Comparison of theoretical and experimental data showed that the methods used are reliable not only for structure determination but spin-spin coupling constants as well. Investigation of the glyconanoparticles is the project funded by 5th Program of EU.

Results of these studies were obtained due to the support of the government (VEGA and APVT), international grant agencies (5th and 6th EU program, Mizutani grant) as well as international collaboration (France, Italy, Spain, Germany, USA, Canada). Total support from the EU and the Mizutani grants was about 11 million SK. A part of finances (4,3 million) was from the governmental program (2003SP200280203) supporting the infrastructure of the National Centre of NMR spectroscopy. Further support within the latter program is expected during 2007

(altogether about 60 million SK) in order to equip the lab with a new 600 MHz spectrometer and the reconstruction of the existing 300 MHz instrument. NMR courses and other activities were carried out within this program. Courses from Biophysical chemistry at the University of Luebeck and NMR spectroscopy at the University Clermond-Ferrand and PhD students funded by two MRTN projects of EU belong among other activities of the department. A new computer lab (with several computer clusters and workstations) has also been build.

Department of Glycomaterials

From various medicinal plants (*Salvia officinalis, Aloe vera, Arctium lappa*, *Mahonia aquifolium*) biologically active polysaccharide mixtures and purified polysaccharide components were isolated and structurally characterized. Their biological activities were studied in cooperation with national and foreign institutions in the framework of international projects COST D13, COST D28 and national VEGA project. Crude polysaccharide mixtures exhibited antitussive activities, which exceeded those of synthetic non-narcotic preparations. Moreover, no undesirable side-effects were observed. Some polysaccharides exhibited also significant immunomodulatory activities. A direct relation between the immunostimulation and antitussive activities and the primary structure of the polysaccharides was not proved. However, the effect of the frequently present phenolic antioxidants was evident. The preparations represent prospective natural herbal pharmaceuticals for stimulation of the immune system and, with regard to absence of side-effects; they are suitable for suppressing the cough-reflex.

From buckwheat hulls and wheat bran representing an important dietary fibre source, xylan-phenolic complexes (XPC) have been isolated using mild extraction conditions, or by original procedures including ultrasound treatment. XPC from both resources showed high antioxidant activities, comparable to that of the commercial food antioxidant α-tocopherol and exhibited significant immunomodulatory activity ''*in vitro*''. With respect to the physicochemical, immunological and antioxidant activities, the preparations are potential hydrocolloid additives with valuable biological effects applicable in food products and as immuno-enhancing pharmaceuticals. A XPC from buckwheat hulls with high antioxidant activity was prepared in pilot plant scale. It represents a new bread-processing additive to low-quality flours, because it increases its effectiveness and the quality of dough, improves the sensory properties and retards aging of bakery products. The results were successfully applied in PMD-Union, a.s., Bratislava (Project VTP).

In the framework of the COST D29 and APVT-51-015802 projects, several novel procedures were elaborated for partial hydrophobization of commercial polysaccharides (HEC, CMC, CMS) and beech wood xylan with the purpose to prepare amphiphilic polysaccharides with new functional properties. Classical and non-conventional methods (i) esterification with mixed C_2/C_{12} anhydrides and (ii) transesterification with vinyllaurate and methyllaurate with and without solvents were investigated using conventional and microwave heating sources. The most convenient methods were the transesterification with vinyllaurate at moderate reaction temperature, and with methyllaurate at higher temperatures, which can be performed even in the absence of organic solvents. They represent ecologically more appropriate processes for the production of amphiphilic polysaccharides. By applying microwave irradiation, the reaction time can be

decreased from hours up to only few minutes, which is important from the economic viewpoint.

The solubility and functional properties of the newly prepared derivatives were influenced not only by degree of esterification, but also by the content of the carboxyl groups. Many water-soluble derivatives with low degree of esterification (DS) exhibit excellent emulsifying efficiency for emulsions of the oil/water type as well as acceptable detergent performance tested by washing power and antiredeposition effect. Due to the very low amounts of esters groups, a loss of biodegradability of the derivatives can be excluded. At DS, the C_{12} and C_{16}-fatty acid esters of CMC and xylans showed increased thermal stability and were suggested to be suitable as additives to blends with synthetic polymers.

From citrus pectin, hydrophobized derivatives were prepared by introduction of $C_{4\text{-}12}$–alkyl and alkylamide groups. The water-soluble derivatives of all polysaccharides represent polymeric biosurfactants with potential utilization in food industry, cosmetics, detergent formulations, and other technical applications.

Department of Glycochemistry

Department of Glycochemistry consists of the Laboratory of Sugars and Glycomimics, Laboratory of Ionized Saccharides, and Laboratory of Biocatalysis and Organic Synthesis and deals with the several aspects of the chemistry research of carbohydrates. The research approaches are in accordance with present modern trends in carbohydrate research and glycobiology.

The main recent accomplishments of Laboratory of Sugars and Glycomimics are synthesis of oligosaccharides, particularly of the linear and branch-chain xylanes, 4-*O*-methylglucuronoxylanes and arabinoxylanes as structural motifs of non-cellulosic polysaccharides; synthesis of derivatives of alkyl(aryl) 2-thio-3-acetamido-β-D-sorbofuranoside as potential inhibitors of glycosyl transferases; synthesis and structural analysis of precursors of saccharide-amino acid conjugates of the mannojirimycin and nojirimycin types as potential antiviral and anticancer agents; regiospecific synthesis of five-member sugar rings; synthesis of ethereally linked glycolipids as non-toxic, immunity stimulating agents mimicking natural lipid A; further extension of the assortment of available chemical transformations of C-glycosyl-nitromethanes for synthesis of glycomimics (electron-transfer reduction, acid-catalyzed methanolysis and mercaptolysis). The part of the research was in 2001-2004 coordinated within the COST D13/015 Project "Glycolipid Mimics against Sepsis".

The main research activities of the Laboratory of Ionized Saccharides were focused on the introduction of ion-exchanging groups into starch, polygalacturonic acids, cyclodextrins, sucrose, sugar beet fiber and other plant materials. Objectives were to study the influence of the ion-exchange groups, supramolecular structure, solvents and other factors on solubility, reactivity and thermal stability of these materials. Methodology has been developed for testing wood materials with flame-retardant properties based on different ions presence.

Methods of preparation of convenient substrates for detection and study of the substrate specificity and action mechanism of the feruloyl esterase have been developed recently and are being further evolved in the Laboratory of Biocatalysis and Organic Synthesis. Distinct regioselective chemical and chemoenzymatic methods of acylation of carbohydrates were also elaborated and are further developed. Research of glycosidases for stereoselective preparation of aromatic glycosides has been performed in the Laboratory as well.

Culture Collection of Yeasts

Culture Collection of Yeasts is involved in two major activities:
a) work associated with maintaining and expanding the Collection
b) realization of research projects

The Culture Collection of Yeasts (CCY) has the general character. It holds 3 200 strains of yeasts and yeast-like microorganisms including biotechnologically important yeasts, pathogenic strains, type strains, patent strains, and fresh isolates from various sources. The CCY offers also following services: distribution of yeasts, identification of unknown strains, isolation of yeasts from the nature and contaminated materials, safe deposit and deposit of patent cultures including the commitments according to the Budapest Treaty. The CCY is a member of European Culture Collections Organization (ECCO) and World Federation of Culture Collections (WFCC). It is listed in the World Directory of Collections of Cultures of Microorganisms under No. 333.

The aim of our previous projects was to investigate the yeasts associated with the soil environment and plant materials. Soil is one of the most heterogenous environments that exist in nature. The project was focused on to the diversity and taxonomy of yeasts and yeast-like microorganisms isolated from agricultural soil, their morphological and physiological properties, the possibility to survive under stress conditions caused by heavy metals and to produce the protective polymeric compounds.

The external surface of the plant leaf as a habitat for yeasts has been recognized more recently than the interior of flowers and fruits. Another project was dealing with the phyllosphere yeasts. Its purpose was to study the yeast community colonizing leaf surfaces of wood plants and to determine the influence of plant environment on the incidence of yeast species and their frequency. The goal of the project was also to find out if the yeasts associated with the leaves of wood plants are taxonomically similar to those common in soil, if the proportion of present yeast species and their qualitative representation varied with the seasons, and if the significant differences between the yeast flora of broad-leaved and coniferous trees exist. Some additional properties of the most frequently isolated species were also examined, more particular killer activity, the ability to modify lignin component and production of pectolytic enzymes. The yeast population, occurring on the surface of leaves is liable to extreme conditions caused by the changes of temperature, illumination, acid rains, and heavy metals. We have also tested the influence of oxygen radicals, induced by the addition of H_2O_2 and the effect of heavy metals on the yeast cells. We have found that the extracellular polymers and pigments play an important role in the scavenging of free radicals and therefore in the protection of yeast cells.

The representatives of isolated and identified species are regularly incorporated into the Culture Collection of Yeasts with the aim of expanding the Collection, since the ecological research is a major source of new strains. Besides the ecological significance, these studies can lead to the discovery, cultivation, and characterization of species and strains of yeasts with potential application in biotechnology and genetic engineering.

3. Concept of R&D activity of the Organization for the next four years (max. 5 pages)

i. **Present state of knowledge and status of ongoing research related to the subject of the Concept, from both international and national perspective**

ii. **Organization's role or significance in the overall research effort within the field of the Concept on both the national and international scales**

iii. **Objectives of the Concept**

iv. **Proposed strategies and methods to be applied, and time schedule**

Department of Enzymology of Carbohydrates

Microbial enzymes involved in decomposition of plant cell walls found important applications in the pulp and paper industry, fodder and food industry and have perspectives to be applied in future biotechnologies leading to conversion of plant biomass to chemical fuels and other useful products, such as functional food additives. The aim of long-term research projects of the Department of Enzymology of Carbohydrates is to expand current knowledge on biodegradation of plant polysaccharides and their complexes with lignin. One of the tasks is to elucidate further the structure-function relationship of the enzymes degrading plant xylans, galactoglucomannas, including the enzymes deacetylating these polymers. The main attention will be given to the search for new, so far not recognized components of the enzyme systems of wood-destroying fungi, responsible for hydrolysis of linkages connecting polysaccharides with lignin. Attention will be also paid to proteinaceous inhibitors of microbial endoglycanses in plants as possible part of plant defense mechanisms against phytopathogens. One of the research projects devoted to investigation of a novel carbohydrate esterase discovered recently by the members of the Department (FEBS Letters, 2006), and called glucuronoyl esterase, has already been supported by the Slovak grant agency APVV. The function of the enzyme may be the hydrolysis of ester linkages between hemicellulose and lignin in plant cell wall, which is an activity of enormous biotechnological potential. The action of the enzyme will be examined on natural substrates and sulfite pulp, which contains preserved ester linkages. Other direction of research of the Department will be the application of the plant cell wall degrading microbial enzymes for synthetic purposes as biocatalysts. The synthetic potential of these enzymes has not been sufficiently investigated. Under specific conditions, the hydrolytic enzymes, such as glycoside hydrolases and esterases, could catalyze reverse reactions that could be explored for the synthesis of biologically important oligosaccharides, glycosides as well as for modification of polysaccharides and natural fibers.

Department of Immunochemistry of Glycoconjugates

Our studies will be aimed at conjugate preparation based on surface carbohydrate antigens isolated from microorganisms – pathogenic yeasts and Gram negative bacteria (*Vibrio*s) as our finances permit. We will monitor the immune response by broader methodic spectrum with focused effort on unknown reactions of the immune system at the cellular level. This direction can

bring significant advances in the research of highly efficient sub-cellular vaccines against permanently threatening new emerging and old pathogens.

In the laboratory of lignin research, we will focus on the development of novel procedures of separation of plant biomass components in order to prepare sulfur-less lignin preparations that will be tested for their antioxidant activity and adsorption affinity towards bile acids, as well as on the study of thermal and thermooxidative stability of polymeric composites containing varying amounts of lignin.

The group of microbial polymers will continue the research of biological activities of fungal polysaccharides expanding the scope of derivatives as well of their potential applications including the areas of environmental protection, modulation of mucosal immune response, and sorption of heavy metals, phosphorus-containing contaminants, and radionuclides. International collaboration within the outlined research areas will be maintained and extended. The methods used in the work will include microbiological procedures, chemical derivatization, analytical physical, and chemical characterization, as well as various biological models including *in vitro* and *in vivo* tests of antioxidant, antimutagenic, antigenotoxic, and antitumor activities.

Department of Glycobiology

Research in the area of transglycosylases will be oriented towards isolation, characterization, and cloning of the major form of xyloglucan endo-transglycosylase/hydrolase (XH/XET) from model plant nasturtium (*Tropaeolum majus*) and from barley (*Hordeum vulgare*). The enzyme is interesting because it catalyzes the heterotransfer, i. e. linking together different types of polysaccharides. For this purpose, we shall develop novel methods enabling detection and screening of new types of heterotransglycosylases. Research will be continued also in the field of yeast cell wall biosynthesis. The investigations will be aimed at detecting the presence of hetero-transglycosylases and elucidation of their role in fungal cell wall biosynthesis.

In the area of biopesticides, we shall focus on elaborating methods for effective production of *Trichoderma* spores by submerged and semisolid fermentations.

Fucosyltransferase recombinant proteins – their truncated, as well as mutated forms will be employed for characterization through the assessment of enzyme parameters. Designing of experimentally defined structure of FuT, e.g. examination of 3D structure and elucidation of essential amino acids in catalysis will be done in collaboration with CNRS in Grenoble. We will continue in *in vitro* testing of more potent and selective inhibitors toward GnTI, GnTV and Core 2 GnT.

To investigate the role of antimicrobial peptides in the defense against larval diseases we will focus on the identification of honeybee colonies having ability of higher production of defensin-1 into larval food and on the exploration of genetic factors determining this property. We will also examine the role of another honeybee defensin-2 in the protection against pathogens. The aim will be to answer the question, whether honeybee colonies producing higher amount of defensins are more resistant against microbial diseases and if yes to try to apply acquired knowledge at breeding of honeybee colonies in the collaboration with honeybee's breeders.

Department of Glycobiotechnology

i. R&D activities at DGBT regarding immobilization biotechnology, biosensors, lectinology, microbial and plant biotechnology represents a frontier research areas in Slovakia with impact to international scientific communities. Ongoing projects carried out at DGBT utilize technologies with gradual worldwide exploitation: a) microbial biotechnology integrating bioencapsulation, nano-technologies and continuous bioprocess monitoring and control for development of progressive whole-cell biocatalysts; b) fabrication of novel amperometric biosensors using nanotechnologies (carbon nanotubes); c) recombinant techniques for production of original modular enzymes/glycoproteins; d) lectins for deciphering of glycocodes for diagnostics of early stages of human diseases; e) investigation of galactoglucomannan oligosaccharides for their role in the plant cell walls; f) elicitation of plant secondary metabolites production by abiotic factors.
ii. R&D activities at DGBT will be further developed in accordance with the main research area of the Institute of Chemistry SAS, on the basis of a significant role of DGBT as a leading or co-operating organization and signatory of 14 national (RDSA, VEGA) and 7 international (FP 5, COST Actions) multilateral projects.
iii. The further R&D at DGBT will be peformed with the aim to develop, study or produce: a) novel biotechnological process for enantioselective production of prodrugs *via* Baeyer-Villiger biooxidations using free and encapsulated recombinant cells; b) robust analytical devices based on carbon nanotube amperometric biosensors integrated with flow injection analysis system for analyses of real samples from fermentations; new bionanocomposites for preparation of biosensors in the frame of newly establishing “Centre of material and technologies” CEMAT c) new oligosaccharides, neoglycoproteins and glycoplasts; synthetic lectins with high specificity towards sialyloligosaccharides of erythrocytes; improvement of stability of enzyme D-amino acid oxidase by encapsulation; thermoswitched immobilization; d) interaction of sensitive and resistant model leucemic mouse cells with exogenous lectins by monitoring of glycosylation changes on the surface of neoplastic cells evoked by development of a Pgp phenotype of a mediated multidrug resistance; e) regulation of root development by GGMOs; enzymes activity studies in plant cell wall during cell differentiation; f) elicitation of secondary metabolites by abiotic factors *in vitro.*
iv. Scientists from DGBT will do their best to utilize the intellectual potential and available equipment to fulfill the objectives of the concept. Used methods will be dependent on the needs of ongoing projects. Time schedule is based on periods for carrying out of ongoing projects.

Department of Structure and Function of Saccharides

The activities will continue within the existing government and EU programs in the nearest future. In the experimental part, 3D structure of heparin-like oligosaccharides will be analyzed in solution and in the complexes with various proteins (growth factors, heparanase). Details of metabolism of bacteria that have been isolated from atmosphere (clouds) will be studies as well. Synthetic approaches will be aimed at new saccharides with anticancer properties.

Relationships between structure and saccharide activities will be analyzed using theoretical chemistry methods. This comprises 3D structure of glycos-

aminoglycans and the corresponding NMR parameters (chemical shifts, coupling constants). Within the design of new glycosyltransferase and glycosylhydrolase inhibitors, efforts will be focused on mechanism of neuraminidase of bird flu H5N1. Structures of glyconanogold particles, which have a potential application in medicine, will be solved within 6th EU program.

Various 1D and 2D high-resolution NMR methods (COSY, HSQC, HMBC, transferred NOESY, etc.) will be used. A new NMR spectrometer (installation is expected in 2007) will allow to solve structures (protein-carbohydrate complexes) that are not possible to analyze using present instrumentation. Within theoretical methods, DFT and QM/MM methods are planned to use in the next period.

Department of Glycomaterials

Utilization of secondary sources of agricultural production of hitherto cultivated domestic crops (corn, wheat) and new potential crops (oil-type pumpkin, topinambur) will be achieved by preparation of polysaccharide hydrocolloids. Using appropriate extraction methods, complexes of polysaccharides and phenolic compounds will be isolated, which are expected to possess antioxidant activity and radical scavenging properties. Ultrasound treatment will be used to enhance the yield of polysaccharides or in separation of the low molar mass phenolics from the complexes.

Certain domestic herbs used in the therapy of respiratory diseases as well as other plants with expected bioactive polysaccharide components (Abelmoschus, tamarind seed hulls) will be investigated. Study of the chemical, structural, molecular properties and biological activity of these polysaccharides will enrich the knowledge on structure/biological activity relationship, which may contribute to elucidation of the interaction mechanisms of the bioactive polysaccharides in biological ''*in vitro*'' and ''*in vivo*'' systems and of their bioactive principle. Determination of the rheological and film-forming properties of structurally well-defined polysaccharides permits to evaluate the influence of the physical properties on the biological response in the used tests. The obtained polysaccharide preparations with antitussive, immunostimulatory, and antioxidant activities might extend the supply of domestic phytoproducts in nutrition and pharmacy.

The research of the altered intestinal function as a consequence of specific dietary interventions, including pectin in the diet, might be a key factor in improving nutrition and eliminating body fat disturbances contributing to the obesity development. Such research might also be useful for assessment of nutritional strategies in prevention of the increase of body fat stores and for treatment of disorders in the energetic metabolism, once obesity had been established. The study of pectins differing in chemical properties offers the possibility for the potential application of new non-commercial pectins, prepared in the frame of the project, in human and veterinary nutrition.

Targeted modifications of selected commercial and new polysaccharides by partial and/or total hydrophobization, eventually combined with cross-linking reactions, will yield hydrocolloids with improved or novel functional properties. Expected are products with film-forming and associative properties, increased thermal stability and/or surfactant properties. They are applicable in cosmetics, as packing materials or for surface modification as well as components of composites with synthetic polymers. Solution of the planned goals of the project

might significantly contribute to a complex and multipurpose utilization of the plant biomass of our agriculture, to the production of advanced products, able to substitute synthetic oil-derived products and, eventually, to compete with the imported expensive plant hydrocolloids.

Department of Glycochemistry

The following R&D activities will be pursued in the Department of Glycochemistry:

O-/*N*-/*C*-Glycosylative modulation of biological activities of iminoalditols, isoprenes, nucleotides and other heterocycles in transfer, biosynthesis and metabolism of saccharides with the aim to obtain potential therapeutics for diagnosis and treatment of viral, tumor, metabolic, nervous disorder, infectious mycobacterial and other diseases.

Synthesis of long-chain and macrocyclic monosaccharides as oligo-saccharide mimics and metal chelators.

Preparation of new carbohydrate derivatives using ionic liquids as solvents.

Explore the properties of prepared derivatives in relation to their possible application in drug delivery system, as films forming and ion exchanging materials.

Enzymatic and chemoenzymatic approaches in a) derivatization studies of carbohydrates with natural phenolic compounds; b) in preparation of tailored branched oligosaccharides and their glycosides as recognition compartments of pharmaceutics.

Enzymatic polymerization of the derivatized monosaccharides *via* radical oxidations to biodegradable linear semi-lignins. Studies of the chemoselectivity and stereoselectivity of the enzymatic reactions using model, monofunctional saccharides.

Synthesis of modified saccharides for mechanistic studies of the enzyme action.

We will also deal with the preparation of new carbohydrate-based and biologically significant compounds and materials applicable in food industry and medicine.

Culture Collection of Yeasts

In the next years we will deal with a project focused on the diversity and taxonomy of yeasts and yeast-like microorganisms isolated from the leaves of various fruit-trees, their morphological and physiological properties, on the influence of environment on their incidence and survival, and also on the study of some specific attributes that might enable different yeast species to successfully colonize the plant materials in the presence of other microorganisms. Its purpose is to study the yeast community colonizing leaf surfaces of various fruit-trees and to determine the influence of this environment (where also the fungicides are applied) on the incidence of yeast species and their frequency. The aim is also to find out whether yeast species associated with the leaves of fruit-trees are similar (or not) to those common on the leaves of wood plants and to ascertain extend of population changes during the growing season of leaves.

We will study the influence of selected fungicides on the yeasts with the aim to find out, if they can reduce or inhibit yeast growth and the influence of the

heavy metals with biogenic effect on the production of various metabolites (pigments, lipids, exopolysaccharides) of selected yeast species and on the fibrillar part of the yeast cell wall. The fibrillar part of the cell wall probably affects the adhesion of the yeast cells on the leaf surfaces.

III. Partial indicators of the main activities:

1. Research output

i. List of the selected publications documenting the most important results of basic research. Total number of publications in the whole assessed period should not exceed the average number of the research employees

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ii. List of monographs/books published abroad

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iii. List of monographs/books published in Slovakia

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iv. List of other scientific outputs specifically important for the Organization

Chapters in monographs and books published abroad

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[18] TENKANEN, M. - BÜRGERMEISTER, M. - VRŠANSKÁ, M. - BIELY, P. - SALOHEIMO, M. - SIIKA-AHO, M. A novel xylanase XYN IV from *Trichoderma reesei* and its action on different xylans. In COURTIN, C.M. - VERAVERBEKE, W.S. - DELCOUR, J.A. *Recent Advances in Enzymes in Grain Processing*. Leuven: Laboratory of Food Chemistry, Katholieke Univesiteit Leuven, 2003, p. 41-46. ISBN 90-9016671-8.

[19] TENKANEN, M. - EIZAGUIRRE, J. - ISONIEMI, R. - FAULDS, C.B. - BIELY, P. Comparison of catalytic properties of acetyl xylan esterases from three carbohydrate esterase families. In MANSFIELD, S.D. - SADDLER, J.N. *ACS Symposium Series 855: Application of Enzymes to Lignocellulosics*. Washington, DC: American Chemical Society, 2003, p. 211-229. ISBN 0-8412-3831-6.

v. Table of research outputs

*Table **Research outputs** shows research outputs in number of specified entries; these entries are then divided by FTE employees with a university degree (from Tab. Research staff) for all Organization at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).*

Research outputs	2003			2004			2005			2006			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
chapters in monographs, books published abroad	5	0,08	0,21	4	0,07	0,16	3	0,05	0,12	7	0,10	0,27	19	4,8	0,07	0,19
chapters in monographs, books published in Slovakia	1	0,02	0,04	1	0,02	0,04	0	0,00	0,00	0	0,00	0,00	2	0,5	0,01	0,02
CC publications	59	1,00	2,48	61	1,00	2,48	56	0,86	2,27	76	1,10	2,95	252	63,0	0,99	2,55
scientific publications indexed by other databases (specify)	6	0,10	0,25	3	0,05	0,12	2	0,03	0,08	2	0,03	0,08	13	3,3	0,05	0,13
scientific publications in other journals	3	0,05	0,13	3	0,05	0,12	1	0,02	0,04	1	0,01	0,04	8	2,0	0,03	0,08
publications in proc. of international scientific conferences	21	0,36	0,88	13	0,21	0,53	21	0,32	0,85	11	0,16	0,43	66	16,5	0,26	0,67
publications in proc. of nat. scientific conferences	3	0,05	0,13	12	0,20	0,49	0	0,00	0,00	1	0,01	0,04	16	4,0	0,06	0,16
active participations at international conferences	121	2,05	5,08	111	1,82	4,51	128	1,97	5,20	114	1,65	4,43	474	118,5	1,87	4,80
active participations at national conferences	18	0,31	0,76	12	0,20	0,49	14	0,22	0,57	12	0,17	0,47	56	14,0	0,22	0,57

vi. Renormalized publications[2]

Renormalized publications = number of CC publications in the given year times authorship's portion of the Organization times the journal impact factor in 2005 divided by the median impact factor in the research field (for more details see Appendix)

Renormalized publications	2003			2004			2005			2006		
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget
Renormalized publications	32,9	0,56	1,38	47,7	0,78	1,94	32,5	0,50	1,32	62,1	0,90	2,41

vii. Standard manuscript page count[3]

Standard manuscript page count	2003			2004			2005			2006		
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget
page count	0	#####	0,0	0	####	0,0	0	####	0,0	0	####	0,0

viii. List of patents and patent applications

[1] NATIONAL RESEARCH OF CANADA: *Synthesis of lipopolysaccharide-protein conjugate vaccines via the lipid A region following removal of the glycosidic phosphate residue*. Inventor: ZOU, W. - COX, A. - JENNIGS, H. - RICHARDS, J.C. - MOXON, R. - MIESZALA, M. - KOGAN, G. International Application No: PCT/CA03/00252 (2003). Application No: WO2003CA00254 (2003). Patent No: WO 03/070282 A2 (2003).

[2] This information is required only from the Organizations of the Section 2 of the Slovak Academy of Sciences.
[3] This information is required only from the Organizations of the Section 3 of the Slovak Academy of Sciences.

[2] FIDIA FARMACEUTICI S.P.A., ITALY, INSTITUTE OF EXPERIMENTAL PHARMACOLOGY, SLOVAK ACADEMY OF SCIENCES, SLOVAKIA: *Clathrate complexes formed by hyaluronic acid derivatives, process for their preparation and pharmaceutical compositions containing them and their use*. Inventor: MENDICHI, R. - MACHOVÁ, E. - KOGAN, G. - ŠOLTÉS, L. - STEINER, B. - BYSTRICKÝ, S. International Application No: PCT/EP01/ 02722 (2001). Application No: HU20030000163 (2001). Hungarian patent: HU 03/00163 (2003).

[3] INDUSTRIAL PROPERTY OFFICE OF THE SLOVAK REPUBLIC: *Spôsob určenia pravosti včelieho medu a prítomnosti včelích produktov v priemyselných výrobkoch*. Applicant: Institute of Chemistry SAS. Inventor: ŠIMÚTH, J. - BÍLIKOVÁ, K. - KOVÁČOVÁ, E. - MAJTÁN, J. Application No: PP 302-2003. Application date: 10.03.2003.

[4] INDUSTRIAL PROPERTY OFFICE OF THE SLOVAK REPUBLIC: *Spôsob prípravy D-hamamelózy*. Patent owner: Institute of Chemistry SAS. Inventor: HRICOVÍNIOVÁ, Z. - PETRUŠ, L. Patent No: 284292. Date: 25.10.2004.

[5] INDUSTRIAL PROPERTY OFFICE OF THE SLOVAK REPUBLIC: *Spôsob prípravy D-sedoheptulózy*. Patent owner: Institute of Chemistry SAS. Inventor: HRICOVÍNIOVÁ, Z. - PETRUŠ, L. Patent No: 284318. Date: 15.11.2004.

[6] NATIONAL RESEARCH OF CANADA: *Synthesis of lipopolysaccharide-protein conjugate vaccines via the lipid A region following removal of the glycosidic phosphate residue*. Inventor: ZOU, W. - COX, A. - JENNIGS, H. - RICHARDS, J.C. - MOXON, R. - MIESZALA, M. - KOGAN, G. European patent: EP1476197. 2004-11-17.

[7] FIDIA FARMACEUTICI, SLOVAK ACADEMY OF SCIENCES: *Clathrate complexes formed by hyaluronic acid derivatives and use thereof as pharmaceuticas*. Inventor: MENDICHI, R. - ALFÖLDI, J. - MACH, M. - MACHOVÁ, E. - BAUER, V. - KOGAN, G. - ŠOLTÉS, L. - STEINER, B. - STRATILOVÁ, E. - BYSTRICKÝ, S. Polish patent: PL357557. 2004-07-26.

[8] FIDIA FARMACEUTICI, SLOVAK ACADEMY OF SCIENCES: *Clathrate complexes formed by hyaluronic acid derivatives and use thereof as pharmaceuticas*. Inventor: MENDICHI, R. - ALFÖLDI, J. - MACH, M. - MACHOVÁ, E. - BAUER, V. - KOGAN, G. - ŠOLTÉS, L. - STEINER, B. - STRATILOVÁ, E. - BYSTRICKÝ, S. US patent: US2004076680. 2004-04-22.

[9] GLYCODESIGN INC: *Novel 3,5,and/or 6 substituted analogues of swainsonine processes for their preparation and their use as therapeutic agents*. Inventor: TROPPER, F.D. - CARVER, J. - TVAROŠKA, I. - DENNIS, J. - SHAH, R. - MARINO-ALBERNAS, J. US patent: US2003236229. 2003-12-25.

[10] INDUSTRIAL PROPERTY OFFICE OF THE SLOVAK REPUBLIC: *Konjugát účinný proti kandidózovým ochoreniam*. Applicant: Institute of Chemistry

SAS. Inventor: BYSTRICKÝ, S. - MACHOVÁ, E. - ĎURANA, R. - PAULOVIČOVÁ, E. Application No: 218-2004. Application date: 18.05.2004.

[11] INDUSTRIAL PROPERTY OFFICE OF THE CZECH REPUBLIC: *Způsob přípravy hydrofobizovaných derivátů hyaluronanu vázaných karbamátovou vazbou*. Applicant: CPN spol. s r.o. Inventor: MLČOCHOVÁ, P. - STEINER, B. - BYSTRICKÝ, S. - VELEBNÝ, V. - MACHOVÁ, E. - KOÓŠ, M. Application No: 2004-579. Application date: 06.05.2004.

[12] INDUSTRIAL PROPERTY OFFICE OF THE CZECH REPUBLIC: *Způsob přípravy hydrofobizovaných derivátů hyaluronanu vázaných éterovou a aminovou vazbou*. Applicant: CPN spol. s r.o. Inventor: MLČOCHOVÁ, P. - STEINER, B. - BYSTRICKÝ, S. - VELEBNÝ, V. - MACHOVÁ, E. - KOÓŠ, M. Application No: 2004-580. Application date: 06.05.2004.

[13] Applicant/inventor: JENNINGS, H. - MIESZALA, M. - KOGAN, G. - ZOU, W. - RICHARDS, J.C. - COX, A. *Synthesis of lipopolysaccharide-protein conjugate vaccines via the lipid A region following removal of the glycosidic phosphate residue*. US patent: US2005147624. 2005-07-07.

[14] Applicant/inventor: GLOSSL, J. - STRASSER, R. - MUCHA, J. - MACH, L. - ALTMANN, F. - WILSON, I.B. - STEINKELLNER, H. *Beta 1,2-xylosyl-transferase-gene from arabidopsis*. Austrian patent: AU781010. 2005-04-28.

[15] INDUSTRIAL PROPERTY OFFICE OF THE SLOVAK REPUBLIC: *Glukuronoyl esteráza zo Schizophyllum commune, spôsob prípravy a použitie pri rozklade biologických materiálov*. Applicant: Institute of Chemistry SAS. Inventor: BIELY, P. - ŠPÁNIKOVÁ. - VRIES, R. Application No: 95-2005. Application date: 12.09.2005.

[16] INDUSTRIAL PROPERTY OFFICE OF THE CZECH REPUBLIC: *Způsob přípravy hyaluronanu s nízkou a velmi nízkou molekulovou hmotností a oligosacharidů hyaluronanu*. Applicant: CPN spol. s r.o. Inventor: DŘÍMALOVÁ, E. - EBRINGEROVÁ, A. - VELEBNÝ, V. - PRISTYÁKOVÁ, Z. Application No: 2005-114. Application date: 25.02.2005.

[17] Applicant: FIDIA FARMACEUTICI, SLOVAK ACADEMY OF SCIENCES: *Clathrate complexes formed by hyaluronic acid derivatives and use thereof as pharmaceuticals*. Inventor: ŠOLTÉS, L. - STEINER, B. - MACHOVÁ, E. - KOGAN, G. - BYSTRICKÝ, S. - MENDICHI, R. - BAUER, V. - MACH, M. - ALFÖLDI, J. - STRATILOVÁ, E. European patent: EP1272530B1. 2006-09-20.

[18] Applicant: GLOSSL, J. *Beta 1,2-xylosyltransferase-gene from arabidopsis*. Inventor: GLOSSL, J. - STRASSER, R. - MUCHA, J. - MACH, L. - ALTMANN, F. - WILSON, I.B. - STEINKELLNER, H. German patent: DE60115863T. 2006-08-10.

ix. Supplementary information and/or comments on the scientific output of the Organization

Scientists of the Institute of Chemistry are frequently serving as referees of manuscripts of scientific papers in international journals as well as evaluators of grant projects proposals. Totally, almost 400 such referee reviews/reports were elaborated in the assessment period.

2. Responses to the scientific output

*Table **Citations** shows specified responses to the scientific outputs; these entries are then divided by the FTE employees with a university degree (from Tab. Research staff) for all Organization at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).*

Citations	2002			2003			2004			2005			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
Web of Science	733	12,4	30,8	860	14,1	34,9	938	14,4	38,1	993	14,4	38,6	3524	881,0	13,9	35,7
Scopus, Google	2	0,0	0,1	84	1,4	3,4	103	1,6	4,2	49	0,7	1,9	238	59,5	0,9	2,4
(specify Database 1)	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0,0
in monographs, conf. proceedings and other publications abroad	7	0,1	0,3	39	0,6	1,6	15	0,2	0,6	13	0,2	0,5	74	18,5	0,3	0,7
in monographs, conf. proceedings and other publications in Slovakia	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0,0

i. List of 10 top-cited publications and number of their citations in the assessment period

[1] BAILEY, M.J. - BIELY, P. - POUTANEN, K. Interlaboratory testing of methods for assay of xylanase activity. In *Journal of Biotechnology*. Vol. 23, (1992), p. 257-270. (179 citatios)

[2] BIELY, P. Microbial xylanolytic systems. In *Trends in Biotechnology*. Vol. 3, (1985), p. 286-290. (87 citations)

[3] BIELY, P. - VRŠANSKÁ, M. - TENKANEN, M. - KLUEPFEL, D. Endo-β-1,4-xylanase families: differences in catalytic properties. In *Journal of Biotechnology*. Vol. 57, (1997), p. 151-166. (68 citations)

[4] KAČURÁKOVÁ, M. - CAPEK, P. - SASINKOVÁ, V. - WELLNER, N. - EBRINGEROVÁ, A. FT-IR study of plant cell wall model compounds: pectic polysaccharides and hemicelluloses. In *Carbohydrate Polymers*. Vol. 43, (2000), p. 195-203. (54 citations)

[5] TVAROŠKA, I. - BLEHA, T. Anomeric and exoanomeric effects in carbohydrate chemistry. In *Advances in Carbohydrate Chemistry and Biochemistry*. Vol. 47, (1989), p. 45-123. (43 citations)

[6] EBRINGEROVÁ, A. - HEINZE, T. Xylan and xylan derivatives - biopolymers with valuable properties, 1 - Naturally occurring xylans structures, procedures and properties. In *Macromolecular Rapid Communications*. Vol. 21, (2000), p. 542-556. (34 citations)

[7] MALOVIKOVÁ, A. - HAYAKAWA, K. - KWAK, J.C.T. Surfactant-polyelectrolyte interactions. IV. Surfactant chain length dependence of the binding of alkylpyridinium cation to dextran sulfate. In *Journal of Physical Chemistry*. Vol. 88, (1984), p. 1930-1933. (33 citations)

[8] BIELY, P. - MISLOVIČOVÁ, D. - TOMAN, R. Soluble chromogenic substrates for the assay of endo-1,4-β-xylanases and endo-1,4-β-glucanases. In *Analytical Biochemistry*. Vol. 144, (1985), p. 142-146. (32 citations)

[9] BRETON, C. - MUCHA, J. - JEANNEAU, C. Structural and functional features of glycosyltransferases. In *Biochimie*. Vol. 83, (2001), p. 713-718. (28 citations)

[10] TVAROŠKA, I. - TARAVEL, F.R. - UTILLE, J.P. - CARVER, J.P. Quantum mechanical and NMR spectroscopy studies on the conformations of the hydroxymethyl and methoxymethyl groups in aldohexosides. In *Carbohydrate Research*. Vol. 337, (2002), p. 353-367. (27 citations)

ii. List of top-cited authors from the Organization (at most 10 % of the research employees) and their number of citations in the assessment period

[1]	BIELY, P.	746 citations
[2]	EBRINGEROVÁ, A.	334 citations
[3]	TVAROŠKA, I.	326 citations
[4]	GEMEINER, P.	323 citations
[5]	VRŠANSKÁ, M.	231 citations

[6] MISLOVIČOVÁ, D. 167 citations
[7] KOGAN, G. 165 citations
[8] FARKAŠ, V. 135 citations
[9] MALOVÍKOVÁ, A. 134 citations
[10] KLAUDINY, J. 132 citations

iii. Supplementary information and/or comments on responses to the scientific output of the Organization

In this assessment period, the Impact Factor of scientific journals registered in Current Contents in which research articles were published, ranges from 0,014 to 8,427 and its average value is 1,751. Considering total 3836 citations and 252 publications accounts for about 15 responses per one publication.

3. Research status of the Organization in the international and national context

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

i. List of the most important research activities documenting international importance of the research performed by the Organization, incl. major projects (details of projects should be supplied under Indicator 4). Collective membership in the international research organisations, in particular within the European Research Area

[1] *Multilateral projects of EU*: 4 projects of 5th FP, 3 projects of 6th FP, 11 projects of COST Actions, and 1 project of NATO

[2] *Other international projects*: 1 project of Mizutani Foundation and 17 bilateral projects in the framework of scientific and technical cooperation (including 6 R&D projects with small enterprises)

[3] *Other important projects and collaboration without funding*: 1 foreign project and 20 foreign collaborations

[4] *Culture Collection of Yeasts*
- membership in the European Culture Collections' Organization (ECCO)
- membership in the World Federation of Culture Collection (WFCC)

ii. List of international conferences (co-) organized by the Organization

[1] *31th Annual Conference on Yeasts, Smolenice, May 19-21, 2003*

[2] *32nd Annual Conference on Yeasts, Smolenice, May 12-14, 2004*

[3] *4th Heparanase meeting „Heparanase Inhibitors in Antiangiogenic and Antimetastatic Cancer Therapy“, Bratislava, May 7, 2004*

[4] *13th European Carbohydrate Symposium „EUROCARB 13“, Bratislava, August 21-26, 2005*

[5] *33rd Annual Conference on Yeasts, Smolenice, May 11-13, 2005*

[6] *34th Annual Conference on Yeasts, Smolenice, May 10-12, 2006*

iii. List of international journals edited/published by the Organization

[1] *Chemical Papers*
6 issues per year, ISSN: 0336-6352 (Print), 1336-9075 (Online).

iv. List of edited proceedings from international scientific conferences and other proceedings

[1] *XXXIth Annual Conference on Yeasts: Proceedings of the conference, May 19-21, 2003, Smolenice*. Bratislava: Chemický ústav SAV, 2003, 84 p.

[2] *32nd Annual Conference on Yeasts: Programme and Abstracts, May 12-14, 2004, Smolenice*. Bratislava: Chemický ústav SAV, 2004, 94 p. ISSN 1336-4839.

[3] *Book of Abstracts of the 13th European Carbohydrate Symposium, August 21-26, Bratislava*. Bratislava: VEDA, 2005, 340 p. ISBN 80-969359-6-8.

[4] *33rd Annual Conference on Yeasts: Programme and Abstracts, May 11-13, 2005, Smolenice*. Bratislava: Chemický ústav SAV, 2005, 86 p. ISSN 1336-4839.

[5] *34rd Annual Conference on Yeasts: Programme and Abstracts, May 10-12, 2006, Smolenice*. Bratislava: Chemický ústav SAV, 2006, 90 p. ISSN 1336-4839.

- **National position of the Organization**

i. List of selected most important national projects (Centres of Excellence, National Reference Laboratories, Agency for the Promotion of Research and Development (APVV/APVT), National Research Programmes, Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA), and others)

See under indicator 4.

ii. List of national scientific conferences (co)-organized by the Organization

[1] Scientific seminar *„Recent possibilities of mass spectrometry and liquid chromatography“*. 15 June 2006, Bratislava.
Co-organizer: Institute of Chemistry of SAS, fy Bruker s.r.o., fy Merck s.r.o.

[2] Scientific seminar *„New dimension in IMS-MS SYNAPT High Definition Mass Spectroscopy“*. 30 November 2006, Bratislava.
Co-organizer: Institute of Chemistry of SAS, fy Waters.

iii. List of national journals published by the Organization

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iv. List of edited proceedings of national scientific conferences/events

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- **International/European position of the individual researchers**

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

[1] BIELY, P. Mode of action and synthetic potential of microbial acetylxylan esterases. In *Galway Workshop 2003 „Molecular, biochemical, structural and genetic aspects of carbohydrate-modifying enzymes“, 14-15 April 2003, Galway, Ireland*.
Abstract published in Book of Abstracts.

[2] KOGAN, G. Microbial Carbohydrates as Pathogen-Associated Molecular Patterns in Innate Immunity. In *The Carbohydrate Workshop 2003, 27-30 March 2003, Güstrow, Germany*. (plenary lecture)
Abstract published in Book of Abstracts.

[3] KOGAN, G. - MIADOKOVÁ, E. - RAUKO, P. Bioprotective and co-mutagenic effects of fungal chitin-glucan from *Aspergillus niger*. In *7th International Conference „Modern Perspectives in Research of Chitin and Chitosan“, 15-18 September 2003, Sankt-Petersburg, Repino, Russia*. (plenary lecture - Dr. Kogan)
Abstract published in Book of Abstracts.

[4] TVAROŠKA, I. Computer-Assisted Design of Enzyme Inhibitors. In *CUKRBLIK 2003, 16 April 2003, Prague, Czech Republic*. (plenary lecture)
Abstract published in Conference Proceedings.

[5] TVAROŠKA, I. Biosynthesis of Glycosidic Linkage: the Catalytic Mechanism of Glycosyltransferases. In *International Symposium on Polysaccharide Engineering, 8-10 June 2003, Osaka, Japan*. (plenary lecture)
Abstract published in Conference Proceedings.

[6] TVAROŠKA, I. Molecular modeling insight into the catalytic mechanism of glycosyltransferases. In *EUROCARB12, Pre-symposium, Molecular Modelling of Carbohydrates, 6 July 2003, Grenoble, France*. (plenary lecture)
Abstract published in Conference Proceedings.

[7] VRŠANSKÁ, M. A novel β-1,4-xylananse from *Trichoderma reesei*. In *Galway Workshop 2003 „Molecular, biochemical, structural and genetic aspects of carbohydrate-modifying enzymes", 14-15 April 2003, Galway, Ireland*.
Abstract published in Book of Abstracts.

[8] BIELY, P. - KREMNICKÝ, Ľ. - VRŠANSKÁ, M. Enzymology and regulatory aspects of utilization of plant polysaccharides by *Aureobasidium pullulans*. In *11th International Congress on Yeasts, 15-20 August 2004, Rio de Janeiro, Brasil*. (keynote lecture - Dr. Biely)
Abstract published in Conference Proceedings.

[9] KOGAN, G. - BABINCOVÁ, M - SLAMEŇOVÁ, D. - STAŠKO, A. - POLOVKA, M. Antioxidant activity of yeast (1→3)-β-D-glucan. In *The Carbohydrate Workshop, 17-20 March 2004, Borstel, Germany*. (plenary lecture - Dr. Kogan)
Abstract published in Abstract Book.

[10] KOŠÍKOVÁ, B. Novel modifications of chemical wood treatment. In *V. International Symposium „Selected Processes at the Wood Processing", 8-10 September 2004, Liptovská Sielnica*.
Published in VEĽKOVÁ, V. - GEFFERT, A. - KAČÍK, F. *Proceedings of the V. International Symposium „Selected Processes at the Wood Processing", 8-10 September 2004, Liptovská Sielnica, Slovakia*. Zvolen: Technická univerzita vo Zvolene, 2004. ISBN 80-228-1328-1. p. 189-194.

[11] PETRUŠ, L. Present status of and further possibilities for the COST coordination of the carbohydrate research in Europe. In *CUKRBLIK 2004, 15 April 2004, Prague, Czech Republic*.
Abstract published in Book of Abstracts.

[12] BIELY, P. - PUCHART, V. Recent progress in the assays of xylanolytic enzymes. In *The Fourth European Symposium on Enzymes in Grain Processing (ESEGP-4), 6-8 June 2005, Nantes, France*. (keynote lecture - Dr. Biely)
Abstract published in Proceedings of ESEGP-4.

[13] EBRINGEROVÁ, A. Strukturelle Diversität und Anwendungspotenzial von Hemicellulosen. In *100th ZELLCHEMING-General meeting, 27-30 June 2005, Wiesbaden, Germany*.
Abstract published in Book of Abstracts.

[14] HRICOVÍNI, M. Modeling of interactions of heparin oligosaccharides with heparanase peptides. In *XVIII International Symposium on Glycoconjugates - GLYCO XVIII, 4-9 September 2005, Firenze, Italy*.

[15] KOGAN, G. Part I. Introduction to glycomics. Part II. Immune system modulation by carbohydrates. In *The Future of Growth Promotion Workshops Europe 2005, 19-22 April 2005, Dunboyne, Ireland*.
Published in *The Future of Growth Promotion Workshops Europe 2005, 19-22 April 2005, Dunboyne, Ireland*. Nicholasville: Alltech, Inc., 2005, DVD111 NTSC.

[16] KOGAN, G. Can a spoonful of sugar optimize gastro-intestinal health? In *International scientific conference „The Future of Growth Promotion", 22 November 2005, Prague, Czech Republic*.
Published in Conference Proceedings.

[17] KOGAN, G. Can a spoonful of sugar optimize gastro-intestinal health? In *International scientific conference „The Future of Growth Promotion", 23 November 2005, Novi Sad, Serbia and Montenegro*.
Published in Conference Proceedings.

[18] KOGAN, G. Can a spoonful of sugar optimize gastro-intestinal health? In *International scientific conference „The Future of Growth Promotion", 24 November 2005, Budapest, Hungary*.
Published in Conference Proceedings.

[19] KOGAN, G. - MIADOKOVÁ, E. - VLČKOVÁ, V. - RAUKO, P. - SLAMEŇOVÁ, D. - MACHOVÁ, E. - BABINCOVÁ, M. - SVIDOVÁ, S. - STAŠKO, A. - BAUEROVÁ, K. - KOROLENKO, T.A. Yeast cell wall polysaccharides as alternative anticancer agents. In *33rd Annual Conference on Yeasts, 11-13 May 2005, Smolenice*. (plenary lecture - Dr. Kogan)
Abstract published in *Programme and Abstracts - 33rd Annual Conference on Yeasts, 11-13 May 2005, Smolenice*. Bratislava: Institute of Chemistry SAS, 2005. ISSN 1336-4839. p. 38.

[20] KOGAN, G. - PAULOVIČOVÁ, E. Can a spoonful of sugar optimize gastro-intestinal health? In *The Future of Growth Promotion Meeting, 19-22 April 2005, Dunboyne, Ireland*. (plenary lecture - Dr. Kogan)
Abstract published in Proceedings Folder.

[21] KOŠÍKOVÁ, B. Novel lignin antioxidants for protection of living organisms and polymer materials. In *The World Congress on Industrial Biotechnology and Bioprocessing, 20-22 April 2005, Orlando, Florida*.
Abstract published in *Abstracts: The World Congress on Industrial Biotechnology and Bioprocessing, 20-22 April 2005, Orlando, Florida*. Orlando: Biotechnology Industry Organization, American Chemical Society, National Agriculture Biotechnology Council, 2005. p. 15.

[22] EBRINGEROVÁ, A. - HROMÁDKOVÁ, Z. Application of ultrasound in production of phenolics-containing xylan. In *Biomass-derived Pentoses: from*

Biotechnology to fine Chemistry, 22-25 October 2006, Reims, France. (invited lecture - Dr. Ebringerová)
Abstract published in *Book of Abstracts: Biomass-derived Pentoses 2006, 22-25 October 2006, Reims, France*. Reims: University of Reims, INRA, 2006, p. 40.

[23] HRICOVÍNI, M. Molecular modeling and NMR studies on the interaction of heparin with heparanase peptides. In *14th Symposium on glycosamino-glycans, 21-23 September 2006, Loveno, Italy*.

[24] KOŠÍKOVÁ, B. Novel biobased anticarcinogenic agents. In *Pacific Rim Summit on Industrial Biotechnology and Bioenergy, 11-13 January 2006, Honolulu, Hawai*.
Abstract published in *Abstracts: Pacific Rim Summit on Industrial Biotechnology and Bioenergy - Building Innovative Collaborations Across the Pacific, 11-13 January 2006, Honolulu, Hawai*. Honolulu: Biotechnology Industry Organization, American Chemical Society, 2006. p. 33.

[25] KOŠÍKOVÁ, B. Novel biodegradable lignin-based surfactants. In *Third Annual The World Congress on Industrial Biotechnology and Bioprocessing, 11-14 July 2006, Toronto, Canada*.
Abstract published in *Abstracts: The World Congress on Industrial Biotechnology and Bioprocessing, 11-14 July 2006, Toronto, Canada*. Toronto: Biotechnology Industry Organization, American Chemical Society, Agri-Food, BioteCanada, CIC, EuropaBio, 2006. p. 63-64.

[26] KOŠÍKOVÁ, B. - SLÁVIKOVÁ, E. - GREGOROVÁ, A. Lignin - initiator of polyolefin degradation in the environment. In *Earth in a trap? Analysis of Environmental Components, 26-28 April 2006, Krpáčovo*. (invited lecture - Prof. Košíková)
Published in VEĽKOVÁ, V. - SAMEŠOVÁ, D. *1st International Scientific Conference „Earth in a trap?“, 26-28 April 2006, Krpáčovo, Slovakia*. ISBN 80-228-1553-5. CD-Rom. p. 351-355.

[27] PETRUŠ, L. - PETRUŠOVÁ, M. Recent advances in chemical transformations of C-glycosylnitromethanes. In *Sugars as Renewable Materials for the Synthesis of Compounds of Biological Interest, 22-27 September 2006, Klekotki, Poland*. (invited lecture - Dr. Petruš)
Abstract published in *Abstracts Book of CEDNETS Conference „Sugars as Renewable Materials for the Synthesis of Compounds of Biological Interest“, 22-27 September 2006, Klekotki, Poland*. Warsaw: CEDNETS, 2006. p. PL05.

ii. List of employees who served as members of the organizing and/or programme committees for international conferences

[1] FARKAŠ, V.
31th Annual Conference on Yeasts, Smolenice, May 19-21, 2003
32nd Annual Conference on Yeasts, Smolenice, May 12-14, 2004

13th European Carbohydrate Symposium „EUROCARB 13“, Bratislava, August 21-26, 2005
33rd Annual Conference on Yeasts, Smolenice, May 11-13, 2005
34th Annual Conference on Yeasts, Smolenice, May 10-12, 2006
35th Annual Conference on Yeasts, Smolenice, May 16-18, 2007

[2] BREIEROVÁ, E.
31th Annual Conference on Yeasts, Smolenice, May 19-21, 2003
32nd Annual Conference on Yeasts, Smolenice, May 12-14, 2004
33rd Annual Conference on Yeasts, Smolenice, May 11-13, 2005
34th Annual Conference on Yeasts, Smolenice, May 10-12, 2006
35th Annual Conference on Yeasts, Smolenice, May 16-18, 2007

[3] KOLAROVA, N.
31th Annual Conference on Yeasts, Smolenice, May 19-21, 2003
32nd Annual Conference on Yeasts, Smolenice, May 12-14, 2004
13th European Carbohydrate Symposium „EUROCARB 13“, Bratislava, August 21-26, 2005
33rd Annual Conference on Yeasts, Smolenice, May 11-13, 2005
34th Annual Conference on Yeasts, Smolenice, May 10-12, 2006
35th Annual Conference on Yeasts, Smolenice, May 16-18, 2007

[4] GUTHOVÁ, J.
31th Annual Conference on Yeasts, Smolenice, May 19-21, 2003
32nd Annual Conference on Yeasts, Smolenice, May 12-14, 2004
33rd Annual Conference on Yeasts, Smolenice, May 11-13, 2005
34th Annual Conference on Yeasts, Smolenice, May 10-12, 2006
35th Annual Conference on Yeasts, Smolenice, May 16-18, 2007

[5] HIRSCH, J.
12th European Carbohydrate Symposium „EUROCARB 12“, Grenoble, July 6-11, 2003
13th European Carbohydrate Symposium „EUROCARB 13“, Bratislava, August 21-26, 2005

[6] KOVÁČIK, V.
16th International Mass Spectrometry Conference, Edinburgh, August 31-September 5, 2003
17th International Mass Spectrometry Conference, Prague, 27 August-1 September 2006

[7] PETRUŠ, L.
BIOTRANS 2003, Olomouc, Czech Republic, June 29-July 3, 2003
2nd Central European Conference „Chemistry towards Biology“, Seggau, Austria, September 26-29, 2004
Advances of Organic Chemistry, Smolenice, September 16-20, 2007

[8] HRICOVÍNI, M.
4th Heparanase meeting „Heparanase Inhibitors in Antiangiogenic and Antimetastatic Cancer Therapy“, Bratislava, May 7, 2004

[9] BIELY, P.
13th European Carbohydrate Symposium „EUROCARB 13“, Bratislava, August 21-26, 2005
11th International Congress on Yeast „ICY 2004“, Rio de Janeiro, August 15-20, 2004 (section Metabolism and Regulation)
European Symposium on Enzymes in Grain Processing „ESEGP-4“, Nantes, France, June 6-8, 2005

[10] KOGAN, G.
13th European Carbohydrate Symposium „EUROCARB 13“, Bratislava, August 21-26, 2005

[11] TVAROŠKA, I.
13th European Carbohydrate Symposium „EUROCARB 13“, Bratislava, August 21-26, 2005
15th European Carbohydrate Symposium „EUROCARB 15“, Vienna, Austria, 19-24 July 2009
International Conference Glyco XXI, Vienna, 2011

[12] VRŠANSKÁ, M.
13th European Carbohydrate Symposium „EUROCARB 13“, Bratislava, August 21-26, 2005

[13] GEMEINER, P.
6th International Conference on Protein Stabilization „ProtStab 2004“, Bratislava, September 26-29, 2004

[14] KOŠÍKOVÁ, B.
8th European Workshop on Lignocellulosics and Pulp „EWLP 2004“, Riga, Latvia, August 22-25, 2004
V. International Symposium „Selected Processes at the Wood Processing“, Liptovská Sielnica, September 8-10, 2004
VI. International Symposium „Selected Processes at the Wood Processing“, Zvolen, 8 September 2005
9th European Workshop on Lignocellulosics and Pulp „EWLP 2006“, Wien, Austria, 27-30 August 2006

[15] GAJDOŠ, J.
13th European Carbohydrate Symposium „EUROCARB 13“, Bratislava, August 21-26, 2005

[16] EBRINGEROVÁ, A.
Biomass-derived Pentoses: from Biotechnology to Fine Chemicals, Reims, France, 22-25 October 2006

iii. List of employees who served as members of important international scientific bodies (e.g. boards, committees, editorial boards of scientific journals)

[1] BIELY, P.
Associate Editor of *Yeast Newsletter* (2003-2006)
Member of International Commission for Yeasts of the International Union of Microbiological Societies (2003-2006)

[2] GEMEINER, P.
Member of Editorial Board of *Biotechnology and Applied Biochemistry* (2003-2006)
Member of Editorial Board of *Biotechnology Letters/Biotechnology Techniques* (2003-2006)
Member of Editorial Board of *Artificial Cells, Blood Substitutes, and Biotechnology* (2003-2006)
Member of Bioencapsulation Research Group (Europe-Canada) (2003-2006)

[3] HIRSCH, J.
Representative of Slovakia in International Carbohydrate Organization (ICO) (2003-2006)
Representative of Slovakia in European Carbohydrate Organization (ECO) (2003-2006); president of ECO (2006-2007)

[4] KOÓŠ, M.
Regional Editor for Slovakia of *Molecules* (2003-2006)

[5] KOVÁČIK, V.
Regional Editor of *Chemia Analityczna-Chemical Analysi*s (2003-2006)
Member of Executive Committee of European Mass Spectrometry Society (2003-2006)

[6] PETRUŠ, L.
Member of Editorial Board of *Arkiv of Organic Chemistry (ARKIVOC)* (2003-2006)
Scientific Secretary of the COST Chemistry in the COST Secretariat at the European Commission (2000-2003)
Scientific Secretary of the COST Chemistry in the COST Office at the European Science Foundation (2004)

[7] ŠIMÚTH, J.
Member of Governing Council of European Science Foundation (2003-2004)
Member of European Apiculture Research Commission (2003-2004)
Member of Working Group of Applied Genomic of European Biotechnology Federation (2003-2004)

[8] TVAROŠKA, I.
Member of International Steering Committee of the International Consortium on Anti-Virals (ISC ICAV) (2005-2006)

iv. List of international scientific awards and distinctions

[1] BIELY, P.
Patočka's Medal (granted by Czechoslovak Microbial Society), 2006.

[2] HIRSCH, J.
Medal of Slovak Chemical Society for merits and work done in favour of SCHS, 2005.

[3] TVAROŠKA, I.
Gold Medal of SAS, 2004.

- **National position of the individual researchers**

i. List of invited/keynote presentations at national conferences documented by an invitation letter or programme

[1] TVAROŠKA, I. Rational Design of Carbohydrate Processing Inhibitors. In *Česká spoločnosť chemická, 9. október 2003, Prague, Czech Republic*.

[2] BLANÁRIKOVÁ, Z. - HRUŠOVSKÁ, F. - PAULOVIČOVÁ, E. - Porovnanie účinnosti subkutánnej a perorálnej formy imunoterapie I. In *XXII. zjazd slovenských a českých alergológov a klinických imunológov, 5.-8. október 2005, Prešov*. (invited lecture - Dr. Paulovičová)

[3] KOGAN, G. - MIADOKOVÁ, E. - SLAMEŇOVÁ, D. - BABINCOVÁ, M. - RAUKO, P. - MAJTÁN, M. Antioxidant, antigenotoxic, and immunomodulating properties of yeast cell wall polysaccharides. In *Bilateral scientific meeting „Protection of genotoxic effects of carcinogens by micronutrients II", 27-28 October, Bratislava*. (plenary lecture - Dr. Kogan)
Published in VLČKOVÁ, V. - GROLMUS, J. *Bilateral scientific meeting „Protection of genotoxic effects of carcinogens by micronutrients II", 27-28 October, Bratislava*. Bratislava: Slovak Academic Information Agency, 2005. ISBN 80-969398-1-5. p. 7-9.

[4] KOGAN, G. - SLAMEŇOVÁ, D. - STAŠKO, A. - BABINCOVÁ, M. - KOROLENKO, T.A. Antioxidačné vlastnosti kvasinkového β-D-glukánu a jeho využitie v protirakovinovej terapii. In *Jesenné pracovné dni „Genetická toxikológia a prevencia rakoviny", 24.-26. október 2005, Bratislava*. (invited lecture - Dr. Kogan)
Published in *Zborník z podujatia: Jesenné pracovné dni „Genetická toxikológia a prevencia rakoviny", 24.-26. október 2005, Bratislava*. Bratislava: Česká a Slovenská spoločnosť mutagenézy vonkajším prostredím, Československá biologická spoločnosť, Onkologická spoločnosť SLS, 2005. ISBN 80-969398-0-7. s. 9-11.

[5] PAULOVIČOVÁ, E. - BLANÁRIKOVÁ, Z. Porovnanie účinnosti subkutánnej a perorálnej formy imunoterapie II. In *XXII. zjazd slovenských a českých*

alergológov a klinických imunológov, 5.-8. október 2005, Prešov. (invited lecture - Dr. Paulovičová)
Abstract published in *Klinická imunológia a alergológia*. Roč. 3, (2005), s. 23.

[6] HROMÁDKOVÁ, Z. Biologicky aktívne polysacharidy z liečivých bylín a iných rastlín. In *Polysacharidy II: Struktura a biologické účinky polysacharidů a jejich derivátů, 10. 11. 2006, Praha, Česká republika*.
Abstract published in *Chemické listy*. Vol. 100, no. 9 (2006), p. 843.

[7] KOGAN, G. Antioxidačné, antimutagénne a antigenotoxické vlastnosti polysacharidov bunkových stien kvasiniek. In *Polysacharidy II: Struktura a biologické účinky polysacharidů a jejich derivátů, 10. 11. 2006, Praha, Česká republika*.
Abstract published in *Chemické listy*. Vol. 100, no. 9 (2006), p. 844-845.

[8] PAULOVIČOVÁ, E. - KELEOVÁ, A. - ŠIMKO, M. Prevalencia anti-S.cerevisiae manánových protilátok u gastrointestinálnych ochorení. In *XXIII. Sjezd českých a slovenských alergologů a klinických imunologů a XI. Kongres českých a slovenských imunologů. 25.-28. október 2006*. (invited lecture - Dr. Paulovičová)
Abstract published in *Alergie*. Vol. 8, Suppl. 2, (2006) p.34, P-39.

ii. List of employees who served as members of organizing and programme committees of national conferences

[1] BIELY, P.
XX. Biochemical Congress, Piešťany, September 12-16, 2006

[2] HIRSCH, J.
59. Zjazd chemikov (Congress of Chemists), Vysoké Tatry, 2.–6. september 2007

iii. List of employees serving in important national scientific bodies (e.g. boards, committees, editorial boards of scientific journals)

[1] BIELY, P.
Member of Council of Excellence Centers Programme of SAS (2003-2004)
Member of Learned Society of SAS (2004-)

[2] BYSTRICKÝ, S.
Member of Expert Commission of Research and Development Support Agency (section Natural sciences II) (2004-2005)

[3] FARKAŠ, V.
Member of Editorial Board of *General Physiology and Biophysics* (2003-2006)
Member of Scientific Board of SAS for Chemical Sciences (2003-2005)

Member of Accreditation Commission and Chairman of Accreditation Subcommission of SAS for Chemical and Biological Sciences (2003-2004)
Chairman of Yeasts Commission of the Czechoslovak Society for Microbiology (2003-)
Member of Learned Society of SAS (2004-)

[4] GAJDOŠ, J.
Member of Editorial Board of *Chemical Papers* (2003-2005)
Secretary of Expert Section of the Slovak Chemical Society (section Saccharides and Glycoconjugates) (2003-)

[5] GEMEINER, P.
Member of Editorial Board of *Chemical Papers* (2003-2006)
Member of Expert Commission of Research and Development Support Agency (section Food chemistry) (2003-2005)
Vice-chairman of Slovak Biotechnological Society (2003-)
Vice-chairman of Commission of Scientific Grant Agency (VEGA) for Chemical and Chemico-technological Sciences (2005-)
Member of Scientific Board of SAS for Chemical Sciences (2005-)
Member of Learned Society of SAS (2005-)

[6] HIRSCH, J.
Editor-in-Chief of *Chemical Papers* (2003-2005, since 2006 - editor)
Member of Scientific Board of SAS for Chemical Sciences (2003-)
Member of Commission of Scientific Grant Agency (VEGA) for Chemical and Chemico-technological Sciences (2003-2004)
Chairman of Expert Section of the Slovak Chemical Society (section Saccharides and Glycoconjugates) (2003-)
Member of Council of Excellence Centers Program of SAS (2005-)

[7] HRICOVÍNI, M.
Member of Commission of Scientific Grant Agency (VEGA) for Chemical and Chemico-technological Sciences (2005-)

[8] KOÓŠ, M.
Member of Commission of Scientific Grant Agency (VEGA) for Chemical and Chemico-technological Sciences (2005-)

[9] KOŠÍKOVÁ, B.
Member of Editorial Board of *Wood Research* (2003-2006)

[10] KOVÁČIK, V.
Chairman of Slovak Society for Mass Spectrometry (2003-)

[11] LIŠKOVÁ, D.
Member of Editorial Board of *Biológia* (2003-2006)
Member of Scientific Board of SAS for Biological and Ecological Sciences (2003-)

[12] PÄTOPRSTÝ, V.
Member of Committee of the Slovak Society for Mass Spectrometry (2003-)

[13] PETRUŠ, L.
Member of Editorial Board of *Chemical Papers* (2003-2006)
Member of Scientific Board of SAS for Chemical Sciences (2003-)
Vice-chairman of Slovak Chemical Society (2003-2004)
Vice-chairman of Expert Section of the Slovak Chemical Society (section Organic Chemistry) (2003-)

[14] SLÁVIKOVÁ, E.
Member of Commission of Scientific Grant Agency (VEGA) for Biological and Ecological Sciences (2003-2005)

[15] ŠIMÚTH, J.
Guarantor of Expert Section for Biotechnology of the Slovak Academy of Engineering Sciences (2003-2004)

[16] TVAROŠKA, I.
Member of Editorial Board of *Chemical Papers* (2003-2006)
Member of Scientific Board of SAS for Chemical Sciences (2003-)
Member of Commission of Scientific Grant Agency (VEGA) for Chemical and Chemico-technological Sciences (2003-2004)
Member of Learned Society of SAS (2004-)

iv. List of national awards and distinctions

[1] KOŠÍKOVÁ, B.
Prize of Ministry of Environment of the Slovak Republic - 2. place in the category PROGRESSIVE IDEA at 9th International Conference TOP 2003 for lecture „New environmentaly suitable utilization of lignin component of biomass for chemoprevention of tumorous and genetic diseases“.

Prize of Ministry of Environment of the Slovak Republic - 2. place in the category PROGRESSIVE IDEA at 12th International Conference TOP 2006 for work „New anticarcinogene compounds from biomass“.

[2] TVAROŠKA, I.
Special Prize of the Presidium of SAS for scientific research results in 2003 - Premium for scientific response in the category of natural and medical sciences, Literary Fund, 2003.

[3] HIRSCH, J.
Dionýz Ilkovič's Honorary Plaque of SAS for merits in physico-chemical sciences, 2004.

[4] BIELY, P.
Scientist of the Year of Slovak Republic 2003 (granted by Journaliste-Studio, Ministry of Education and Federation of Slovak Scientific-Technical Societies), 2004.

Premium of Literary Fund for scientific response - II. place in the category of natural and medical sciences, 2005.

[5] GEMEINER, P.
Dionýz Štúr's Honorary Plaque of SAS for merits in natural sciences, 2006.

Supplementary information and/or comments documenting international and national status of the Organization

The Institute of Chemistry is recognized as unic national and international research institute which covers all scientific fields of chemistry and biochemistry of carbohydrates. It gained remarkable worldwide reputation in scientific community documented, besides other, by organizing of the 7th International Carbohydrate Symposium in 1974 (under the auspices of the IUPAC) and 13th European Carbohydrate Symposium in 2005.

4. Project structure, research grants and other funding resources

- **International projects and funding**

i. List of major projects within the European Research Area – 5th and 6th Framework Programme of the EU, European Science Foundation, NATO, COST, INTAS, CERN, etc. (here and in items below please specify: type of project, title, grant number, duration, funding, responsible person in the Organization and his/her status in the project, e.g. coordinator, principal investigator, investigator)

[1] Project Number: QLRT-2001-02049 (5th FP EU)
Contract Number: QLK3-CT-2002-02049
Heparanase inhibitors in antiangiogenic and antimetastatic cancer therapy
Coordinator: Prof. Benito Casu (Italy)
Principal Investigator: Ing. Miloš Hricovíni, PhD.
Duration: 10/2002 - 10/2005
Funding from EC Brussels: 148 000 EUR
Funding from State Budget: 1 744 000 Sk

[2] Project Number: QLRT-2001-01343 (5th FP EU)
Evidenčné číslo kontraktu: QLK5-CT-2002-01343
Process development for microbial production of the bulk 1,3-propanediol from glycerol water as a waste effluent
Acronym: BIODIOL
Coordinator: Prof. Klaus-Dieter Vorlop (Germany)
Principal Investigator: Ing. Peter Gemeiner, DrSc.
Duration: 02/2003 - 02/2006

Funding from EC Brussels: 120 000 EUR
Funding from State Budget: 2 248 000 Sk

[3] Project Number: MCFI-2002-01580 (Marie Curie Individual Fellowship)
Investigation of direct and mediated bioelectrochemistry of galactose oxidase and related enzymes. The application of the biosensors for measurement of clinically important metabolites
MCFI Applicant: Ing. Ján Tkáč, PhD.
Host Organization: Dept. of Analytical Chemistry, Lund University, Lund, Sweden
Duration: 01/2003 - 12/2004

[4] Project Number: MCFI-2002-01664 (Marie Curie Individual Fellowship)
Rapid detection of food-borne pathogens by optical biosensors using lectins
MCFI Applicant: Ing. Jana Masárová, PhD.
Host Organization: Dept. of Pure and Applied Biochemistry, Lund University, Lund, Sweden
Duration: 01/2004 - 12/2005

[5] Project Number: 005645 (FP6-2004-HRM-Marie Curie Actions-RTN)
Contract Number: MRTN-CT-2004-005645
GlycoGold: Exploration of the nature and potential of Glyco-nano-particles
Acronym: GLYCOGOLD
Coordinator: Prof. Johannis P. Kamerling (Netherlands)
Principal Investigator: Ing. Igor Tvaroška, DrSc.
Duration: 03/2005 - 02/2009
Funding from EC Brussels: 68 500 EUR (advance payment - first period)
Funding from State Budget: 1 200 000 Sk

[6] Project Number: 504192 (FP6-2002-Mobility-1 - HRM-Marie Curie Actions-RTN)
Contract Number: MRTN-CT-2004-512265
Functional genomics for biogenesis of plant cell walls
Acronym: WALLNET
Coordinator: Prof. Henrik Vibe Scheller (Denmark)
Principal Investigator: Doc. Ing. Vladimír Farkaš, DrSc.
Duration: 04/2005 - 03/2009
Funding from EC Brussels: 42 750 EUR (advance payment - first period)
Funding from State Budget: 454 000 Sk

[7] Project Number: MRTN-CT-2006-035866 (FP6 EU)
(R) Evolutionary catalysis
Acronym: REVCAT
Coordinator: Prof. Joost Nicolaas Hendrik Reek (Netherlands)
Principal Investigator: Ing. Igor Tvaroška, DrSc.
Duration: 10/2006 - 09/2010
Funding from EC Brussels: 86 075 EUR (advance payment - first period)

[8] Project Number: NATO LST.CLG.979392
Differentiation, classification and evaluation of biotechnological potential of feruloyl esterases
Coordinator: Prof. Paul Christakopoulos (Greece)
Principal Investigator: RNDr. Peter Biely, DrSc.
Duration: 05/2003 - 05/2005
Prideľovateľ finančných prostriedkov: NATO – Scientific Affairs Division, Brussels
Funding from NATO: 4 000 EUR (mobility 2004 and 2005)
Funding from State Budget: 318 000 Sk

[9] Project Number: COST Action 840
Bioencapsulation: innovation and technologies
Coordinator: Prof. Denis Poncelet (France)
Principal Investigator: Ing. Peter Gemeiner, DrSc.
Duration: 10/1998 - 11/2004
Funding from EC Brussels: 2135 EUR
Funding from State Budget: 290 000 Sk

[10] Project Number: COST Action 837
Plant biotechnology for the removal of organic pollutants and toxic metals from wastewaters and contaminated sites
Coordinator: Dr. Jean-Paul Schwitzguebel (Switzerland)
Principal Investigator: RNDr. Desana Lišková, PhD.
Duration: 11/1998 - 11/2003
Funding from State Budget: 80 000 Sk

[11] Project Number: COST Action E23
Biotechnology in the pulp and paper industry
Coordinator: Dr. Liisa Viikari (Finland)
Principal Investigator: Ing. Peter Biely, DrSc.
Duration: 07/2001 - 07/2004
Funding from State Budget: 160 000 Sk

[12] Project Number: COST Action D25
New enzymes and selective methods for glycosidase-catalysed synthesis of bioactive glycosides and glycomimetics
Coordinator: Prof. Vladimír Křen, DrSc. (Czech Republic)
Principal Investigator: Ing. Peter Biely, DrSc.
Duration: 06/2001 - 10/2006
Funding from State Budget: 290 000 Sk

[13] Project Number: COST Action D29 WG No. 0008-03
Production and functionalization of hemicelluloses for sustainable advanced products
Coordinator: Prof. Tiina Maija Tenkanen (Finland)
Principal Investigator: RNDr. Peter Biely, DrSc. (aplicant No. 11)
Ing. Anna Ebringerová, PhD. (aplicant No. 6)
Duration: 09/2003 - 09/2007
Funding from State Budget: 480 000 Sk

[14] Project Number: COST D13/015/01 MC-D13
Glycolipid mimics against sepsis
Coordinator: Ing. Slavomír Bystrický, DrSc.
Principal Investigator: Ing. Slavomír Bystrický, DrSc.
Duration: 01/2001 - 09/2004
Funding from State Budget: 170 000 Sk

[15] Project Number: COST D13/016/01 MC-D13
Therapeutic polysaccharides
Coordinator: Prof. Stephen E. Harding (England)
Principal Investigator: Ing. Zdenka Hromádková, PhD.
Duration: 02/2001 - 12/2003
Funding from State Budget: 80 000 Sk

[16] Project Number: COST Action D28
Therapeutic polysaccharides II. Bioactive polysaccharides and their structure-function relationships
Coordinator: Prof. Stephen E. Harding (England)
Principal Investigator: Ing. Zdenka Hromádková, PhD.
Duration: 02/2004 - 06/2006
Funding from State Budget: 220 000 Sk

[17] Project Number: COST Action 859
Phytotechnologies to promote sustainable land use management and improve food safety
Coordinator: Dr. Jean-Paul Schwitzguebel (Switzerland)
Principal Investigator: RNDr. Desana Lišková, PhD.
Duration: 05/2004 - 05/2009
Funding from State Budget: 200 000 Sk

[18] Project Number: COST Action 928
Control and exploitation of enzymes for added-value food products
Coordinator: Prof. Johanna Buchert (Finland)
Principal Investigator: RNDr. Peter Biely, DrSc.
Duration: 10/2005 - 01/2010
Funding from State Budget: 125 000 Sk

[19] Project Number: COST Action 868
Biotechnical functionalisation of renewable polymeric materials
Coordinator: Prof. Georg M. Guebitz (Austria)
Principal Investigator: RNDr. Peter Biely, DrSc.
Duration: 05/2006 - 09/2010
Funding from State Budget: 65 000 Sk

[20] Project Number: Mizutani 040013
Development of transition-state analog inhibitors of human glycosyl-transferases
Principal Investigator: Ing. Igor Tvaroška, DrSc.
Duration: 01/2004 - 03/2005

Funding from Mizutani Foundation for Glycoscience: 54 115 USD
Funding from State Budget: 822 000 Sk

ii. List of other international projects incl. funding

[1] Project Number: 58-3620-2-F133
Improved utilization of corn fiber
Principal Investigator: RNDr. Peter Biely, DrSc.
Duration: 09/2002 - 08/2007
Funding: 20 508 USD (from USDA, ARS, REE, Peoria, IL 61604, USA)

[2] Project Number: (Greek-Slovak scientific and technological cooperation)
Extraction and separation of the cell wall polymers of new agricultural plants
Principal Investigator: Ing. Anna Ebringerová, PhD.
Duration: 01/2001 - 12/2003
Funding from State Budget: 51 000 Sk

[3] Project Number: 055/096 (slovak-czech scientific and technical cooperation)
The influence of stress factors on metabolic activity of carotenogenic yeasts
Principal Investigator: Ing. Emília Breierová, PhD.
Duration: 01/2002 - 12/2003
Funding from State Budget: 23 000 Sk

[4] Project Number/Contract Number: 30/2002
Preparation od hyaluronan and other polysaccharide derivatives
Principal Investigator: Ing. Slavomír Bystrický, DrSc., Ing. Miro Kóóš, PhD.
Duration: 01/08/2002 - 31/05/2003
Funding: 250 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[5] Project Number/Contract Number: 32/2003
Chemistry of natural macromolecular compounds – saccharides and polysaccharides
Principal Investigator: Ing. Anna Ebringerová, PhD.
Duration: 01/01/2003 - 31/12/2003
Funding: 70 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[6] Project Number: 07 (SK-FR sci. & techn. cooperation - program Štefánik)
Structural analyse of polysaccharides inferred from NMR in field oriented media and molecular modeling
Principal Investigator: Ing. Igor Tvaroška, DrSc.
Duration: 01/2004 - 12/2005
Funding from State Budget: 132 000 Sk

[7] Project Number: 138 (slovak-czech scientific and technical cooperation)
New chemical and enzymatic methods of preparation and modifications of glycosamines for medicinal applications – development of semi-preparative methods for production and commercial utilization

Principal Investigator: Doc. Ing. Ladislav Petruš, DrSc.
Duration: 01/2004 - 12/2005
Funding from State Budget: 58 000 Sk

[8] Project Number: (greek-slovak scientific and technical cooperation)
Extraction and separation of the cell wall polymers of new agricultural plants
Principal Investigator: Ing. Anna Ebringerová, PhD.
Duration: 06/2004 - 06/2006
Funding from State Budget: 80 000 Sk

[9] Project Number: 99-11
Contract Number: 43/2004
Preparation od hyaluronan and other polysaccharide derivatives
Principal Investigators: Ing. Slavomír Bystrický, DrSc., Ing. Miroslav Kóóš, DrSc.
Duration: 20/01/2004 - 31/12/2005
Funding: 400 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[10] Project Number: 99-15
Contract Number: 44/2004)
Preparation of arabinogalactans, arabinoxylans and other polysaccharides; fragmentation of hyaluronan under various conditions
Principal Investigator: Ing. Anna Ebringerová, PhD.
Duration: 01/03/2004 - 20/12/2004
Funding: 70 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[11] Project Number: 99-16
Contract Number: 45/2004
Development of methods for chitinglucan complex isolation and solubilization
Principal Investigator: RNDr. Jozef Šandula, PhD.
Doba riešenia: 01/03/2004 - 30/06/2004
Funding: 40 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[12] Project Number: 436 SLK 113/9/0-1
The role of transglutaminases in the biogenesis of fungal cell walls
Principal Investigator: Doc. Ing. Vladimír Farkaš, DrSc.
Duration: 07/04/2003-06/04/2006
Funding: 26 800 EUR (from Deutsche Forschungsgemeinschaft (DFG), Germany)

[13] Project Number: ALLTECHEMINST 2005
Study of functional properties of yeasts „ALLTECHEMINST 2005“
Principal Investigator: Ing. Grigorij Kogan, DrSc.
Duration: 01/01/2005 - 31/12/2005
Funding: 281 821 Sk (from Alltech, Inc., Nicholasville, KY, USA)

[14] Project Number: 22 (slovak-french scientific and technical cooperation - program Štefánik)

Functionalization of lignins using enzymatically feruloylated saccharides
Principal Investigator: Ing. Mária Mastihubová, PhD.
Duration: 01/2006 - 12/2007
Funding from State Budget: 80 000 Sk

[15] Project Number: 99-38
Preparation of hyaluronan derivatives with potential biological activity
Principal Investigator: Ing. Slavomír Bystrický, DrSc., Ing. Miro Kóóš, DrSc.
Duration: 01/04/2006 - 31/12/2006
Funding: 120 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[16] Project Number: ALLTECHEMINST 2006
Biologically active fungal polysaccharides and selection of the yeasts appropriate for commercial utilization
Principal Investigator: Ing. Grigorij Kogan, DrSc.
Duration: 01/01/2006 - 31/12/2006
Funding: 11 200 USD (from Alltech, Inc., Nicholasville, KY, USA)

[17] Project Number: 99-15
Preparation of xyloglucans and other polysaccharides; fragmentation of hyaluronan under various conditions
Principal Investigator: Ing. Anna Ebringerová, PhD.
Duration: 01/12/2006 - 31/12/2007
Funding: 124 200 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

iii. List of other important projects and collaborations without direct funding

[1] **Synthesis of biologically significant *C*-glycosyl compounds**
Collaboration with: Whistler Center for Carbohydrate Research, Purdue University, West Lafayette, USA

[2] **Synthesis and structural studies of saccharide part of *Vibrio cholerae* O:1**
Collaboration with: NIDDK, NIH, LMC, Sect Carbohydrates, Bethesda, USA

[3] **Development of processes for enzymatic modification of plant polysaccharides**
Collaboration with: Pulp and Paper Research Organization (PAPRO), Forest Research, Rotorua, New Zeeland

[4] **Characterization of heterogeneous biocatalysts and bioaffinity separations using thermal and optical biosensors**
Collaboration with: Pure and Applied Biochemistry, Center for Chemistry and Chemical Engineering, Lund University, Lund, Sweden

[5] **Structural studies of saccharides using X-ray analysis**
Collaboration with: Department of Chemical and Biological Engineering, Chalmers University of Technology, Göteborg, Sweden

[6] **Syntesis, analysis of structure, dynamics of oligo- and polysaccharides with biological activity in solution; protein-carbohydrate interactions**
Collaboration with: Institute for Chemistry, Medical University of Lübeck, Lübeck, Germany

[7] **Apigen - honey bee as a new model for functional genomics**
Collaboration with: Max-Planck Institute of Molecular Genetics, Berlin-Dahlem, Germany

[8] **Synthesis of polysaccharide derivatives**
Collaboration with: Center of Excellence for Polysaccharide Research, Friedrich-Schiller University, Jena, Germany

[9] **Polymer properties and interactions in dilute and concentrated solutions**
Collaboration with: National Centre for Macromolecular Hydrodynamics, University of Nottingham, Sutton-Bonington, England

[10] **Development of enzyme systems for saccharification of lignocellulosic materials**
Collaboration with: Department of Microbiology, University of Stellenbosch, Matieland, South Africa

[11] **Isolation and structural analysis of microbial (1→3)-β-D-glucans**
Collaboration with: Institute of Physiology, Siberian Branch RAMS, Novosibirsk, Russia

[12] **Structure, conformation and dynamics of oligo- and polysaccharides with biological activity; protein-carbohydrate interactions**
Collaboration with: Institute of Chemistry and Biochemistry "G. Ronzoni", Milan, Italy

[13] **Development of microarrays for carbohydrate-protein and carbohydrate-cell interaction and diagnostic applications**
Collaboration with: University of Milano-Bicocca, Department of Biotechnology and Bioscience, Milan, Italy; University of Santiago Compostela, RIAIDT, Santiago De Compostela, Spain; CSIC, Esfera UAB, Barcelona, Spain

[14] **Structure of bacterial metabolites produced by bacteries *Fibrobacter succinogenes* S85 with ^{13}C-enriched cellulose**
Collaboration with: UMR 6504 SEESIB, Université Blaise Pascal-CNRS, Aubiere, France

[15] **Photodegradation of modified wood**
Collaboration with: Institute of Physics, University of Sopron, Sopron, Hungary

[16] **Extraction, modification and characterization of plant polysaccharides and their derivatives**
Collaboration with: General Chemistry Laboratory, Agricultural University of Athens, Athens, Greece

[17] **Regulation of capsule formation in *Cryptococcus neoformans***
Collaboration with: Research Center for Pathogenic Fungi and Microbial Toxicoses, Department of Molecular Function, Chiba University, Chiba, Japan

[18] **Biosynthesis of plant cell walls**
Collaboration with: Faculty of Sciences, University of Adelaide, School of Agriculture and Wine, Glen Osmond, Australia

[19] **Characterization of pectolytic enzymes of plants**
Collaboration with: Institute of Food Science and Biotechnology, Faculty of Chemistry, Brno University of Technology, Brno, Czech Republic

[20] **Multidisciplinary frontiers of magnetic resonance**
Proposal 05-PGM-022, Acronym: EMAR
Coordinator: Prof. Miquel Pons (Barcelona Science Research Park, Spain)

[21] **Degradation of plant fibres by *Ruminococcus albus* bacteria**
Collaboration with: Institute of Microbiology, INRA, Clermond-Ferrand-Theix, France

- **National projects and funding**

i. List of projects supported by the Agency for the Promotion of Research and Development (APVV/APVT), National Research Programmes, Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA), and their funding

APVV/APVT projects:
(Principal Investigator, Project Duration, Project Number, Allocated Finance in Assessment Period)

[1] **Hydrophobized polysaccharide derivatives for various industrial applications**
Ing. Anna Ebringerová, PhD., 08/2002-09/2005, APVT-51-015802,
2 707 000 Sk

[2] **Use of antigenic properties of polysaccharides and manoproteins from pathogenic yeasts in diagnosis and prevention of candidiasis**
Ing. Slavomír Bystrický, DrSc., 08/2002-10/2005, APVT-51-015902, 2 082 000 Sk

[3] **Biodegradable polymers based on saccharides and natural phenolic substances**
Ing. Mária Mastihubová, PhD., 02/2004-12/2006, APVT-51-032502,
1 572 000 Sk

[4] **New environmentally friendly use of lignin biopolymers from wastes of chemical wood treatment for chemoprevention of cancer and genetic diseases**
Prof. Ing. Božena Košíková, DrSc., 01/2004-12/2006, APVT-51-032602,
3 000 000 Sk

[5] **Preparation of bioactive Lipid A-mimetic conjugates leading to a novel type of immuno-therapeutics preventing Gram-negative bacteria-mediated septic shock**
Doc. Ing. Ladislav Petruš, DrSc., 01/2004-12/2006, APVT-51-039802,
2 665 000 Sk

[6] **Therapeutics based on an inhibition of glycosyltransferases**
Ing. Igor Tvaroška, DrSc., 01/2005-12/2007, APVT-51-004204, 1 782 000 Sk

[7] **Significance of defined oligosaccharide structures in plant cells - regulation of elongation growth, cell differentiation and protection abilities**
RNDr. Anna Kákošová, 01/2005-12/2007, APVT-51-013304, 1 626 000 Sk

[8] **Study of structure and properties of biologically active glycosamino-glycans in solution and their complexes with proteins**
Ing. Miloš Hricovíni, PhD., 01/2005-12/2007, APVT-51-034504, 2 254 000 Sk

[9] **Microbial esterases cleaving linkages between saccharides and lignin in plant cell walls**
RNDr. Peter Biely, DrSc., 03/2006-02/2009, APVV-51-003805, 3 165 000 Sk

[10] **Genetically engineered microorganisms as whole-cell catalysts of enantioselective biooxidations performing novel immobilization biotechnologies**
Ing. Peter Gemeiner, DrSc., 03/2006-02/2009, APVV-51-033205,
2 655 000 Sk

[11] **Oligosaccharides, neoglyco-peptides/proteins and humanized plastics – their synthesis and applications**
Ing. Jozef Nahálka, PhD., 03/2006-02/2009, APVV-51-040205, 856 000 Sk

[12] **Synthesis and biological evaluation of some model compounds with potential antimycobacterial activity**
Ing. Monika Poláková, PhD., 03/2006-02/2009, APVV-51-046505,
2 583 000 Sk

[13] **Immobilized biological systems: regulation of transport of nanoscale bioactive substances through well-defined polymer membranes in biotechnology and biomedicine**
Ing. Igor Lacík, PhD. (Polymer Institute of SAV), Ing. Peter Gemeiner, DrSc. (Institute of Chemistry of SAS), 09/2002-08/2005, APVT-51-016002, 680 488 Sk

[14] **Prediction of properties and functions of biological macromolecules based on computer modelling**
Prof. Ing. Tomáš Bleha, DrSc. (Polymer Institute of SAV), Ing. Igor Tvaroška, DrSc. (Institute of Chemistry of SAS), 01/2004-12/2006, APVT-51-044902, 593 000 Sk

[15] **Nanocomposite hybrid dispersions (materials): Preparation and collective properties**
Prof. RNDr. Ignác Capek, DrSc. (Alexander Dubček University in Trenčín, Faculty of Industrial Technologies in Púchov), Mgr. Peter Capek, PhD. (Institute of Chemistry of SAS), 03/2005-03/2008, APVT-20-017304, 600 000 Sk

[16] **Functional supramolecular surface nanostructure based on cyclodextrins**
Doc. Ing. Dušan Velič, PhD. (International Laser Center, Bratislava), Ing. Ivan Šimkovic, PhD. (Institute of Chemistry of SAS), 01/2005-12/2007, APVT-20-029804, 149 000 Sk

[17] **Molecular mechanisms of action of new drugs interfering with oxidative stress - the important factor in etiopathogenesis of numerous diseases**
Doc. MUDr. Svorad Štolc, DrSc. (Institute of Experimental Pharmacology of SAS), Ing. Grigorij Kogan, DrSc. (Institute of Chemistry of SAS), 03/2006-02/2009, APVV-51-017905, 298 000 Sk

Scientific-technical and industrial projects:

[18] Project Number: 2/9012/21
Preparations for biological plant protection based on the fungus *Trichoderma*
Principal Investigator: Doc. Ing. Vladimír Farkaš, DrSc.
Duration: 04/2001 - 12/2003
Funding: 165 000 Sk (from Ministry of Finance)

[19] Project Number: 51-51-9031-00/2002
Research, development and operating verification of synthesis of potential pharmacopreparatives and drugs, package materials and traps of heavy metals based on natural polymer – chitin
Principal Investigator: Ing. Grigorij Kogan, PhD.
Duration: 01/09/2002 - 01/09/2003
Funding: 168 000 Sk (from Ministry of Finance)

[20] Project Number: 51-51-9032-00/2002
Development and optimization of synthetic method for preparation of new biologically active polysaccharides, especially derivatives of hyaluronic acid, with potential utilization in cosmetics and medicine
Principal Investigator: Ing. Slavomír Bystrický, DrSc.
Duration: 01/09/2002-01/09/2003
Funding: 58 000 Sk (from Ministry of Finance)

[21] Project Number: 51-51-9033-00/2002
Novel environmental friendly utilization of lignin biomass component for preparation of new types of composite blends
Principal Investigator: Prof. Ing. Božena Košíková, DrSc.
Duration: 01/10/2002 - 01/10/2003
Funding: 144 000 Sk (from Ministry of Finance)

[22] Project Number: VTP-SP-2003-01-U-00-01
Preparation of polysaccharide product from buckwheat hulls and its application in bakery technology as a new functional food
Principal Investigator: Ing. Ján Hirsch, DrSc.
Duration: 01/10/2003 - 31/12/2004
Funding: 900 000 Sk (from Ministry of Finance)

[23] Project Number: 2004 ŠP 26 028 0C 05
State research and development program: Utilization of domestic materials and resources
Project: **Complex utilization of plant raw materials**
Subject part 2.1.: **Fytoproducts based on plant polysaccharides and its derivatives**
Coordinator: Doc. Ing. Stanislav Šilhár, CSc. (Food Research Institute-Biocenter, Modra, 2004-2005)
Coordinator: Doc. Ing. Peter Šimko, DrSc. (Food Research Institute, Bratislava, 2006)
Principal Investigator: Ing. Ján Hirsch, DrSc.
Duration: 01/07/2004 - 31/08/2007
Funding: 3 400 000 Sk (from Ministry of Finance)

[24] Project Number: 2004 ŠP 26 028 0C 05
State research and development program: Utilization of domestic materials and resources
Project: **Complex utilization of plant raw materials**
Subject part 5.7.: **Biopesticides based on fungi**
Coordinator: Doc. Ing. Stanislav Šilhár, CSc. (Food Research Institute-Biocenter, Modra, 2004-2005)
Coordinator: Doc. Ing. Peter Šimko, DrSc. (Food Research Institute, Bratislava, 2006)
Principal Investigator: Doc. Ing. Vladimír Farkaš, DrSc.
Duration: 01/07/2004 - 31/12/2006
Funding: 800 000 Sk (from Ministry of Finance)

[25] Project Number: 2003SP200280203
State research and development program: Complex solution of support of research and development infrastructure utilization
Completing of top-level nuclear magnetic resonance laboratory
Coordinator: Doc. Ing. Tibor Liptaj, CSc. (Slovak University of Technology)
Principal Investigator: Ing. Miloš Hricovíni, PhD., RNDr. Mária Matulová, PhD. (Institute of Chemistry of SAS)
Duration: 2003-2005 (first stage); 2006-2010 (second stage)
Funding: 5 002 000 Sk (from Ministry of Finance)

[26] Project: **Development of flavonoids as food additives with preventive effect**
State research and development program: Quality of life - health, nutrition, education
Subprogram: Foods - quality and safety
Principal Investigator: Doc. Ing. Ernest Šturdík, CSc. (University of Saint Cyril and Methodius in Trnava, Faculty of Natural Sciences)
Authorized Investigator: RNDr. Daniela Kákoniová, PhD., RNDr. Desana Lišková, PhD. (Institute of Chemistry of SAS)
Duration: 01/11/2004 - 31/01/2005
Funding: 80 000 Sk (from Ministry of Finance)

Projects of Centres of Excellence SAS:

[27] Project/Contract Number: II/2/2003
Centre Excellence SAS for the degradation of biopolymers (CEDEBIPO)
Principal Investigator: Ing. Grigorij Kogan, PhD.
Duration: 01/10/2002 - 01/10/2006
Prideľovateľ finančných prostriedkov: SAV
Funding: 1 131 000 Sk (from SAS)

[28] Project/Contract Number: II/2/2005
Centre Excellence SAS GLYCOBIOS
Principal Investigator: Doc. Ing. Vladimír Farkaš, DrSc.
Duration: 01/01/2005 - 31/12/2008
Funding: 1 430 000 Sk (from SAS)

VEGA projects:
(Principal Investigator, Project Duration, Project Number, Allocated Finance in Assessment Period)

[29] **Biorecognition techniques/technologies based on lectin-saccharide interactions employing native, synthetic and recombinant glyco-conjugates**
Ing. Peter Gemeiner, DrSc., 01/2001-12/2003, 2/1047/23, 121 000 Sk

[30] **Biologically active polysaccharides of yeasts and filamentous fungi: preparation and characterization of their derivatives with potential practical applications**
Ing. Grigorij Kogan, PhD., 01/2001-12/2003, 2/1048/23, 98 000 Sk

[31] **Plant oligosaccharides – signalling molecules and nontraditional growth regulators**
RNDr. Desana Lišková, PhD., 01/2001-12/2003, 2/1049/23, 93 000 Sk

[32] **Novel alternative environmentally friendly modes of utilisation of modified lignin polymeric products derived from chemical wood treatment**
Prof. Ing. Božena Košíková, DrSc., 01/2001-12/2003, 2/1052/23, 91 000 Sk

[33] **Molecular-genetic study of nutritional proteins and antimicrobial peptides of honeybeee (Apis mellifera L.) royal jelly**
Doc. Ing. Jozef Šimúth, DrSc., 01/2001-12/2003, 2/1053/23, 126 000 Sk

[34] **Diversity of yeasts and yeast-like organisms in agricultural soil – their activity and survival**
Ing. Elena Sláviková, PhD., 01/2001-12/2003, 2/1054/23, 100 000 Sk

[35] **NMR study of structure, dynamics and intermolecular complexes of biologically active saccharides**
Ing. Miloš Hricovíni, PhD., 01/2002-12/2004, 2/2002/23, 54 000 Sk

[36] **Design and synthesis of lipopolysaccharide mimetics**
Ing. Igor Tvaroška, DrSc., 01/2003-12/2005, 2/3077/23, 340 000 Sk

[37] **Microbial hemicellulolytic glycosyl hydrolases and esterases**
RNDr. Peter Biely, DrSc., 01/2003-12/2005, 2/3079/23, 134 000 Sk

[38] **Glycanases and their role in growth and modification of plant and fungal cell walls**
Doc. Ing. Vladimír Farkaš, DrSc., 01/2003-12/2005, 2/3158/23, 134 000 Sk

[39] **Structure elucidation studies of components of antigens of *Vibrio cholerae* O:1, serotypes Ogawa and Inaba**
Ing. Vladimír Kováčik, DrSc., 01/2003-12/2005, 2/3159/23, 95 000 Sk

[40] **Polygalacturonases – major enzymes of pectolytic enzyme system produced by yeasts and yeast-like microorganisms**
Ing. Eva Stratilová, PhD., 01/2003-12/2005, 2/3160/23, 118 000 Sk

[41] **Methodology of preparation of new cyclodextrin derivatives with ion-exchanging groups**
Ing. Ivan Šimkovic, PhD., 01/2003-12/2005, 2/3161/23, 47 000 Sk

[42] **Bioactive and functional plant polysaccharides for applications in food, pharmacy and cosmetics**
Ing. Ján Hirsch, DrSc., 01/2003-12/2005, 2/3162/23, 139 000 Sk

[43] **Chemical, biological and engineering aspects of improvement of biotechnological processes using immobilized systems**

Doc. Ing. Ernest Šturdík, CSc. (Slovak University of Technology), Ing. Peter Gemeiner, DrSc. (Institute of Chemistry SAS), 01/2003-12/2005, 1/0067/03, 99 000 Sk

[44] **Theoretical basis of phytoremediations applicable for decontamination of the environment polluted by metals**
Prof. RNDr. Elena Masarovičová, DrSc. (Comenius University), RNDr. Desana Lišková, PhD. (Institute of Chemistry SAS), 01/2003-12/2005, 1/0100/03, 27 000 Sk

[45] **Study of physiological and antimicrobial properties of proteins and peptides of the honeybeee (*Apis mellifera* L.) larval food**
Doc. Ing. Jozef Šimúth, DrSc., 01/2004-12/2006, 2/4059/04, 134 000 Sk

[46] **Biorecognition techniques: Lectins and modular saccharide-binding enzymes designed for application in biomedicine and biotechnology**
Ing. Peter Gemeiner, DrSc., 01/2004-12/2006, 2/4133/04, 122 000 Sk

[47] **Novel modifications of wood and agriculture plants treatment and use of lignin wastes as component of polymer blends**
Prof. Ing. Božena Košíková, DrSc., 01/2004-12/2006, 2/4141/04, 92 000 Sk

[48] **Diversity of yeasts and yeast-like microorganisms associated with plant material – their characterization, activity, and survival**
Ing. Elena Sláviková, PhD., 01/2004-12/2006, 2/4142/04, 97 000 Sk

[49] **Polysaccharides of yeast and filamentous fungi as ecological protective compounds**
Ing. Grigorij Kogan, DrSc., 01/2004-12/2006, 2/4143/04, 99 000 Sk

[50] **Preparation and immunological properties of saccharide-protein conjugates based on surface antigens of selected potential pathogens**
Ing. Slavomír Bystrický, DrSc., 01/2004-12/2006, 2/4144/04, 123 000 Sk

[51] **Involvement of cell wall galactoglucomannan-derived oligosaccharides in plant growth and developmental processes**
RNDr. Desana Lišková, PhD., 01/2004-12/2006, 2/4145/04, 73 000 Sk

[52] **In vitro production of taxanes - effective cancerostatic compounds**
RNDr. Daniela Kákoniová, PhD., 01/2004-12/2006, 2/4146/04, 60 000 Sk

[53] **Study of capsular galactoxylomannan biosynthesis in the yeast *Cryptococcus laurentii***
RNDr. Nadežda Kolarova, PhD., 01/2005-12/2007, 2/5073/25, 110 000 Sk

[54] **Glycosyltransferases of secretory pathway from model organisms: structure-function study of GDP-L-Fuc: Asn GlcNAc α 1,3 fucosyl-transferase (FucT 3c)**
RNDr. Ján Mucha, PhD., 01/2005-12/2007, 2/5074/25, 113 000 Sk

[55] **Study of structure, dynamics and intermolecular complexes of biologically active saccharides using methods of NMR spectroscopy and theoretical chemistry**
Ing. Miloš Hricovíni, PhD., 01/2005-12/2007, 2/5075/25, 88 000 Sk

[56] **Study of honeybee antimicrobial peptides-defensisns as protection factors of honeybees and their colonies against microbial pathogens**
RNDr. Jaroslav Klaudiny, PhD., 01/2006-12/2008, 2/6128/26, 64 000 Sk

[57] **Synthesis and biological activity of *N*-substituted iminoalditols of mono- and disaccharide types as potential therapeutics of viral and other diseases**
Doc. Ing. Ladislav Petruš, DrSc., 01/2006-12/2008, 2/6129/26, 670 000 Sk

[58] **Microbial glycoside hydrolases and esterases attacking plant cell walls**
RNDr. Peter Biely, DrSc., 01/2006-12/2008, 2/6130/26, 166 000 Sk

[59] **Plant hydrocolloids and their derivatives – a source of new phytoproducts**
Ing. Zdenka Hromádková, PhD., 01/2006-12/2008, 2/6131/26, 157 000 Sk

[60] **The development of methodologies for structural analysis of saccharides and their conjugates**
Ing. Vladimír Pätoprstý, PhD., 01/2006-12/2008, 2/6132/26, 84 000 Sk

[61] **The role of glycanases in biosynthesis of plant and fungal cell walls**
Doc. Ing. Vladimír Farkaš, DrSc., 01/2006-12/2008, 2/6133/26, 166 000 Sk

ii. Number of projects supported by the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA) for each year, and their funding

VEGA	2003	2004	2005	2006
number	16	16	19	16
funding (millions of SKK)	1,816	2,002	2,099	2,455

- **Summary of funding from external resources**

External resources	2003	2004	2005	2006	total	average
external resources (millions of SKK)	16,287	13,204	17,025	29,568	76,084	19,021
external resources transfered to coooperating research organizations (millions of SKK)	0,275	0,773	0,307	2,078	3,433	0,858
ratio between external resources and total salary budget	0,684	0,537	0,691	1,149	-	0,765
overall expenditures (millions of SKK)	68,792	78,412	89,978	107,976	345,158	86,290

Supplementary information and/or comments on research projects and funding resources

In addition to primary funding resources from grants, a significant portion of funding resources is available due to commercial activities of Production Department. This unit produces rare saccharides (some of them as a only producer in the world) and the income from their selling accounted for 18.1 mil. Sk in the assessment period. Some resources are also obtained from individual contracts, custom synthesis and services for other organizations.

5. Organization of PhD studies, other pedagogical activities

i. List of accredited programmes of doctoral studies (as stipulated in the previously effective legislation as well as in the recently amended Act on the Universities)

Previously accredited programmes of doctoral studies:

14-02-9 organic chemistry	(supervised by: PriF UK)
14-04-9 physical chemistry	(supervised by: PriF UK)
14-05-9 macromolecular chemistry	(supervised by: CHTF STU)
14-10-9 biochemistry	(supervised by: PriF UK)
15-02-9 molecular biology	(supervised by: PriF UK)
15-10-9 microbiology	(supervised by: PriF UK)

Recently accredited programmes of doctoral studies:

4.1.16 organic chemistry	(supervised by: PriF UK, FCHPT STU)
4.1.18 physical chemistry	(supervised by: PriF UK, FCHPT STU)
4.1.19 macromolecular chemistry	(supervised by: FCHPT STU)
4.1.22 biochemistry	(supervised by: PriF UK, FCHPT STU)

4.2.27 microbiology (supervised by: PriF UK)
5.2.25 biotechnology (supervised by: FCHPT STU)

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

ii. Summary table on doctoral studies (number of internal/external PhD students; number of students who completed their study by a successful thesis defence; number of PhD students who quitted the programme)

PhD study	12/31/03			12/31/04			12/31/05			12/31/06		
number of potential PhD supervisors	43			43			43			41		
PhD students	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted
internal	17	3	1	20	0	0	19	3	2	21	3	1
external	4	1	0	3	0	0	4	1	2	5	0	0
supervised at external institution by the research employees of the assessed organisation	5	0	0	6	0	0	6	1	0	4	1	1

iii. Postdoctoral positions supported by

a) external funding (specify the source)

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b) internal funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz

Júlia MIČOVÁ, PhD. - postdoctoral position for 2004–2007

iv. Summary table on pedagogical activities in undergraduate programmes for each year

Teaching	2003	2004	2005	2006
lectures (hours/year)	159	112	53	86
practicum courses (hours/year)	1388	857	1368	2006
supervised diploma works (in total)	10	7	6	7
members in PhD committees (in total)	14	14	14	16
members in DrSc. committees (in total)	5	5	5	5
members in university/faculty councils (in total)	2	2	1	1
members in habilitation/inauguration committees (in total)	3	2	1	2

v. List of published university textbooks

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vi. List of published academic course books

[1] HRICOVÍNI, M. - PETERS, T. *Molecular modeling*. Universität zu Lübeck. 2003.

[2] PETRUŠ, L. - PETRUŠOVÁ, M. *Chémia sacharidov*. *Učebný text pre 5. ročník špecializácie Organická chémia*. Bratislava: Katedra organickej chémie, Prírodovedecká fakulta Univerzity Komenského, 2005. http://chemia.rt.sk/

vii. List of joint research laboratories/facilities with the universities

[1] ***Fourier Transform Infrared Spectroscopy Laboratory***

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) situated at Institute of Chemistry SAS. The Laboratory serves for basic service and special measurements for individual research projects and pedagogical purposes, as well.

[2] ***National NMR Center***

Established at Faculty of Chemical and Food Technology (Slovak University of Technology). In the framework of the state research and development program, this Center 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 Institute of Chemistry SAS.

viii. Supplementary information and/or comments on doctoral studies and pedagogical activities

Due to grants obtained in 2006 through special scholarship programmes of European Union, there are 3 foreign students performing PhD study at the Institute of Chemistry.

Two scientists of the Institute of Chemistry participated at “Summer School of NMR Spectroscopy” regularly organized by Faculty of Chemical and Food Technology (Slovak University of Technology in Bratislava) for education of PhD students and young researchers.

6. Direct output to the society

(applications of results, popularization and outreach activities)

i. List of the most important results of applied research projects

[1] Enzymatic oligosaccharides synthesis is able overcome difficulties associated with chemical methods. Therefore, syntheses of oligosaccharides using immobilized recombinant enzymes and immobilized whole recombinant cells were compared. Based on the results, a suitable system for synthesis of sialyloligosaccharides was proposed.

[2] A glucuronoxylan with high antioxidative activity was prepared in laboratory and pilot plant scales from buckwheat hulls, a byproduct from buckwheat flour production. It represents a new breadmaking additive to low-quality flours, because it increases its effectivness and the quality of dough, improves the sensory properties and retards aging of bakery products. The results were successfully applied in PMD-Union, a.s., Bratislava.

[3] From wheat bran, a by-product of the milling procces of wheat grains and an important dietary fibre resource, polysaccharide preparations rich in phenolic substances (particularly ferulic acid and its derivatives) have been isolated at mild reaction conditions. The main polysaccharide component comprises a heteroxylan of very high molecular mass, which represents the dietary fiber component of the bran. The polysaccharide preparations exhibit significant antioxidant activity, which is comparable to that of the commercial food antioxidant α-tocopherol. Based on the physicochemical and antioxidant properties, the wheat bran polysaccharide preparations represent potential hydrocolloidal additives for the production of bakery products.

[4] The invention deals with the suggestion of application of the two hyaluronic acid derivatives that produce an inclusion complex upon being mixed

together, and a low-molar-mass drug molecule that serves as a complexation inhibitor. This mixture is to be applied intra-articularly at the joint osteoarthritis therapy. Use of such multicomponent mixture is advantageous in comparison with the application of a single high-molar-mass compound from the viewpoint of a more simple administration and a controlled release of the drug at the site of application.

[5] Determination of structure, molecular properties and biological activity of xylan-pectin complex from mahony (*Mahonia aquifolium*) and polysaccharide-phenolic complex from tamarind (*Tamarindus indica*) seed hulls. (for CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[6] Elaboration of methods for isolation of plant antioxidants.

[7] Elaboration of efficient method for preparation of xyloglucans and other polysaccharides and method for degradation of hyaluronan under various conditions. (applied in CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[8] Preparation and characterization of various fluorescence and hydrophobized derivatives of hyaluronan as well as cross-linked derivatives of hyaluronan. (applied in CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[9] Elaboration of method for removal of glucose from low-molecular dextran using biotransformation with immobilized enzyme. (for Biotika, a.s., Slovenská Ľupča)

[10] Cultivation of cell cultures of *Taxus baccata* aimed at production of compounds with antitumor activity - development of *in vitro* techniques for increasing of production of effective compounds, especially of paclitaxel. (for Výskumný ústav liečiv, Modra)

[11] Preparation of polysaccharidic hydrophobizing agents and testing of tenside properties of amphiphilic polysaccharide derivatives. (for VÚTCH-CHEMITEX, spol. s r.o., Žilina)

[12] Identification and production of extracellular biopolymers using milk bacteria. (for Výskumný ústav mliekarenský, a.s., Žilina)

ii. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign organizations

[1] BYSTRICKÝ, S.; GEMEINER, P.; MATULOVÁ, M.
External members of Commission for decision making in objections at Office for Public Procurement (2004-)

[2] GEMEINER, P.; KOGAN, G.
Members of Commission for evaluation of MCFI projects (EU) (2003-)

[3] HIRSCH, J.
Expert Advisor in Council of Research and Development State Program (program „Complex utilization of plant materials“ (2003-)

[4] FARKAŠ, GEMEINER, P.; HIRSCH, J.; V.; KOGAN, G.; PETRUŠ, L.; ŠIMÚTH, J.; TVAROŠKA, I.
Experts of FP5 EU - participation at 5 evaluations in Brussels (2003-2005)

[5] FARKAŠ, GEMEINER, P.; HIRSCH, J.; V.; KOGAN, G.; PETRUŠ, L.; TVAROŠKA, I.
Experts of FP6 EU - participation at 6 evaluations in Brussels (2005-)

[6] KOVÁČIK, V.
Representant of Slovakia in Verification Group, Organization for the Prohibition of Chemical Weapons (2003-)

[7] ŠIMÚTH, J.
Opponent reports on Research and Developmnent State Program (2003-2004)

Member of Commission for Biological Safety at Ministry of Environment of the Slovak Republic (2003-2004)

Member of Commission for Genetically Modified Organisms at Ministry of Agriculture of the Slovak Republic (2003-2004)

Member of Council of Opponents for Research and Development State Program (program „Nutrition and health in cultivation and education“) (2004)

iii. List of the most important popularization activities

Contributions in press:

[1] BIELY, P. 30. Výročná konferencia o kvasinkách – jubileum Komisie pre kvasinky. In *Bulletin Československej spoločnosti mikrobiologickej*. 2003, ročník XXXXIV, č. 1, s. 26-27.

[2] HIRSCH, J. Ocenené vedecké výsledky Chemického ústavu SAV v oblasti ochrany životného prostredia. In *Správy SAV*. 2003, č. 9, s. 9.

[3] PETRUŠ, L. Z tohtoročného Zjazdu Nemeckej chemickej spoločnosti. In *Bulletin SCHS*. 2003, č. 49, s. 18-19.

[4] BIELY, P. Vedec roka SR 2003 - rozhovor. In *Quark*. Ročník X, č. 9 (2004), s. 6-7.

[5] BIELY, P. Sebecké baktérie alebo ako kuriózne si mikroorganizmy chránia zdroj výživy. In *Quark*. Ročník X, č. 10 (2004), s. 18-20.

[6] BIELY, P. Záhadná veda, ktorú jeme v chlebe - rozhovor. In ŠKREKO, B. - DUBRAVAY, J. *Národná obroda: Víkend - príloha na 43. týždeň. 23. októbra 2004, s. II*.

[7] HIRSCH, J. Po trajektórii prioritného záujmu vedy. In *Správy Slovenskej akadémie vied*. Roč. 40, č. 9 (2004), s. 4-5. Bratislava: VEDA. ISSN 0139-6307.

[8] MARKOVIČ, O. Môj Štokholm. In *Správy Slovenskej akadémie vied*. Roč. 40, č. 4 (2004), s. 12-13. Bratislava: VEDA. ISSN 0139-6307.

[9] ŠIMÚTH, J. Pilierom Európskeho výskumného priestoru je základný výskum. In *Správy Slovenskej akadémie vied*. Roč. 40, č. 5/6 (2004), s. 6-7. Bratislava: VEDA. ISSN 0139-6307.

[10] ŠIMÚTH, J. Prezident Max-Planckovej spoločnosti Prof. Peter Gruss na návšteve v SAV. In *Správy Slovenskej akadémie vied*. Roč. 40, č. 4 (2004), s. 2. Bratislava: VEDA. ISSN 0139-6307.

[11] FARKAŠ, V. Biologická ochrana rastlín mikroskopickou hubou *Trichoderma*. In *Enviromagazín*. Roč. 8, č. 5 (2003), s. 12-13. Banská Bystrica: MŽP SR, SAŽP. ISSN 1335-1877.

[12] KOŠÍKOVÁ, B. - SLAMEŇOVÁ, D. - LÁBAJ, J. Nové environmentálne vhodné využitie lignínových odpadov pre chemoprevenciu nádorových a genetických ochorení. In *Enviromagazín*. Roč. 8, č. 5 (2003), s. 24-25. Banská Bystrica: MŽP SR, SAŽP. ISSN 1335-1877.

[13] SLÁVIKOVÁ, E. Zbierka kultúr kvasiniek SAV. In *Enviromagazín*. Roč. 8, príloha č. 5 (2003), s. 12-13. Banská Bystrica: MŽP SR, SAŽP. ISSN 1335-1877.

[14] FARKAŠ, V. Tradícia „kvasinkových“ Budmeríc. In *Správy SAV*. Roč. 41, č. 5 (2005), s. 7. Bratislava: VEDA. ISSN 0139-6307.

[15] KOGAN, G. Európske sympózium o sacharidoch. In *Správy SAV*. Roč. 41, č. 9 (2005), s. 7. Bratislava: VEDA. ISSN 0139-6307.

[16] TVAROŠKA, I. Globálna odpoveď na pandemickú hrozbu. In *Správy SAV*. Roč. 41, č. 11 (2005), s. 10-11. Bratislava: VEDA. ISSN 0139-6307.

[17] TVAROŠKA, I. Rozhovor o Chemickom Ústave SAV. In *TASR, 22.8.2005*.

[18] BIELY, P. Štyridsať rokov Medzinárodnej komisie pre kvasinky: Vzišla na pôde akadémie. In *Správy SAV*. Roč. 42, č. 1 (2006), s. 14. Bratislava: VEDA. ISSN 0139-6307.

[19] BIELY, P. 40 rokov Medzinárodnej komisie pre kvasinky - International Commission on Yeasts (ICY). In *Bulletin Československé společnosti*

mikrobiologické. Vol. 47, č. 1 (2006), s. 49-52. Praha: Čs. společnost mikrobiologická, 2006. ISBN 0009-0646.

[20] BIELY, P. Osemdesiatka Ing. RNDr. Oskara Markoviča, DrSc. In *ChemZi*. Vol. 2, č. 2 (2006), s. 91. ISSN 1336-7242.

[21] FARKAŠ, V. Neviditeľný ochranca rastlín – huba *Trichoderma*. In *Quark*. Roč. XII, č. 12 (2006), príloha: Aktuálna veda a výskum. ISSN 1335-4000.

[22] FARKAŠ, V. V Smoleniciach to opäť kvasilo. In *Správy SAV*. Roč. 42, č. 6 (2006), s. 10. Bratislava: VEDA. ISSN 0139-6307.

[23] FARKAŠ, V. Patočkova medaila RNDr. Petrovi Bielemu, DrSc. In *Správy SAV*. Roč. 42, č. 6 (2006), s. 10. Bratislava: VEDA. ISSN 0139-6307.

[24] KOŠÍKOVÁ, B. K ochrane zdravia môže výrazne prispieť aj lignín - rozhovor s redaktorom ČTK. In *Pravda, 21.11.2006*.

[25] PETRUŠ, L. Vtáčiu chrípku môžu vyliečiť cukry - rozhovor s redaktorom ČTK. In *Pravda, 21.11.2006*.

[26] TVAROŠKA, I. Pandémii chceme zabrániť – rozhovor. In *Quark*. Roč. XII, č. 2 (2006), s. 6-7. ISSN 1335-4000.

Contributions in radio and television:

[27] ŠIMÚTH, J. Genomika včely. In *Slovenský rozhlas, 2.9.2003*.

[28] FARKAŠ, V. Biologická ochrana rastlín I. In *Rádio Devín, relácia Solárium, 27.10.2004*.

[29] FARKAŠ, V. Biologická ochrana rastlín II. In *Rádio Devín, relácia Solárium, 8.11.2004*.

[30] BIELY, P. Interview po prevzatí ocenenia Vedec roka SR 2003. In *Televízia TA3, 21.6.2004*.

[31] FARKAŠ, V. Rozhovor o medzinárodnom sympóziu EUROCARB 13. In *Rádio Regina, relácia Ranný Rádiožurnál, 18.8.2005*.

[32] GREGOROVÁ, A. Rozhovor - Deň otvorených dverí na CHÚ SAV v rámci Týždňa vedy. In *Rádio Regina, relácia Ranný Rádiožurnál, 10.11.2005*.

[33] SLÁVIKOVÁ, E. Rozhovor o Zbierke kvasiniek - Deň otvorených dverí na CHÚ SAV v rámci Týždňa vedy. In *Rádio Regina, relácia Ranný Rádiožurnál, 10.11.2005*.

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Contributions on internet:

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iv. List of patents issued abroad, incl. revenues

[1] NATIONAL RESEARCH OF CANADA: *Synthesis of lipopolysaccharide-protein conjugate vaccines via the lipid A region following removal of the glycosidic phosphate residue*. Inventor: ZOU, W. - COX, A. - JENNIGS, H. - RICHARDS, J.C. - MOXON, R. - MIESZALA, M. - KOGAN, G. International Application No: PCT/CA03/00252 (2003). Application No: WO2003CA00254 (2003). Patent No: WO 03/070282 A2 (2003).

[2] FIDIA FARMACEUTICI S.P.A., ITALY, INSTITUTE OF EXPERIMENTAL PHARMACOLOGY, SLOVAK ACADEMY OF SCIENCES, SLOVAKIA: *Clathrate complexes formed by hyaluronic acid derivatives, process for their preparation and pharmaceutical compositions containing them and their use*. Inventor: MENDICHI, R. - MACHOVÁ, E. - KOGAN, G. - ŠOLTÉS, L. - STEINER, B. - BYSTRICKÝ, S. International Application No: PCT/EP01/ 02722 (2001). Application No: HU20030000163 (2001). Hungarian patent: HU 03/00163 (2003).

[3] NATIONAL RESEARCH OF CANADA: *Synthesis of lipopolysaccharide-protein conjugate vaccines via the lipid A region following removal of the glycosidic phosphate residue*. Inventor: ZOU, W. - COX, A. - JENNIGS, H. - RICHARDS, J.C. - MOXON, R. - MIESZALA, M. - KOGAN, G. European patent: EP1476197. 2004-11-17.

[4] FIDIA FARMACEUTICI, SLOVAK ACADEMY OF SCIENCES: *Clathrate complexes formed by hyaluronic acid derivatives and use thereof as pharmaceuticas*. Inventor: MENDICHI, R. - ALFÖLDI, J. - MACH, M. - MACHOVÁ, E. - BAUER, V. - KOGAN, G. - ŠOLTÉS, L. - STEINER, B. - STRATILOVÁ, E. - BYSTRICKÝ, S. Polish patent: PL357557. 2004-07-26.

[5] FIDIA FARMACEUTICI, SLOVAK ACADEMY OF SCIENCES: *Clathrate complexes formed by hyaluronic acid derivatives and use thereof as pharmaceuticas*. Inventor: MENDICHI, R. - ALFÖLDI, J. - MACH, M. - MACHOVÁ, E. - BAUER, V. - KOGAN, G. - ŠOLTÉS, L. - STEINER, B. - STRATILOVÁ, E. - BYSTRICKÝ, S. US patent: US2004076680. 2004-04-22.

[6] GLYCODESIGN INC: *Novel 3,5,and/or 6 substituted analogues of swainsonine processes for their preparation and their use as therapeutic*

agents. Inventor: TROPPER, F.D. - CARVER, J. - TVAROŠKA, I. - DENNIS, J. - SHAH, R. - MARINO-ALBERNAS, J. US patent: US2003236229. 2003-12-25.

[7] Applicant/inventor: JENNINGS, H. - MIESZALA, M. - KOGAN, G. - ZOU, W. - RICHARDS, J.C. - COX, A. *Synthesis of lipopolysaccharide-protein conjugate vaccines via the lipid A region following removal of the glycosidic phosphate residue*. US patent: US2005147624. 2005-07-07.

[8] Applicant/inventor: GLOSSL, J. - STRASSER, R. - MUCHA, J. - MACH, L. - ALTMANN, F. - WILSON, I.B. - STEINKELLNER, H. *Beta 1,2-xylosyl-transferase-gene from arabidopsis*. Austrian patent: AU781010. 2005-04-28.

[9] Applicant: FIDIA FARMACEUTICI, SLOVAK ACADEMY OF SCIENCES: *Clathrate complexes formed by hyaluronic acid derivatives and use thereof as pharmaceuticals*. Inventor: ŠOLTÉS, L. - STEINER, B. - MACHOVÁ, E. - KOGAN, G. - BYSTRICKÝ, S. - MENDICHI, R. - BAUER, V. - MACH, M. - ALFÖLDI, J. - STRATILOVÁ, E. European patent: EP1272530B1. 2006-09-20.

[10] Applicant: GLOSSL, J. *Beta 1,2-xylosyltransferase-gene from arabidopsis*. Inventor: GLOSSL, J. - STRASSER, R. - MUCHA, J. - MACH, L. - ALTMANN, F. - WILSON, I.B. - STEINKELLNER, H. German patent: DE60115863T. 2006-08-10.

v. List of the patents issued in Slovakia, incl. revenues

[1] INDUSTRIAL PROPERTY OFFICE OF THE SLOVAK REPUBLIC: *Spôsob prípravy D-hamamelózy*. Patent owner: Institute of Chemistry SAS. Inventor: HRICOVÍNIOVÁ, Z. - PETRUŠ, L. Patent No: 284292. Date: 25.10.2004.

[2] INDUSTRIAL PROPERTY OFFICE OF THE SLOVAK REPUBLIC: *Spôsob prípravy D-sedoheptulózy*. Patent owner: Institute of Chemistry SAS. Inventor: HRICOVÍNIOVÁ, Z. - PETRUŠ, L. Patent No: 284318. Date: 15.11.2004.

vi. List of licences sold abroad, incl. revenues

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vii. List of licences sold in Slovakia, incl. revenues

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viii. List of contracts with industrial partners, incl. revenues

[1] *Vodní sklo Brno, a.s.*
Development of foundry compositions based on water glass.
Revenues: 25 490 Sk

[2] *CMS Chemicals, Q-chem, spol. s r.o., Bratislava*
Mesurement and interpretation of mass, NMR, and IR spectra; determination of C, H, N, S, Cl, and sulfate ash in selected samples.
Revenues: 134 600 Sk

[3] *Skloplast, a.s., Trnava*
Determination of elemental composition of selected samples.
Revenues: 6 000 Sk

[4] *Mikrochem, spol. s r.o., Pezinok*
Measurement of optical rotation of selected samples.
Revenues: 224 000 Sk

[5] VÚRUP Slovnaft, a.s., Bratislava
Determination of elemental composition of selected samples.
Revenues: 4 600 Sk

[6] SCIF, a.s., Bratislava
Verification of pilot production of potassium pectate.
Revenues: 168 000 Sk

[7] VUCHT, a.s., Bratislava
Determination of elemental composition of selected samples.
Revenues: 17 000 Sk

[8] Biotika, a.s., Slovenská Ľupča
Agreement about scientific and technical cooperation – providing with microorganisms for scientific purposes.

For further contracts see List of research projects with industrial partners in following chapter.

ix. List of research projects with industrial partners, incl. revenues

[1] Project Number/Contract Number: 30/2002
Preparation od hyaluronan and other polysaccharide derivatives
Principal Investigator: Ing. Slavomír Bystrický, DrSc., Ing. Miroslav Kóóš, PhD.
Duration: 01/08/2002 - 31/05/2003
Funding: 250 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[2] Project Number: 51-51-9012-00/2002
Cooperation with industry: Azoter, spol. s r.o., Nové Zámky
Preparations for biological plant protection based on the fungus *Trichoderma*
Principal Investigator: Doc. Ing. Vladimír Farkaš, DrSc.
Duration: 04/2001 - 12/2003
Funding: 165 000 Sk (from Ministry of Finance)

[3] Project Number: 51-51-9031-00/2002
Cooperation with industry: SCIF, spol. s r.o.
Research, development and operating verification of synthesis of potential pharmacopreparatives and drugs, package materials and traps of heavy metals based on natural polymer – chitin
Principal Investigator: Ing. Grigorij Kogan, PhD.
Duration: 01/09/2002 - 01/09/2003
Funding: 168 000 Sk (from Ministry of Finance)

[4] Project Number: 51-51-9032-00/2002
Cooperation with industry: CPN spol. s r.o., Dolní Dobrouč, Czech Republic
Development and optimization of synthetic method for preparation of new biologically active polysaccharides, especially derivatives of hyaluronic acid, with potential utilization in cosmetics and medicine
Principal Investigator: Ing. Slavomír Bystrický, DrSc.
Duration: 01/09/2002-01/09/2003
Funding: 58 000 Sk (from Ministry of Finance)

[5] Project Number: 51-51-9033-00/2002
Cooperation with industry: Matador, a.s., Púchov
Novel environmental friendly utilization of lignin biomass component for preparation of new types of composite blends
Principal Investigator: Prof. Ing. Božena Košíková, DrSc.
Duration: 01/10/2002 - 01/10/2003
Funding: 144 000 Sk (from Ministry of Finance)

[6] Project Number/Contract Number: 32/2003
Chemistry of natural macromolecular compounds – saccharides and polysaccharides
Principal Investigator: Ing. Anna Ebringerová, PhD.
Duration: 01/01/2003 - 31/12/2003
Funding: 70 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[7] Project Number: VTP-SP-2003-01-U-00-01
Preparation of polysaccharide product from buckwheat hulls and its application in bakery technology as a new functional food
Principal Investigator: Ing. Ján Hirsch, DrSc.
Duration: 01/10/2003 - 31/12/2004
Funding: 900 000 Sk (from Ministry of Finance)

[8] Project Number: 99-11
Contract Number: 43/2004
Preparation od hyaluronan and other polysaccharide derivatives
Principal Investigator: Ing. Slavomír Bystrický, DrSc., Ing. Miroslav Kóóš, DrSc.
Duration: 20/01/2004 - 31/12/2005
Funding: 400 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[9] Project Number: 99-15
Contract Number: 44/2004)
Preparation of arabinogalactans, arabinoxylans and other polysaccharides; fragmentation of hyaluronan under various conditions
Principal Investigator: Ing. Anna Ebringerová, PhD.
Duration: 01/03/2004 - 20/12/2004
Funding: 70 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[10] Project Number: 99-16
Contract Number: 45/2004
Development of methods for chitinglucan complex isolation and solubilization
Principal Investigator: RNDr. Jozef Šandula, PhD.
Doba riešenia: 01/03/2004 - 30/06/2004
Funding: 40 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[11] Project Number: ALLTECHEMINST 2005
Study of functional properties of yeasts „ALLTECHEMINST 2005“
Principal Investigator: Ing. Grigorij Kogan, DrSc.
Duration: 01/01/2005 - 31/12/2005
Funding: 281 821 Sk (from Alltech, Inc., Nicholasville, KY, USA)

[12] Project Number: 99-38
Preparation of hyaluronan derivatives with potential biological activity
Principal Investigator: Ing. Slavomír Bystrický, DrSc., Ing. Miroslav Koóš, DrSc.
Duration: 01/04/2006 - 31/12/2006
Funding: 120 000 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

[13] Project Number: ALLTECHEMINST 2006
Biologically active fungal polysaccharides and selection of the yeasts appropriate for commercial utilization
Principal Investigator: Ing. Grigorij Kogan, DrSc.
Duration: 01/01/2006 - 31/12/2006
Funding: 11 200 USD (from Alltech, Inc., Nicholasville, KY, USA)

[14] Project Number: 99-15
Preparation of xyloglucans and other polysaccharides; fragmentation of hyaluronan under various conditions
Principal Investigator: Ing. Anna Ebringerová, PhD.
Duration: 01/12/2006 - 31/12/2007
Funding: 124 200 Sk (from CPN spol. s r.o., Dolní Dobrouč, Czech Republic)

x. Summary of outreach activities

Outreach activities	2003	2004	2005	2006	total
studies for the decision sphere, government and NGOs, international and foreign organizations	7	9	6	5	27
articles in press media/internet popularizing results of science, in particular those achieved by the Organization	6	7	5	9	27
appearances in telecommunication media popularizing results of science, in particular those achieved by the Organization	1	3	6	0	10
public popularization lectures	4	1	3	16	24

xi. Supplementary information and/or comments on applications and popularization activities

Since 2005, the Institute regularly organizes “The Open Doors's Day” for general public to popularize results of research achieved in institutional laboratories as well as chemistry and biochemistry of saccharides generally.

7. Background and management. Staffing policy and implementation of findings from previous assessments

i. Summary table of personnel

Personnel	2003	2004	2005	2006
all personnel	124	146	133	135
research employees from Tab. Research staff	69	68	66	71
FTE from Tab. Research staff	59	61	65	69
averaged age of research employees with university degree	47	47	45	46

ii. Professional qualification structure

Number of	2003	2004	2005	2006
DrSc.	12	14	13	12
PhD / CSc.	46	44	46	45
Prof.	2	2	2	2
Doc./Assoc. Prof.	4	4	3	2

iii. Status and development of research infrastructure incl. experimental, computing and technical base (description of the present infrastructure, premises, and material and technical resources. Infrastructure, instrumentation and major technical equipment necessary for the achievement of the objectives specified in the research Concept)

The major instrumentation available at the Analytical Department includes:

Multinuclear FT NMR spectrometer Bruker Avance DPX 300
-equipped with gradient enhanced spectroscopy kit GRASP for generation of Z gradients up to 50 Gauss/cm, VAS 300 inverse broadband probehead, QNP probehead for ^{1}H-^{31}P-^{13}C-^{15}N nuclei, variable temperature system from –40 to 180°C.

The Institute has also possibility to use Unity Inova 600 MHz Varian NMR spectrometer at the Faculty of Chemical and Food Technology of Slovak University of Technology.

FTIR spectrometer Nicolet Magna 750
IR spectrometer Perkin-Elmer

Combined system SSQ 700 GC/MS/DS (Finnigan)
MALDI TOF Compact Kratos Analytical

Automatic polarimeter Perkin-Elmer Model 241

Lyophilization system LABCONCO Freezone 18

Elemental Analyzer Fisons EA 1108

The availability of some other necessary major instrumentation and technical equipment (for X-ray diffraction, thermic analysis, ORD, CD) is arranged through cooperating institutes and laboratories in Slovakia as well as abroad.

The other instrumentation available at the Institute:

HPLC - Preparative Chromatography System WATERS Delta Prep 3000
FPLC - Fluid Pressure Liquid Chromatography
HPLC System Shimadzu
HPLC Gold Star System BECKMAN (4 individually programmable blocks with integrated refractometer Beckman 156)
4 HPLC with UV/VIS and RI detector

Reverse-osmotic Unit SSR050G

Centrifuge Hettich Universal 32

Rotatory viscosimeter RHEOTEST 2
Rotatory digital viscosimeter LVDV-II+ Brookfield

4 Spectrophotometers SPEKOL 11 Beckman
3 UV/VIS Spectrophotometer Shimadzu
2 UV/VIS Spectrophotometer Specord Carl Zeiss Jena
Spectrophotometer MRX II

Cooled Centrifuge Jouan
Cooled Centrifuge Boeco Hettich
Non-cooled centrifuge
2 Microtube Centrifuges Heraeus

Flow Calorimeter-Enzyme Thermistor Thermal Assay Probe-TAP3300 AB Technology
Flow Injection Analyzer-FIA System (intergrated with Flow Calorimeter and Process Monitoring Cabinet)

Encapsular Reactor

2 Ultrasound Generators

3 Ultrafiltrations Amicon

Microscopic Workstation (microscope LM 6-3 and stereomicroscope STM 723; digital picture processing)

Computers for theoretical calculations:
3 Computers Quantum Cube (16 CPU's)
1 Computer Silicon Graphics Origin 200
2 Linux PC (4 CPU's)
2 Linux Clusters (24 CPU's)

Laboratories of organic chemistry and biochemistry are equipped with routine infrastructure and instrumentation (rotatory vacuum evaporators, membrane vacuum pumps, fraction-collectors, magnetical and mechanical stirrers,

electrophoresis, thermostats, rotatory and vibratory shakers, refractometric detectors, pH-meters, precise digital balances, freezing boxes, ...).

For the achievement of the objectives specified in the research Concept, following new technical equipments are required:

HPLC, GPC
- with UV/VIS, refractometric, fluoroscence, light scattering, and electro-chemical detectors, column thermostat, autosampler, fraction collector.

Electrophoresis
- capillary zone electrophoresis, capillary isotachophoresis, capillary isoelectric focusation, micellar electrokinetic capillary chromatography, gel electrophoresis.

GC
- head space, pyrolyzer, fast GC, microextraction on solid phase.

HPTLC

Mass spectrometry: LTQ Orbitrap, ICP MS, MALDI TOF/TOF
- to provide ionization methods: EI, CI, FAB, ESI, NESI, APCI, MALDI
- to provide high resolution, MS-MS methods, direct introduction of solid and liquid sample, GC, LC, CE, broad scale of molecular mass measurement.

Rheometer
- multifunctional instrument

IR
-thermogravimetric analyzer

iv. Status and development of bibliographic resources, activities of the Organization's library and/or information center

The Library as a basic information center with two employees has provided scientific information through complete librarian, recherching and reprographic services. In librarian funds, totally 25 170 librarian units were registered. In the assessment period, 23 scientific journal titles (hardcopies) were subscribed (among them 10 through Central Library of SAS. The membership of Central Library of SAS in several corresponding consortia (ScienceDirect, SpringerLink, Blackwell-Synergy, ProQuest, Suweco-Wiley) allows institutional employees an open access to many electronic-online versions of scientific journals.

Regarding activities and information necessary for research projects solving, following services were provided:
- aquisition and compilation of primary and secondary information sources in the main scientific direction as well as relative and auxiliary disciplines;

- accomodations of library's own literature for institutional as well as external users (for external users, 410 accomodations were realized during 2003-2006);
- accomodations of literature for institutional users from other libraries via interlibrary accomodation service;
- reprography and xerox copying (ca 296 000 xerox copies during 2003-2006);
- participation in compilation of necessary data for annual evaluation of scientific workers;
- participation in elaboration of citation indexes.

v. Describe how the results and suggestions of the previous assessment were taken into account

Suggestion a) closer cooperation with universities regarding pedagogical activities with emphasis on possibility to increase number of doctorands as well as creation of joint laboratories:

In this respect, pedagogical activity of the Institute given by teaching indicators (see Table iv under indicator 5) increased significantly, in comparison with previous assessment period. To increase the number of doctorands is problematic due to existing competences and financing. According to effective legislative, all doctorands are PhD students of corresponding university and therefore finances from Ministry of Education are allocated to the university. Financial support from Presidium of SAS and from institutional budget is limitted. Despite this problem, about 19 internal PhD students in average yearly are educated at the Institute. Recently, some new possibilities of PhD student positions became available through special scholarship programmes of European Union and projects of Agency for the Promotion of Research and Development (APVV). Thus, 3 PhD student scholarships were obtained from EU in 2006.

As to joint laboratories, in addition to already existing Joint FTIR Laboratory, the Institute cooperated closely with several university NMR laboratories (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) in the project: Completing of top-level nuclear magnetic resonance laboratory in the framework of the State research and development program: Complex solution of support of research and development infrastructure utilization. As a result, the National NMR Center has been established at Faculty of Chemical and Food Technology equipped with Unity Inova 600 MHz instrument (Varian) and the Institute of Chemistry has a possibility to use this instrument. Additionally, in 2007, the Institute of Chemistry will be also provided with modern 600 MHz NMR instrument, and simultaneously, currently operating 300 MHz instrument will be upgrated.

Suggestion b) renovation/modernization of existing laboratory equipment:

Due to increased finances from research grants, most of laboratories were able to modernize their equipments and infrastructure. For example, old-fashioned rotatory vacuum evaporators were replaced by modern Heidolph

instruments connected with Vacuubrand membrane vacuum pumps. Analogously, several Reverse Osmosis Systems SSR050G (water purifiers) replaced all electrical water distillers. In addition, several cupboards were remodelled. The Analytical Department obtained new Lyophilization System LABCONCO Freezone 18 (in 2005). During this assessment period, most of laboratories were provided with modern precise digital balances, efficient magnetical and mechanical stirrers, thermostats, rotatory and vibratory shakers, pH-meters, centrifuges, instruments for electrophoresis and ultrasound generation, digital viscosimeters, laminar, freezing and cooling boxes. A great progress has been also registered in computing technique. New obtained computers Quantum Cube, Silicon Graphics Origin 200, and Linux Clusters represent state-of -art computing facility in the field.

vi. Supplementary information and/or comments on management, research infrastructure, and trends in personnel development

A new organization structure came into effect from January 2005. The research activities were concentrated into Center for Glycomics which consists of nine scientific departments:

- Department of Enzymology of Saccharides
- Department of Glycobiology
- Department of Glycobiotechnology
- Department of Glycochemistry
- Department of Glycomaterials
- Department of Immunology of Glycoconjugates
- Department of Structure and Function of Saccharides
- Analytical Department
- Culture Collection of Yeasts

Because all chairmen of departments become the members of Institute Board, this organization structure allows more effective cooperation with leadership and other institutional bodies as well as more practical information transfer and management of research and organizational duties.

The Institute applied for a grant from ESF which we plan to use for development of skills of all personnel in modern IT and analytical methods.