

HUNGARIAN ACADEMY OF SCIENCES



RESEARCH INSTITUTIONS
AND THEIR ACTIVITIES



2008



HUNGARIAN ACADEMY OF SCIENCES

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**RESEARCH INSTITUTIONS
AND THEIR ACTIVITIES**



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ABBREVIATIONS

Scientific degrees:

HAS = Hungarian Academy of Sciences

Ph.D. = Doctor of Philosophy

C.Sc. = Candidate of Sciences

D.Sc. = Doctor of Sciences

C.M. = Corresponding Member of the H.A.S.

F.M. = Full Member of the H.A.S.

Cover photo:

Johann Nepomuk Ender: Allegory of the Hungarian Academy of Sciences, 1831.

Oil on canvas, 273×189 cm

PREFACE

Two hundred years ago by Act VIII of 1808 the need for establishing a scholarly society in Hungary was mentioned first. During the last decade of the 18th and the first decade of the 19th century, various plans were conceived for the establishment of an academy for developing and propagating the Hungarian language and for promoting the development of science, but funds for establishing such a society were not available. Count István Széchenyi an outstanding personality offered one year's income of his estate for the purposes of a learned society. From that very day up to now the Hungarian Academy of Sciences serves as a scholarly public body founded on the principle of self-government, whose main task is the study of science, the publicizing of scientific achievements, and the aid and promotion of research.

The scientific network of the Academy comprises a wide range of research institutions as well as integrates almost the whole of higher education represented by various research teams. The field of research done in this network covers natural, life, and social sciences and humanities.

This booklet has been written and compiled to provide readers with valuable information concerning the scope and field of research work done at the scientific institutions of the Academy. We do hope, that the following passages will enable readers to get acquainted with the research network of ours.

Budapest, 1st June 2008

Tamás Németh
Secretary General



Count István Széchenyi (1791–1860) founder of the Academy in 1825

**PRINCIPAL OFFICERS
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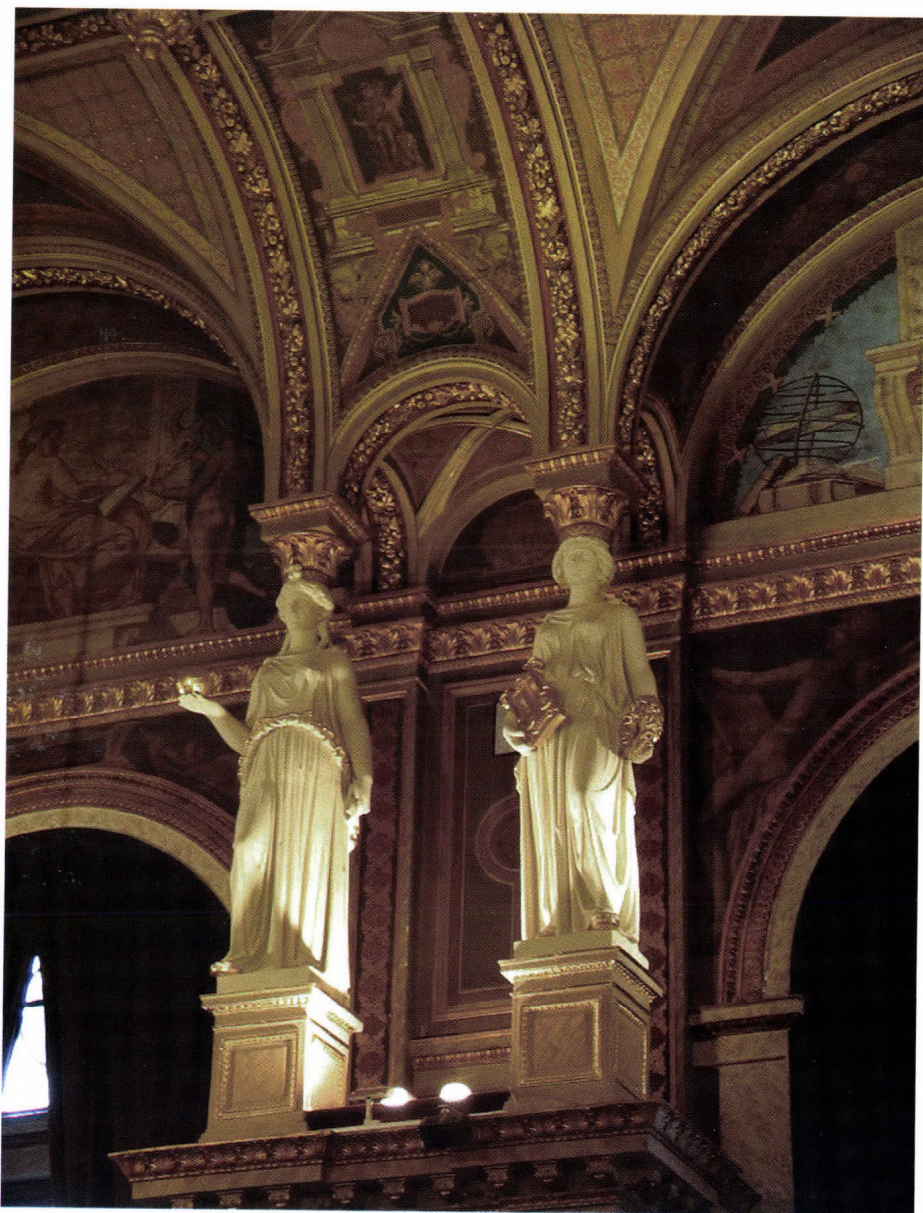
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FOR LIFE SCIENCES**

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Scope of activities

The mandate of the Institute is to investigate viral, bacterial and parasitic diseases of farm, pet and wild animals (including fishes) by using both classical and state-of-art molecular biological approaches. The overwhelming part of the work is basic research, focusing on molecular and genetic characterization of microorganisms. In addition, the Institute participates in the improvement of diagnostic and vaccination methods, as well as in different forms of graduate and post-graduate training. It also plays role in the development of international collaborations, in publicizing the scientific achievements, and in the technological transfer of research results for application purposes. At present, the Institute, as an internationally acknowledged site of basic research, continues to consolidate its position as a national resource of new knowledge applicable in prevention of infectious animal diseases.

Research aims and topics

Most of the research is concentrated on studying the genetic material and



The main building of the Institute

proteins of various pathogens. Among the viruses, primarily adenoviruses, herpesviruses, avian influenza, and certain avian tumor-inducing viruses are investigated. Among the bacteria, members of *Escherichia*, *Pasteurella*, *Salmonella*, *Bordetella* as well as *Mycoplasma* genera are studied to gain information espe-

cially about virulence characteristics. An important direction of the research is the elaboration of modern diagnostic methods based on the detection of nucleic acids of different infective agents. It is also important to study the relationship between virulence and antigenic composition of the pathogenic organisms. Basic research activities on fish parasites are related to the etiology of diseases and to the biology of myxosporean species. Food safety problems and environmental health aspects of certain infections are also investigated. A brief overview is given below about the research activity in the three main areas.

Virology projects

- Comparative genome analysis of adenoviruses from different hosts including fish, reptiles, birds and mammals to study viral evolution, and to produce novel diagnostics, vaccines and gene delivery vectors.
- DNA based (PCR) detection of the pathogens of tick-born diseases.
- Testing the performance of novel vaccines against avian influenza.
- The comparative study of animal herpesviruses (from fish, cattle and wild mammals).

Bacteriology projects

- The pathology of *Mycoplasma bovis*; improvement of diagnosis; the mycoplasma infection of birds; elaboration of vaccines against mycoplasma.
- The interaction of different bacteria and viruses in the pathology of

atrophic rhinitis; study of the nose deformations in pigs with computer tomography.

- Enteric bacteriology, food born zoonoses (salmonellosis, colibacillosis): the genetic basis of growth and colonization inhibition in *Salmonella*; gene transfer in the development of *Escherichia coli* pathotypes; *E. coli* toxic and adhesion virulence and antibiotic resistance genes.
- The comparative study of *Pasteurella* strains from different domesticated birds.

Fish parasitology projects

- The development cycle, host specificity and infection pathomechanism of fish parasitic myxosporeans; phylogenetic studies.
- Survey on parasitic infections and diseases of fishes in Lake Balaton and Small Balaton water-reservoir.

Education activities

There are generally about 15 PhD students supervised by scientists of the Institute on the subject of molecular virology, bacteriology and fish parasitology. Lectures on veterinary microbiology, molecular evolution, bioinformatics and fish diseases are given at the Szent István University, Faculty of Veterinary Sciences, Budapest. Numerous veterinary, zoology and biology students make their BSc, MSc/diploma research work in the Institute.

Fields for cooperation

- Basic research cooperation concerning animal viruses, bacteria, parasites and the diseases caused by them.
- Applied research to develop new type, safer, better performing vaccines and diagnostics to detect and/or prevent animal diseases.
- Common grant application in veterinary and zoonosis projects, including food safety, preserving biodiversity, and forecasting veterinary and medical problems caused by microbes in the future.

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Scope of activities

The Institute was opened in 1927 and since 1951 it belongs to the Hungarian Academy of Sciences. The Institute has two departments. The Department of Hydrobiology is involved in the ecological research of Lake Balaton, the largest lake in Central Europe. Due to the activities of the institute Balaton became one of the most intensively studied lakes of the world and has had an ecologically sound water quality protection program. The Department of Experimental Zoology concentrates on the cellular bases of neuronal regulation in invertebrates, combining neuroanatomical, neurochemical and electrophysiological techniques, but it also deals with the physiological effects of organic pollutants and their effect on neuronal regulation.

Research aims and topics

The two Departments of Hydrobiology (Aquatic Botany, Aquatic Zoology) aim to determine the role of different factors in lake eutrophication and the optimal strategy of the reversal of this process, to monitor the biological diversity of the lake, to



Partial view of the institute

clarify interactions in aquatic ecosystems, and to make proposals for the conservation of biodiversity.

The main topics of hydrobiological research are the following:

- Phosphorus metabolism of the lake
- Ammonia, nitrate and urea uptake by phytoplankton

- Characteristics and ecological effects of dissolved humic substances
- Seasonal and long-term changes in phytoplankton
- Distribution and photosynthesis of cyanobacterial picoplankton
- Factors influence on growth and toxicity of filamentous blue-green algae
- Zoology of the tributaries
- Composition and quantity of the littoral macrobenthos
- The littoral food chain
- Production and respiration of planktonic, epiphytic and epilithic crustaceans
- Population dynamics and early development of fishes
- Biomanipulation by fishes

The Department of Experimental Zoology aims to study the comparative neurobiology of signal molecules and their receptors in the central and peripheral nervous systems of model invertebrates, the physiologi-

cal and membrane effects of anthropogenic pollutants and blue-green algae toxins on aquatic animals, and to monitor the toxic pollution of living organisms of Lake Balaton and its catchment area.

The main topics of the department are the following:

- Colocalization and cotransmission of signal molecules
- Neurochemical characterization of signal molecules and their receptors
- Effect of neuropeptides on membrane currents and ionic channels
- Synaptogenesis and embryogenesis of the chemical specificity of neurons
- Molecular neurobiology of secondary messengers
- Neurobiological effects of algal toxins on the transmitter and receptor systems of aquatic organisms



Partial view of the institute

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The main building and the Medical Gene Technology Division of the Institute

Scope of activities

The Institute was established in 1952 as a member of the research institute network of the Hungarian Academy of Sciences (HAS) and it is currently the only institution in Hungary dedicated exclusively to basic medical research. Over the last decade the

Institute has evolved into a premier neuroscience center with a focus on understanding neurotransmission, learning and memory, anxiety and depression, epilepsy, and neural control of the endocrine and immune systems. Institute scientists have adopted a farsighted basic strategy of using multidisciplinary approaches

that combine the best of traditional methods with cutting-edge technologies. They are now especially well known for developing and applying state of the art cellular and molecular neuroanatomical-neurophysiological and neuropharmacological methods of analysis.

The Institute occupies about 9,000 square meters of laboratory space with a staff of about 170, including 81 researchers. The Medical Gene Technology Division is an important recent addition that includes vivarium facilities for 25,000 mice and 3,500 rats. Research and educational activity of the Institute is facilitated by a group of about 25 Ph.D. students, 25 undergraduates, half a dozen visiting scientists, and a similar number of visits to foreign laboratories by Institute students and scientists. Four scientists are members of the Hungarian Academy of Sciences, and four high impact international journals have their chief editor's or section editor's offices in the Institute.

The Institute is focused on a range of topics at the gene, molecular, cellular, systems, and behavioral levels with foci in pharmacology, endocrinology, cellular and network neurobiology, development, and behavioral neurobiology.

The reputation of the Institute is reflected by the fact that in 2000, the European Commission awarded the "Center of Excellence" title for Institute of Experimental Medicine HAS.

Education activity

The Institute has trained PhD students and provides research opportunities for young scientists (equivalent of postdocs).

Close ties have been established with several Hungarian universities in the form of joint PhD programmes or undergraduate and graduate training.

The Institute hosts the Department of Neuroscience of the Pázmány Péter Catholic University, Faculty of Information Technology.

Researchers teach regularly at the Eötvös Loránd and Semmelweis University.

Fields of cooperation

In harmony with the interdisciplinary nature of neuroscience, the intramural cooperations are considered as effective and promising forms of research activity.

The Institute has scientific links with more than 50 institutions from nearly 20 countries, the majority of which are North American and European universities and research organizations, but it also has partners in Asia.

Cellular- and network-neurobiological studies

- High resolution, subcellular localization of proteins involved in synaptic transmission (transmitters, receptors) and in determining the intrinsic electrical properties of neurons (voltage gated ion channels).

- Molecular, physiological and pharmacological mechanisms of retrograde neurotransmission mediated by the endocannabinoid system.
- Basic synaptic mechanisms of short term plasticity and neuronal oscillations.
- Studies on the perturbation of neuronal circuits following epileptic and ischemic brain damage in humans and in rodent models.
- Microcircuits of the olfactory bulb.
- Combined *in vivo* physiological and anatomical investigation of sleep related oscillations and information transfer in the thalamus.
- Pacemaker properties and rhythmic electrical activity in the septohippocampal system.
- Fine-tuning of the noradrenergic system in dendrites of cortical pyramidal cells.
- Patented novel scanning technology to improve investigation of cellular networks in 3 dimension.
- Importance of Ca^{2+} exchange mechanism in the development of operational units in the processes of neural cells.
- Understanding of different aspects of nonsynaptic transmission and various receptorial systems. Role of interneural communication forms in the medical therapy with special regard to the nonsynaptic receptors.
- Identification of new drug targets in collaboration with pharmaceutical companies.
- Balance and imbalance of catecholamines and cytokines; possible role in depression.

Pharmacological studies

- Pharmacological studies to uncover the role of nicotinic acetylcholine receptors in different brain regions
- Investigation of glutamatergic receptors in the cochlea
- Studies on oxygen-glucose deprivation-induced glutamate release with special respect to the role of purinergic receptors and adenosine.
- Examination of NMDA receptor-induced currents in cultured cortical cells. The direct inhibitory effect of the antidepressant drug fluoxetine.
- Importance of inhibition of NMDA receptors in the antidepressant effects of drugs.
- Two-photon laser scanning imaging studies on the role of working memory and dendritic Ca^{2+} regulation.

Endocrine neurobiological studies

- Studies on the pathogenesis of reproduction-, adaptation- and metabolism-related disorders to reveal potential drug targets.
- Organization and physiology of hypothalamic neurosecretory systems regulating endocrine events.
- Neuromorphological and electrophysiological aspects of endocannabinoid signaling in the regulation of food intake and reproduction.
- Identification of estrogen-regulated expression profiles in the rodent brain.
- Hypothalamic regulatory mechanisms in obesity and nonthyroidal illness.

- Distribution of neuropeptides regulating food intake in the human and rodent brain.
- Regulation of time and region-dependent thyroid hormone activation in the brain by deiodination.
- Neurobiology of stress related disorders.
- Comparison of brain structures regulating the white and brown adipose tissue.
- Role of microglial cells in inflammation and ischemia.

Gene technological and developmental neurobiological studies

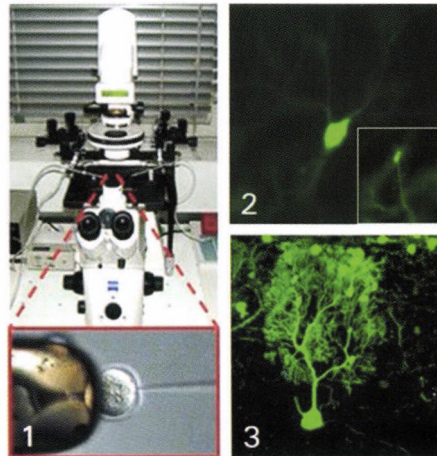
- Uncovering the common and distinct molecular and genetic bases of the multi-functional GABA signaling system by studying its molecular components, primarily the GABA-synthetic enzymes: their expression, regulation of their genes and the mode of their action in adult and developing brain and also in different embryonic tissues.
- Investigating the role of the cell adhesion molecule N-cadherin in developmental processes of the nervous system including neuronal path finding, formation of synaptic connections and in neuronal plasticity.
- Developing and utilizing transgenic approaches to genetically modify well defined neuronal cell types and circuits and signaling pathways in mice in order to better understand their role in brain function, development and disease.
- Studies on the *in vitro* neurogenesis using immortalized neuronal pro-

genitor cells derived from embryonic mouse brains.

- Selection and characterization of implantable neuronal stem cell populations and studies on the *in vivo* neuron production after implantation of neuronal progenitor cells into different regions of adult mouse brains.

Behavioral neurobiological studies

- The study of the interactions between glucocorticoid stress response and emotional behavior, with special emphasis on aggression, anxiety, and traumatic experience.
- The study of the brain mechanisms of the stress response.



Generation of transgenic mouse models: pronuclear microinjection of DNA construct. (1)

Green fluorescent protein expressing GABAergic interneuron in the striatum of GAD65/gfp transgenic mice. (2)

Green fluorescent protein expressing cerebellar Purkinje cell from GAD65/gfp transgenic mice. (3)

AGRICULTURAL RESEARCH INSTITUTE

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The Brunszvik mansion, rebuilt in Neo-Gothic style between (1872 and 1875, is now the headquarters of the research institute

Institute profile

The profile of the Agricultural Research Institute of the Hungarian Academy of Sciences covers an integrated spectrum of complex research ranging from basic and methodological problems to applied research, including practical applications. The fundamental goal is to

develop new generic plant genotypes to satisfy the needs of the future, based on the internationally acknowledged plant gene pool accumulated over the last half century in Martonvásár and using up-to-date genetic, physiological, cell and reproduction biological, functional genomic, biotechnological, plant breeding and crop production

methods. A scientific department was set up in 2005 to support, expand and intensify the genomic research already underway in the institute. It is responsible for carrying out the genomic research required for the improvement of plant breeding methods, for providing the genomic background for molecular breeding, and for the development of new genomic products. In 2008 another new scientific department was established with the aim of strengthening the already existing gene bank research, organic breeding programmes and prebreeding activities. Continuing gene bank research and prebreeding activities at the same department makes it possible to utilize more efficiently the gene supply of the related species stored in the gene bank for breeding purposes. The investigations in the institute also cover production technologies and crop environments, the maintenance of the agroecological equilibrium, the preservation and improvement of genetic variability, the production of raw materials for healthy nutrition, durable plant stress resistance, and an improvement in seed safety, all aimed at satisfying the criteria of sustainable development. This state-run institute contributes to research on the genotype \times environment \times society interaction and to the stability of this interaction. In addition to this complex research programme, institute staff play an active part in undergraduate and postgraduate education, in scientific cooperation with Hungarian and foreign institutions and in the practical introduction of scientific results and technical knowledge.

Research aims and topics

Plant genetics research

- Use of functional genomic methods in studies on the expression of genes influencing the regulation of abiotic stress adaptation in cereals, aimed at gene isolation and gene mapping.
- Gene expression studies. Investigations into programmed cell death and its correlation with stress adaptation.
- Demonstration of DNA sequences occurring in the wheat genome in small numbers of copies by means of fibre FISH and PCR *in situ* methods.
- Mapping and fine mapping of the QTLs of properties responsible for early spring adaptability in cereal species.

Plant cell and reproduction biology research

- Molecular cell biology studies on *in planta* and *in vitro* fertilisation and early embryo development in cereals using the functional genomic approach.
- Investigations on the mechanism of egg-cell activation; development of plant clones from egg-cells.
- Studies on the role and symptoms of programmed cell death during the formation and maturation of the male and female gametophytes and during the sexual processes and microspore embryogenesis of plants.
- Investigations into the molecular regulation of *in vitro* androgenesis

using various ultrastructural and immunocytochemical methods.

- Development of dihaploid plants of microspore origin for breeding purposes.
- Micromanipulation of wheat egg-cells.

Plant physiology research

- Investigation of physiological and biochemical processes involved in the abiotic stress adaptation of cereals, and studies on how defence mechanisms develop.
- Studies on interactions between heavy metal (Al, Cd, Zn, Hg) tolerance and phytochelatin synthase activity in crops.
- Analysis of the flowering biology and physiological effects of UV-B radiation in maize.

Cereal gene bank research

- Collection, preservation and maintenance of the genetic pool of maize. Morphological description and agronomic testing of the sources, varieties, populations, synthetics and lines collected and studies on how they are related to each other.
- Broadening the collection of wheat and related species. Determination of the diversity available for major morphological and agronomic traits and of how these are inherited.
- Incorporation into cultivated wheat of gene complexes responsible for agronomically useful properties from related species in order to create new basic breeding stock (prebreeding).

Molecular breeding research

- Molecular marker-assisted selection for the incorporation of new genes ensuring biotic stress resistance.
- Association studies on cereal species to determine the allele frequency of genes influencing adaptation.
- Studies on how plant transformation systems can be used in cereal breeding.
- Incorporation of certain storage protein genes from the wheat variety Bánkúti 1201 into modern genotypes using marker-assisted selection.

Research on cereal chemistry and quality

- Research on the storage protein composition of old Hungarian wheat varieties; determination and isolation of new and mutant genes.
- Biochemical, technological and molecular genetic studies on factors determining the endosperm structure of wheat grains.
- Improvements in the yellow pigment content of durum wheat.
- Increase in the efficiency of whole plant utilisation in feeding by improving the chemical quality and digestibility of maize.
- Breeding of maize hybrids for various end-uses (sweetcorn, cornflakes, waxy).

Plant stress resistance research

- Studies on the host plant – pathogen relationship, the genetic background of resistance and the efficiency of resistance genes. Incorporation of

new, effective resistance genes into genotypes with good agronomic properties.

- Development of basic maize breeding stock resistant or tolerant to abiotic and biotic stress factors. Research on the chilling tolerance of maize.
- Research into genotypes resistant to the toxin-producing *Fusarium* spp. prevalent in Hungary in order to improve production and food safety.
- Utilisation of haploid cultures and *in vitro* cell selection for the development of cereals tolerant of heavy metal and oxidative stress.

Maize breeding research

- Increase in the frequency of dominant genes responsible for favourable agronomic properties in source populations using recurrent selection methods.
- Use of exotic gene sources to select inbred lines with excellent specific combining ability.
- Improvement in the harvest index and grain filling period and rate of maize without a change in the length of the vegetation period by increasing the durability of the leaf area.
- Development of maize genotypes tolerant of environment-friendly herbicides effective in microquantities by incorporating resistance genes.
- Breeding of silage and grain maize hybrids competitive on Hungarian and export markets.
- Development of maize hybrids which can be grown using cost-

saving, environment-friendly technologies and which use ecological sources efficiently.

Cereal breeding research

- Breeding of winter wheat varieties with excellent milling and bread-making quality and which can be successfully grown under agroecological conditions similar to those in the Carpathian Basin.
- Breeding of winter-hardy, high quality winter durum wheat varieties which can be marketed both in Hungary and abroad and provide satisfactory raw material for pasta-making.
- Breeding of spring and winter oat genotypes suitable for human consumption and animal feeding.
- Research on triticale and barley genotypes for various end-uses.

Crop production research

- Use of growth analysis, ecophysiological studies and stability analysis in long-term experiments to achieve the sustainable development of maize and wheat production.
- Use of growth models for yield prediction and to investigate the spatial variability and time processes of yield formation.
- Research on the agronomic responses of maize hybrids and wheat varieties at the plant stand, individual plant and plant organ levels.
- Site-specific measurement and regulation of major yield-determining factors in field crop production experiments.

- Analysis of phosphorus effects and after-effects in long-term fertilisation experiments set up on chernozem soil with forest residues.
- Improvement in the efficiency of N fertilisation by analysing the N utilisation of maize hybrids and wheat varieties.

Agroecological research

- Research into hulled diploid and tetraploid wheat suitable for organic farming.

- Studies on the effect of the most important components of global climate changes on the yield components, abiotic and biotic resistance and chemical quality of cultivated plants.
- Investigations into the potential environmental effects of genetically modified plants.
- Testing and selection of cereal varieties and genotypes with durable resistance, making them suitable for organic farming.



One of the largest phytotrons in Europe allows plants to be grown under controlled conditions

PLANT PROTECTION INSTITUTE

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The view of the Institute

Scope of activities

The Institute is the research centre for plant protection and it is involved mainly in basic research in the fields of plant pathology, entomology, ecotoxicology, pesticide chemistry, herbology and disease resistance of crop plants. In addition to the basic

research, most of the individual scientists are involved in postgraduate training, applied research as well as in innovation.

Research aims and topics

The aim of plant protection research is to reduce the crop yield losses by

modern management of diseases, insects and weeds, which are harmful in the field. An additional aim is to help environmental protection by creating environmentally safe and sound methods of plant protection. In fact, the final aim of our activities is to understand the biological basis of environment-friendly pest management. Accordingly, research is carried out in order to understand the biology of plant disease agents, insects and weeds, the physiology of diseased crops, the mechanisms of disease and insect resistance, problems of ecotoxicology as well as resistance of pests to pesticides. Research also covers the genetic manipulation of crop plants to create resistant cultivars, reduction of pesticide use in agriculture, the development of selective pesticides and seeking for alternative methods of pest management which are environmentally safe and sound.

Plant Pathology

- Molecular aspects of interspecific interactions in the genus *Phytophthora*.
- Molecular taxonomy of *Fusarium* genus, *Fusarium* toxins.
- Interactions of antagonistic micro-organisms as potential biocontrol agents.
- Mycological, pathological and ecological aspects of forest decline.

Physiological and Molecular Aspects of Plant Disease

- Host-pathogen relationships in bacterial diseases. Early induced gen-

eral resistance to bacterial pathogens

- Characterisation of viruses infecting crop plants. Physiology of virus infected plants.
- Wheat rust resistance.
- Role of oxygen free radicals in necrotic disease symptoms and the action of antioxidants in disease resistance.
- Biochemical immunisation of cultivated plants.
- Study of biotransformation steps of the formaldehyde cycle with special reference to the stress syndrome.

Biotechnology

- Phytoplasma detection and identification by DNA-based techniques.
- Construction of micro-organisms for biological control of plant diseases.
- Use of genetic transformation to introduce resistance into plants.

Insect Pest and Insect Physiology

- Influence of biotic ecological factors on environmentally safe plant protection methods.
- Study of the spread of population dynamics of insects with respect to climatic changes.
- Pheromone biology of agricultural pests previously unapproachable because of methodological problems.
- Hormonal mechanisms controlling development and reproduction of insects.

Insect Ecology

- Research of the functioning and food web structure of agroecosystems.
- Analyses of the data from long term monitoring networks.
- Development of biological control techniques.
- Establishment of taxonomical and faunistical databases.
- Conservation biological studies in natural parks and nature reserve areas.
- Behavioral ecological and autecological studies.
- Life history and reproductive biology of predatory arthropods.

Ecotoxicology and environmental analysis

- Monitoring of the effects of pesticides on the environment and non-target organisms.
- Testing the side effect of pesticides on beneficial organisms.
- Development of immunodetection systems for environmental monitoring.

Chemical Aspects of Pest Control

- Development of new selective anti-insect agents.
- Design and synthesis of selective antifungal agents.
- Design and synthesis low-dose herbicides and herbicide safeners.
- Natural compounds as potential pest and disease control agents.

Education activities

The Plant Protection Institute participates in the graduate and post graduate schools of all the Hungarian agricultural and science Universities with wide range of disciplines from plant pathology and pathophysiology through pesticide chemistry and ecology to entomology.

Fields for cooperation

The institute is open for cooperation in all above fields of research.

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Home page: <http://www.taki.iif.hu>



The view of the Institute

Scope of Activity

RISSAC is the scientific centre in Hungary for soil science, agrochemistry and soil biology. The Institute is responsible primarily for fundamental research in these fields with significant applied research, education, advisory and information activities, and extensive national and international cooperation. RISSAC

is the coordination centre of numerous national and international programmes. The institute was established in 1949.

Research Objectives and Topics

Soils represent a considerable part of the natural resources of Hungary. Consequently, their rational utilization, conservation and the mainte-

nance of their multipurpose functionality have particular significance both for the national economy and environment protection.

The efficiency of soil functions (conditionally renewable natural resource; media for biomass production; primary nutrient resource of the biosphere; storage of heat, water, plant nutrients and pollutants; natural filter; high capacity buffer media; gene reservoir) is determined by the integrated impacts of soil properties, which are the result of soil processes. The main task of sustainable land use and rational soil management is the control of soil processes: mass and energy regimes, abiotic and biotic transport and transformation and their interactions.

The elaboration of the scientific basis for these actions is the main task of the Institute

- Qualitative and quantitative characterization of soil resources.
- Quantification and prediction of soil processes for their efficient control.
- Development of scientifically based, rational plant nutrition.
- Prevention and reduction of soil pollution and its unfavorable environmental consequences.
- Analysis of the role of micronutrients in soil processes.

Soil Science

- Quantitative characterization of spatial (vertical and horizontal) and temporal variabilities of soil

properties (soil mapping, soil monitoring) with the application of up-to-date GIS facilities, geostatistical analyses and remote sensing.

- Identification of various soil function and their multidisciplinary evaluation from the viewpoints of sustainable biomass production, land use and environment protection.
- Description, quantification and modeling of the mass and energy regimes of soil, their determining and influencing factors and mechanisms for an efficient prediction and control

Agrochemistry

- Determination and quantification of the spatial and time variabilities of the various forms of plant nutrients in soils; status and dynamics of plant nutrients in the soil – plant roots micro-environment; the up-to-date evaluation and characterization of the “plant nutrient supply” function of soils and possibilities of its regulation.
- Determination of the nutrient uptake and fertilizer response of the main cultivated crops and – on this basis – the development of the modern environmentally and economically sustainable plant nutrition system and advisory service based on soil tests, plant analyses, precision techniques and long-term field experiments.
- Prevention and reduction of soil pollution and its unfavorable agricultural and environmental consequences.

Soil Biology and Biochemistry

- Development of standard and applicable techniques by using appropriate soil microorganisms or processes as possible bioindicators of the soil functioning and the soil degradation.
- Monitoring ecological status of soils at various natural, industrial and agro-ecosystems.
- Study of the interrelations between the microorganisms and higher plants, agricultural crops at various biotic and abiotic environmental conditions by using rhizotechnological tools for soil protection.
- Development of bioremediation technologies for rehabilitation of contaminated areas.

INSTITUTE OF ECOLOGY AND BOTANY

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Phone: (36) 28-360-122, 28-360-147

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Director: Katalin TÖRÖK, Ph.D.

E-mail: igazgato@botanika.hu



The former manor house of Count Vigyázó in the middle of the richest botanic garden of Hungary is the central building of the institute of Ecology and Botany

Scope of activities

Basic and applied research in the field of ecology, botany and hydrobiology. Research is carried out in the following topics:

- Organisation and dynamics of bio-coenoses;
- Biodiversity patterns at various scales;
- Hydrobiology of running and standing waters and wetlands;
- Ecological effects of climate- and land use changes;
- Conservation biology and restoration ecology;
- Exploring and utilising new plant resources;
- Investigation and analysis of natural vegetation in Hungary;
- As a special task, the maintenance and development of the collections of the Botanical Garden.

Governmental funding ensures the functioning of the Institute and the Botanical Garden, but does not cover the expenses of research itself. It covers the salaries of the permanent researcher staff, and partly the purchase of laboratory devices and the infrastructure of the Institute. It also supports the development of databases of the Botanical Garden.

Major national and international research projects coordinated by the Institute

ILTER

The International Long Term Ecological Research Network (ILTER) consists of research sites and scientists, dedicated to multi- and interdisciplinary long-term and large spatial scale ecological research and monitoring. The development of the Hungarian LTER Network started in 1994 with the initiative and coordination of the IEB. Now it consists of three sites /Sikfőkút, Kiskun and Lake Balaton/ representing the characteristic biomes of the country and meeting the minimum site standards of IILTER. The Institute directly manages the Kiskun LTER site allocated in the Danube-Tisza interfluvial region, where the central ecological problem is the impact of global environmental changes on the biocoenoses. The Hungarian LTER Network became partner of the ALTER-Net Network of Excellence (EU Framework Programme 6) with the leadership of the IEB.

META

Mapping the present vegetation of Hungary is a long debt of Hungarian botany. Only the National Research Grant (NKFP) in 2001 made it possible for the IEB to launch this huge task. The mapping project will be accomplished by the end of 2005 with the help of 250 Hungarian botanists who will spend altogether 7000 days in the field. The GIS-based vegetation map is Europe's largest vegetation database. This data source will facilitate the development of Hungarian landscape ecology and predictive modeling, will help nature conservation practices, and enrich the knowledge-base of environmental education.

Hungarian Forest Reserve Program

The Institute is responsible for scientific co-ordination of the Hungarian Forest Reserve Program of the Ministry of Environment and Water. Within the Program, 63 forest reserve sites were legally designated to preserve old-growth and semi-natural forests and also to ensure long-term research of natural forest ecosystems. The strictly protected core area (3600 ha) is left to natural development without silvicultural management; the protected buffer zone (9500 ha) is designated for experimentation. Our most important research partners are University of West Hungary, Eötvös Loránd University, University of Pécs, "Vásárhelyi István" Nature Conservation Group, Directorates of the National Parks, and the Forest Research Institute. These studies play a prin-

cial role in understanding natural processes, conserving biological diversity, and developing the methods of sustainable and close-to-nature forest management.

The research activity of the Hungarian Danube Research Station Department

Hydrobiology of running waters

Research is based on the experiences gained during the long-term survey of the previous decades: basic patterns of the river biota; material cycling of the different river sections; impact of environmental factors (natural or human induced hydrological regime) and the structure of the biotic community. A long-term task of the Station is

the hydrobiological monitoring of the Szigetköz area. The latest studies of water and sediment chemistry, fito- and zooplankton, macrophytes, macroinvertebrates, fish populations and amphibians are all closely related to the functional aspects of biodiversity, river fragmentation, functioning of the river system and adjacent wetlands.

Hydrobiology of standing waters and wetlands

Most of the research of standing waters and wetlands is carried out at the Fertő-Hanság region. The investigations of the structure and function of communities and on the effects of environmental factors focus on two major habitat types of Lake Fertő: the



The most spectacular point of the Danube: the Danube-Bend

open water surfaces and the reed belt. The hydrobiological monitoring of small lakes and constructed wetlands in the Hanság area serves mainly the reconstruction goals of nature conservation.

The Hungarian Danube Research Station takes part in the implementation of the EU Water Framework Directive, mainly in the elaboration of methodology for biomonitoring and the problem of reference sites.

The collections of the Botanical Garden Department

The Department maintains the richest living plant collection in Hungary, having more than 12000 taxa ordered to the following collections:

- Systematic collection
- Tropical collection
- Dendrological collection
- Collections of rock garden and bulbiferous plants

The research activity of the Department of Plant Ecology

Organisation and dynamics of biocoenoses

The studies aim to establish the theoretical background of effective nature conservation. Researches focus on the stability and vulnerability of food chains and the relationship between fine-scale pattern and process of vegetation

Taxonomic studies

Taxonomic and phylogenetic studies by traditional and molecular methods

contribute to the assessment of biodiversity. Specialists on lichens and tropical *Rubiaceae* species carry out these investigations.

Ecological effects of climate- and land use changes

These studies – focusing on the Kiskunság region – are performed mostly in international collaboration. They include subsequent phytosociological surveys, vegetation and biomass mapping, monitoring of invasive species, climate simulation field experiments, which aim at monitoring and explaining the changes in ecosystem structures and functions to support sustainable management and land use.

Conservation biology and restoration ecology

Due to the structural changes of agriculture, large areas are abandoned. Restoration ecology can help the development of seminatural vegetation in these fields. Beyond increasing biodiversity, the developed management practices (mowing and seed sowing) decrease the cover of alien weeds, including ragweed (*Ambrosia artemisiifolia*), the most important allergenic plant species.

Exploring and utilising new plant resources

Plants, especially members of the *Lamiaceae* family, contain a lot of compounds that are potential raw materials for medicines. Isolation of new

compounds and comparison of compound content between cultivated varieties are done at the Department, using the experimental field of the Botanic Garden.

Exploration and analysis of natural vegetation in Hungary

In order to increase the scientific knowledge on the Hungarian vegeta-

tion heritage we study the landscape historical changes of the vegetation, and also its recent pattern, dynamics, landscape ecology and regeneration potential.

BIOLOGICAL RESEARCH CENTER (BRC)

Address: H-6726 Szeged, Temesvári krt. 62.

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General director: Dénes DUDITS, F.M.

E-mail: dudits@brc.hu



The Biological Research Center of the HAS in Szeged

Scope of activities

Basic research in molecular, cellular and developmental biology in the field of genetics, biochemistry, enzymology, plant biology and biophysics. The interdisciplinary research activities are supported by central laboratories with facilities in DNA chip technology, protein analysis (MALDI-TOF) bioinformatics, DNA sequencing and synthesis. In addition to generation of novel knowledge, researchers are engaged by production of intellectual properties that can be used through a technology transfer company Szeged

Biopolisz Innovation and Service Ltd. Participation in organized scientific postgraduate training, higher education and work of the International Training Course. Publication of the scientific results. Closest possible co-operations with related institutes of the Hungarian Academy of Sciences, universities, and other Hungarian and foreign research institutions. Methodological training of young scientists.

The Biological Research Center of the Hungarian Academy of Sciences gained the "Center of Excellence" title from the EU in 2000.

BRC INSTITUTE OF BIOPHYSICS

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Director: Pál ORMOS, F.M.

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Scope of activities

Basic research aiming at the elucidation of the operation of biological systems on physical grounds. Studies focusing on the processes of biological energy conversion, membrane biophysics and neurobiology using modern physical, chemical and biological methods. Research on the self-organization ability of matter and studies on the regulation processes in living matter primarily by physical methods.

Research aims and topics

Studies in membrane bioenergetics

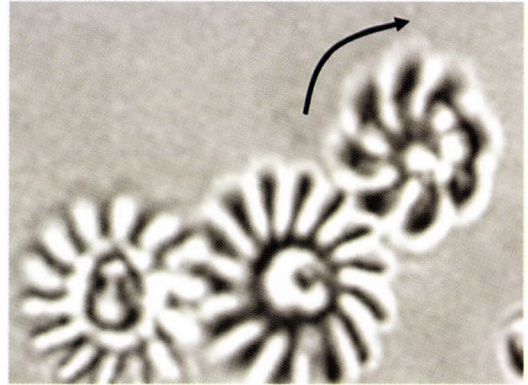
- Physical characterisation of the function of proteins based on myoglobin. Studies of protein dynamics and the details of the relationship between structure and function.
- The mechanism of light energy conversion in retinal proteins. The energetic relationships of the protein motion and charge transfer.
- Spectroscopic and photoelectric studies of the visual and photosynthetic apparatus of *Chlamydomonas*.

- Dynamics of the electron transfer in proteins, particularly in cytochrome c and azurin. Effect of the protein structure on the rate of electron transfer.
- Implementation of high time resolution (10 ns) infrared spectroscopy for dynamic studies.
- Single molecule manipulations by laser tweezers; dynamic studies of the DNA molecule.
- Nanobiotechnology. Design and construction of microscopic optomechanical and optoelectronic devices by photopolymerisation. Biological application of micromachines manufactured and driven by light.
- Technical applications of bacteriorhodopsin: development of bioelectronic and nonlinear optical devices.

Studies of the microbial gas metabolism

- Determination of the missing data for the molecular characterization of the photosynthetic bacterium *T. roseopersicina*.
- Development of a gene transfer system for *T. roseopersicina*; site specific mutagenesis studies.

- Investigation of the proteins participating in the Ni metabolism, Ni transport and storage, and Ni incorporation into proteins of *T. roseopersicina*, by molecular biological and biophysical methods.
- Development of a gene transfer method for the molecular investigation of hyper-thermophiles.
- Biochemical, biophysical and molecular biological characterisation of the thermostable methanotroph isolate and the methane monooxygenase (MMO) enzymes found within.
- Implementation of the biogas intensification system for practical application.

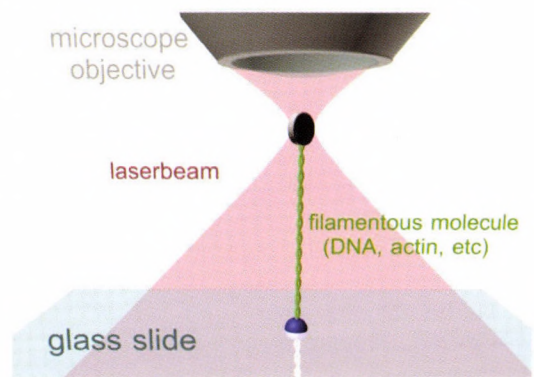


Studies in molecular neurobiology

- Cellular basis of neurodegenerative disorders.
- Experiments on the in vivo model of the blood-brain barrier.
- Complex morphological, biophysical and molecular biological characterization of nervous tissue.
- Effect of gonadal steroids on neuroglial plasticity and neuroprotection.
- Studies of the transport processes in the brain.
- Cell adhesion molecules and the neuro-glial plasticity

Studies of membrane structure and dynamics

- Transmembrane proton pumping by a membranous molecular motor: the vacuolar proton-ATPase.
- Transmembrane electron transport and redox activity in plasma membranes: the plant plasma membrane b-type cytochromes.
- Protein insertion, folding and assembly in membranes and on membrane surfaces.
- Membrane dynamics and protein-lipid interactions in native membranes.



BRC INSTITUTE OF BIOCHEMISTRY

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Director: György PÓSFAL, D.Sc

E-mail: posfaigy@brc.hu

Scope of activities

Basic research using various modern methods applicable in natural sciences, studies of nucleic acids, proteins and lipids and their complexes on different organizational levels. The studies are aimed at better understanding of the chemical and physicochemical nature of living matter, its changes, regulation of processes taking place in living matter and laws governing life phenomena. Emphasis is on projects with potential practical applications in medicine and biotechnology.

Research aims and topics

Membrane-lipid and molecular stress biology projects

The role of membrane physical state in stress perception and signaling; regulation and molecular architecture and function of chaperones

Neurobiology projects

- Structural and functional analysis of opioid (morphine) receptor system: molecular basis of the heterogeneity

- Molecular mechanisms of opioid tolerance/dependence
- Design, synthesis and radioactive labelling of biological active peptides
- Construction of mouse models of human neurodegenerative and cardiovascular diseases

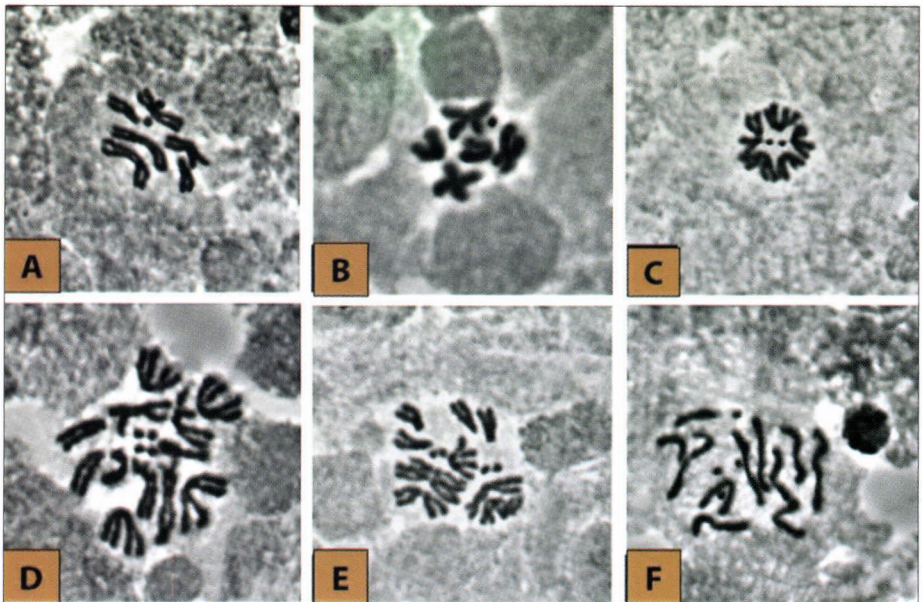


Eukaryotic molecular biology projects

- Regulation of intracellular protein breakdown
- The role of cytokines in immune defense and in autoimmune diseases
- New mechanisms in eukaryotic transcription regulation
- Studies on key proteolytic complexes in cell cycle regulation
- Structure, expression and regulation of genes coding for extracellular matrix proteins

Nucleic acid research projects

- Sequence-specific DNA recognition by type II restriction endonucleases and modification methyltransferases
- In vitro evolution studies on enzyme thermotolerance and stability
- Genome engineering of prokaryotic cells; role of mobile genetic elements in the evolution and adaptation of bacterial genomes



BRC INSTITUTE OF ENZYMOLOGY

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Director: Péter ZÁVODSZKY, F.M.
E-mail: zxp@enzim.hu



Scope of activities

Basic research aimed at elucidating the role of enzymes and other proteins in biological processes, regulation of these processes at molecular level, the structure-function relationship of proteins. Development of experimental and theoretical techniques to investigate the molecular action and structure of proteins.

Research aims and topics

Studies on protein function

- Calpain system in health and disease, designing calpain inhibitors
- Plasmamembrane and intracellular receptor proteins of lysophospholipid mediators
- The role of TPPP/p25 protein in neurogenerative diseases

- Cellular function and mechanisms of serine oligopeptidases
- Structure-function relationship of ABC transporters and their role in multidrug resistance and genetic diseases
- Development of compounds against chemotherapy resistant cells
- Structure-function relationship of intrinsically unstructured proteins
- Protein complexes of DNA repair and the pathway of thymine-less apoptosis
- Activation and regulation of the multidomain serine proteases of the complement system (C1 and MASPs) involved in the innate immunity of vertebrates
- Intrinsically unstructured proteins in molecular diseases
- Flagellin-based design of artificial-receptors
- The role of misfolded proteins in diseases
- Proteins in WNT signalling pathway
- Role of modular organisation in folding and function of proteins
- Specificity and catalysis of DNA enzymes



Studies on protein structure

- Structure determination (X-ray) of proteins of the complement system
- Structure determination (X-ray) of aminoacyl peptidase in thermophilic and mesophilic forms and determination of its oligomeric state
- Structure determination (NMR) of intrinsically unstructured proteins: securin-separase, calpastatin
- Structural characterization of dUTPase along the reaction pathway (X-ray)
- Relationship of protein flexibility to stability and function (biophysical methods)

Studies on protein-protein interactions

- Interactions of WFIKKN1 and WFIKKN2 multidomain proteins with miostatin/miostatin prodomain
- partners of WNT signaling proteins

- interactions of complement proteases with PAR receptor
- partners of proline-oligopeptidase
- functionally different complexes of intrinsically unstructured proteins (moonlighting)
- aggregation of α -synuclein
- calmodulin-SPC interactions

Studies on protein evolution

- Prediction of gene structure and alternative splicing
- Evolution of multidomain proteins
- Evolution of intrinsically unstructured proteins
- Evolution of prion proteins

Bioinformatics studies

- Predicting topology of transmembrane proteins
- Predicting intrinsically unstructured proteins
- Predicting interactions of intrinsically unstructured proteins
- Predicting stability of globular proteins

BRC INSTITUTE OF GENETICS

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Telefax: (36) 62-433-503

Director: István RASKÓ, D.Sc.(medicine)

e-mail: rasko@brc.hu

Scope of activities

Basic research on the mechanisms of heredity and on the processes regulating and influencing the manifestation of hereditary traits on molecular and various other organizational levels by the means of the methods of functional genomics. Teaches and disseminates the science of genetics at high standard.

Research aims and topics

Molecular genetic changes during oogenesis

- Genetic and functional interactions between genes participating in protein phosphorylation/dephosphorylation during oogenesis.
- Identification and characterization of genes and gene families playing role in germ line development.
- Molecular genetic characterization of cell sub-populations of innate immunity.

Genetic regulation of chromatin structure

- The role of higher order chromatin structure in the regulation of expression of homeotic genes.

- Efficient tissue and cell specific delivery of artificial chromosomes.
- Construction of artificial chromosome vectors for gene therapy, gene therapy in animal model with therapeutic artificial chromosomes.

Signaltransduction, cell communication, apoptosis

- Characterization of genes participating in cell proliferation during oogenesis and tumorous growth.
- Map-based cloning of genes of symbiotic nitrogen fixation in alfalfa and molecular genetic studies of signal molecules in *R. meliloti* participating in legume induction.
- The understanding of molecular biological basis of galectin-induced apoptosis in the immune system.

Molecular human genetic studies

- Population genetic studies by the means of mitochondrial DNA and Y chromosome specific markers from ancient bones.
- Identification of molecular genetic susceptibility factors in complex diseases.

Innate immunity

- Genetic control of blood cell development and the cellular immune response in *Drosophila melanogaster*.

DNA repair, mutagenesis and carcinogenesis

- Investigation of the molecular mechanism of DNA lesion bypass and its connection to checkpoint regulation.
- To gain insight into the function of yeast and human genes playing

role in DNA repair, mutagenesis, and carcinogenesis.

Population genetic and phylogenetic studies

- Population genetic studies of different insect species by the means of mitochondrial DNA markers.
- Phylogeography and phylogenetics of oak gall wasps.
- Population genetics of the great bustard, a highly endangered bird species in Hungary.

BRC INSTITUTE OF PLANT BIOLOGY

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Director: Imre VASS, D.Sc

E-mail: imre@brc.hu

Scope of activities

Basic research for the identification of genes and molecular mechanisms which determine the development, light perception and utilization, as well as environmental stress responses of plants. Exploration of biotechnical approaches to produce plants with enhanced agronomical value. Teaching the results and methods of plant molecular biology in the framework of graduate and postgraduate programs.

Research aims and topics

Light as energy source, environmental stress factor and information carrier in plants

- Studies on photosynthetic light energy utilization and oxygen evolution
- The structure and function of the Photosystem II reaction center complex
- The structure of photosynthetic light harvesting complexes and dynamic structural changes of lipid-protein macromolecules
- The damaging mechanisms of visible and ultraviolet light
- UV-induced gene expression in cyanobacteria

- The mechanism of temperature adaptation of plant membranes
- Identification of genes required for the regulation of the plant circadian clock
- The influence of phytochrome photoreceptors on the function of plant circadian clock
- Studies on the mechanism of nuclear localization of phytochromes

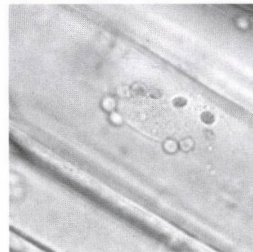
Identification and characterization of genes and proteins involved in stress tolerance of plants

- Identification of stress-induced genes by T-DNA mutagenesis and differential gene expression profiling in Arabidopsis
- Application of DNA microarrays to study the expression profile of Arabidopsis genes with regulatory functions
- Identification of genes and proteins effecting drought tolerance in wheat by using functional genomics and proteomics approach
- Detection of reactive oxygen species involved in mediation of stress-induced damage in plant system
- Identification of genes and proteins induced during defence against oxidative stress

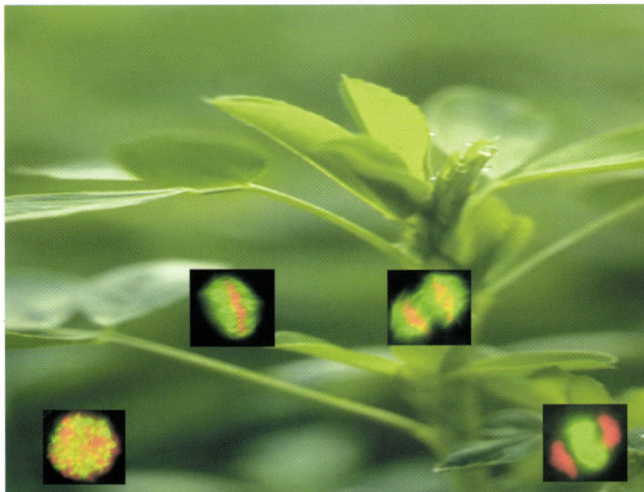
- Studies on stress-related responses of plants by monitoring photosynthetic activity parameters
- Studies on the role of non-coding micro RNAs in stress responses of plant cells.
- The effect of stress factors on cell cycle followed by cell division markers

Regulation of the plant cell division cycle

- Identification of the key elements, which participate in the regulation of stress- and hormone-induced signal transduction
- Functional characterisation of plant histon-dependent kinases and their genes
- Application of functional genomic and proteomic approaches to study the main regulatory components of plant cell cycle
- Study of embriogenesis, as a developmental process closely related to the cell cycle



Nuclear localization of phytochromes in tobacco cell



The phases of cell cycle in alfalfa cells



**MATHEMATICS
AND NATURAL SCIENCES**

INSTITUTE OF NUCLEAR RESEARCH

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Director: Zsolt FÜLÖP, D.Sc.
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Home page: www.atomki.hu



The Institute of Nuclear Research (Atomki) and the Departments of Physics of the University of *Debrecen* (DE) are located next to each other. There is traditional strong collaboration with them both in research and education.

Scope of Activities

The mission of the Institute is to perform fundamental research in experi-

mental and theoretical atomic, nuclear and particle physics, and to apply the physical methods and knowledge in other fields of science like materials research, environmental and earth sciences, biological and medical research etc. Strong emphasis is laid on the development of techniques and instruments for fundamental and applied research, and on solving practical problems for industry, agriculture and medicine. The Institute is deeply

involved in undergraduate as well as graduate physics education. The Department of Environmental Physics is run jointly by the University and by the Institute. The activity of the researchers of Atomki is rapidly increasing in knowledge and technology transfer. The Institute is hosting a European Research Council (FP7) Starting Grant in the field of nuclear astrophysics.

Research Fields and Topics

Particle Physics

- Calculation of radiation corrections of quantum chromodynamics
- Theoretical description of the formation of multijets, the most frequent final states of high-energy particle collisions with perturbative quantum chromodynamics
- Participation in the preparation for and data analysis of CERN experiments; radiation tests of electronic components for particle detector systems
- Development of devices for the Compact Muon Solenoid detector system planned for the Large Hadron Collider at CERN;
- Study of possible CPT violation at the Antiproton Decelerator of CERN in the framework of the ASACUSA collaboration

Nuclear Physics

- Interpretation of the binding energy systematics of nuclei on the basis of symmetry considerations

- Study of nuclear clustering and cluster decay
- Description of nuclei close to the nucleon drip lines
- Investigation of the neutron skin and neutron halo phenomena, the difference between the neutron and proton distributions, the symmetry energy and the equation of state for neutron rich nuclear matter by the measurement of giant multipole resonances with radioactive beams at RIKEN and at GSI. Study of the properties of resonance states and weakly bound states;
- Study of elongated nuclear states with length-to-thickness ratio 3:1 (hyperdeformed states and clustering before fission)
- Search for a short-lived neutral boson beyond the standard model in nuclear transitions
- Nuclear reaction studies involved in the astrophysical p-process, the production mechanism of heavy proton-rich isotopes in nucleosynthesis
- Study of reactions relevant to the solar neutrino problem in other laboratories using radioactive isotopes produced by the cyclotron of Atomki
- Study of exotic nuclei by means of the radioactive ion beam separator of RIKEN in Japan
- Study of high-spin nuclear states, nuclear chirality and band termination
- Investigation of low-lying Gamow-Teller strength distribution in exotic nuclei: β -decay studies with the total-absorption technique
- Nuclear physics with lasers

- Study of shell closure in the nuclei around 100Sn
- Measurement and compilation of nuclear reaction data for nuclear techniques for the International Atomic Energy Agency
- Development of new methods for the production of radioactive isotopes and labeled compounds for medical purposes, e.g., PET examinations
- Application of the thin-layer activation method for wear measurements
- role in radiation damages of biological tissues
- Examination of the capture of electrons from the target atom to the energy continua in the field of ionic, atomic, molecular and positron projectiles
- Quantum-mechanical and semiclassical description of atomic collisions; distorted wave, coupled channels and non-perturbative classical trajectory Monte-Carlo methods
- Interaction of highly charged heavy ions with matter: Atomic physics, surface physics and plasma physics research with the keV energy beams of an electron-cyclotron resonance (ECR) ion source. Investigation of the properties of strongly ionized plasmas by detection of the emitted electromagnetic radiation

Atomic and Molecular Physics

- Study of the dynamics of atomic and molecular collisions by electron- and X-ray spectroscopy
- Experimental and theoretical studies of rare and higher-order processes (multi-electron transitions, multiple electron scattering) in ion-atom and ion molecule collisions
- Study of positron impact on atomic and molecular targets by measuring double and triple differential cross sections
- Higher order effects in the electron emission in photoionization by synchrotron radiation
- Study of excitation, ionization and annihilation mechanisms in low-energy antiproton-atom collisions; decay mechanisms in exotic antiprotonic atoms
- Study of fast electron production by multiple electron scattering in atomic collisions: the Fermi-shuttle acceleration mechanism, and its
- Application of plasmas and beams of the ECR ion source to materials research and to medical and industrial purposes; carbon and fullerene plasmas and beams,
- Experimental and theoretical study of the effects of the atomic environment on atomic transitions and collective excitations induced by X-rays.
- Study of the fragmentation of biological molecules by charged particle impact; Coulomb explosion induced by electron transfer and ionization processes; radiation therapy aspects

General Quantum Physics

- Solution of specific quantum mechanical few-body problems

- Symmetries in quantum mechanics and their application to nuclear physics
- Investigation of Bell inequalities whose maximum violation is achieved by measurements on Hilbert spaces with higher than two dimensions.
- Quantum entanglement in macroscopic systems
- Geometric phase in the course of near adiabatic evolution of quantum systems
- Study of the magnetic, diffusion and optical properties of nano-structured materials produced by mechanical techniques.
- Pattern formation and optimization problems of statistical physics

Environmental Analysis, Earth Sciences and Chronology

Physics of Solids and Surfaces, Materials Science and Statistical Physics

- Determination of the ages of ancient settlements by radiocarbon dating and reconstruction of the history of environmental changes in the Carpathian basin by radiocarbon dating aided by stable-isotope and noble-gas mass spectrometry
- Isotope hydrogeology and isotope hydrology studies by mass spectroscopy; determination of the vulnerability of aquifers, of the origin of dissolved nitrate, ammonium and sulphate in surface water and in drinking water, the infiltration, mixing and residence time of water in karstic aquifers. Monitoring the origin and purity of foodstuff and waters. Study of the climate change by monitoring of stable-isotope and tritium concentrations in the precipitation and by the trend of ice formation rates in ice caves.
- Measurement of uncontrolled radionuclide emission from nuclear facilities into the air and groundwater. Quality control of the management and disposal of radioactive waste, and modelling the spread of the underground transport of radioisotopes
- Diffusion and dispersion of organic contaminants in materials used for
- Study of the interaction of highly charged ions with surfaces in nano- and microcapillaries; self-organizing ion-guiding effects
- Study of the chemical and electronic structure of surfaces and interfaces, micro- and nanolayers with Auger- and photoelectron-spectroscopy
- Experimental and theoretical study of vortex structure and dynamics of layered superconductors.
- Study of the electronic phase separation, nanomagnetism and electric charge transport of perovskites
- Application of SIMS/SNMS techniques to the study of surfaces and multilayers
- Electron scattering in surface, interface and bulk layers of solids.
- Applications of electron spectroscopy to the analysis of surface-passive layers (components of nuclear power plants) and thin film solar cells.

- the stabilization of borehole walls and vaults
- Study of the composition and propagation of atmospheric aerosol contaminants (e.g., heavy metals) by ion beam analysis; investigation of the distribution of trace elements in geological and biological samples with a scanning proton microprobe.
- Study of the propagation of atmospheric radon in the human environment
- Geo-chronological research with the K/Ar method
- Development of measurement techniques with new, high-sensitivity plastic track detectors and their application in dosimetry
- Assessment and safety analysis of naturally occurring radioactive materials (NORM) in waste depositories
- Gas-geological and flow dynamical studies for safe and efficient use of dry carbon dioxide spas (mofettes)

Methods and Instruments

- Radiation-hardness tests of electronic components of satellites and high energy physics detectors.
- Ion beam analysis (proton-induced X-ray emission analysis, Rutherford backscattering, nuclear reaction analysis etc.), and its applications in geology, environmental and materials sciences, biology and archaeology
- Proton-beam micromachining
- Studies related to the optimization of the parameters of semiconductor and scintillation particle detectors;

- development of new types of position sensitive scintillation detectors for nuclear imaging purposes; study of the detection mechanism of photons in semiconductor detectors
- Development of signal processing and detector systems; search for new methods for analogue and digital processing of signals of nuclear detectors
- Development of a positron emission tomograph for examining small animals
- Development of the ECR ion source in order to extend the ion range, to improve the beam parameters, and to establish new “plasma-chemistry” technologies
- Development of electronic devices for medical and pharmaceutical research and for university teaching

Radiochemistry

Study of the synthesis of pharmaceuticals labelled with on-site produced radioisotopes for single photon (SPECT) and positron emission (PET) tomography

Main Facilities

A cyclotron (MGC), two Van de Graaff accelerators including a scanning nuclear microprobe, a ^{14}C laboratory, ESCA and other electron spectrometers, an ECR ion source, a range of mass spectrometers, low temperature facilities including superconducting magnet systems and dilution refrigerator

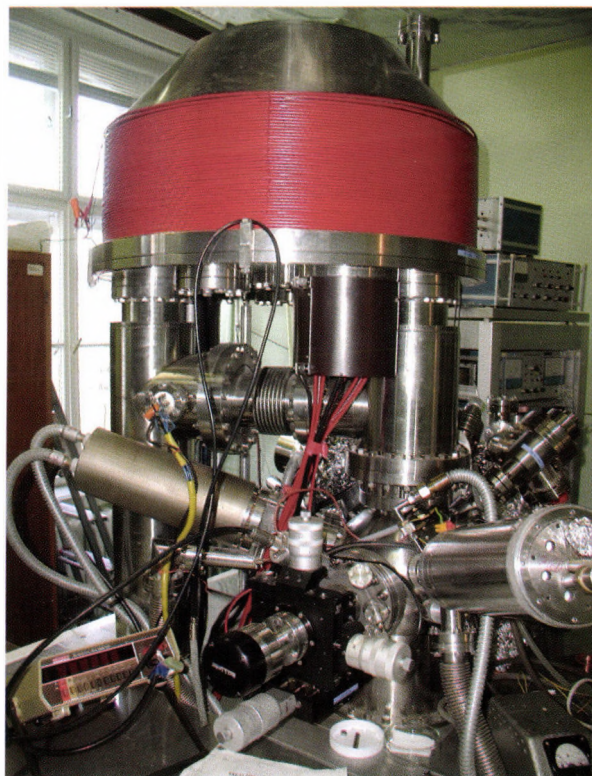
Atomki – University of Debrecen
common facilities: a secondary ion/

neutrals mass spectrometer (SIMS/ SNMS), electron microscopes and a magnetron aided sputtering system

Educational Activities

The contribution of Atomki to graduate teaching is characterized by the following numbers: in the Physics PhD School there are 2 program directors and 30 members belonging to Atomki. About one third of the courses, and almost half of the research subjects are supervised by researchers of Atomki. The teaching activity of the Department of Environmental Physics (5 faculty members, 20 Atomki researchers)

comprises the following fields: physics of the environment, radioactivity and ionising radiation in the environment, application of physical methods in environmental research, applied and basic nuclear physics. The Department provides lecture courses and laboratory practices mainly for the students studying physics, environmental science and management, agriculture and pharmacy. Atomki also has strong connections with other departments at the Faculties of Physics and Informatics. Atomki members deliver undergraduate courses from quantum informatics to nuclear imaging for medical practice.



KONKOLY OBSERVATORY

(founded by Miklós Konkoly-Thege in 1899)

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The main building of the Astronomical Institute
(Konkoly Observatory) of the HAS

Scope of activities

Carrying out observational astronomical studies, mainly related to the physics of the variable stars, galactic structure and solar activity. These tasks imply operation of the internationally recognized observational network developed during the last three decades. A very important task is the development of the national astronomical information system, including the observatory's library.

Research aims and topics

Studies concerning the behaviour of variable stars: investigation of multiple periodicity and period changes of pulsating variables, as well as research on stellar activity of various time-scales. Studies related to the galactic structure and physics of interstellar matter with an emphasis on the star-forming processes. Studies on solar activity, investigation of the problems of sunspots and prominences.

Variable stars

A better insight into the physics (mechanism of light variation, processes occurring in the stellar atmosphere) and evolutionary status of the variable stars.

Solar physics

Research on the active regions, kinematics of spots, spot-groups, prominences and flares.

Galactic astronomy

Studies of galactic structure and processes of star formation in Milky Way, mainly from the observational point of view.

Miscellaneous

Other minor topics which have been successfully studied, mainly in the fields of interdisciplinary and/or space research, in cooperation with the staff of other institutes.



Image of the M3 globular cluster taken with the CCD camera attached on the RCC telescope

GEOGRAPHICAL RESEARCH INSTITUTE

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Director: Ferenc SCHWEITZER, D.Sc. (Geography)

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Scope of activities

Development of theoretical bases and methodology for physical, human and regional geography, studies on spatial processes and interrelationships; temporal and spatial survey of the interaction between man and environment; assessment of factors of the geographical environment with a special reference to natural and socio-economic resources and to the emerging socio-economic problems in Hungary and within its distinct territorial units (natural macro-, meso- and microregions, districts and administrative units); international cooperation; documentation and dissemination of research achievements (through volume of studies, periodicals and other publications in Hungarian and foreign languages).

Research objectives and topics

The Institute has a staff and infra-structural equipment to successfully meet the European professional standards. Priorities should be given to the following topics:

In the field of physical geography:



- analyses of the geographical consequences of global and regional natural processes;
- survey of the use of domestic natural resources and environmental issues for the Carpathian Basin;
- studies on the degradation of the natural environment and related local tensions.

In the field of human (social and economic) geography:

- International processes exert an ever increasing impact on social and economic development fostering interregional relations, thus upgrading comparative studies in geography. This new approach to spatial processes renders a closer co-operation between physical and human geographers indispensable.
- In the wake of the 21st century a growing emphasis has been placed on the assertion of regional and local interests, requiring a more exact knowledge of the resources and endowments within the particular spatial units. There has been a growing demand in complex studies on territorial units and human settlements of various hierarchical levels. International comparative studies might be instrumental in “bringing closer” different regions to each other.

Information about nature, society and economy – on global, regional and local levels – serves geographical learning properly only when the former is organised in an adequate GIS. An internal computer network has been developing continuously under the supervision of the *Department of cartography*. Based on this system a map series (on seven sheets) on the changing ethnic patterns in the Carpathian Basin was published between 1995 and 2006 (Transylvania, Slovakia, Transcarpathia, Pannonian part of Croatia, Voivodina, Burgenland, Prekmurje). The eighth map under edition is to show the chang-

ing ethnic pattern in the present-day territory of Hungary.

The *library* serves research, education and culture and scope of its activities has expanded since 2006 (due to the application of HUNTEKA integrated librarian system for Opac and Geobase systems). Now it is part of the nation-wide information system (through the EISZ). As a center of education and culture it promotes a rapid dissemination of the scholarly achievements by the Institute.

A comprehensive research of recent and paleomorphological processes, of regional and local phenomena; landform assessment and environmental analysis; interpretation and evaluation of human impacts

- Engineering geomorphological and environmental survey of the high bluff stretching along the Danube River and endangered by landslides.
- The river valley between Dunaalmás and Mohács (at a ca 250 km length) is flanked by a high steep bluff of 20 to 40 m height posing landslide hazard, e.g. massive slumps at Dunaszekcső in 2007 and 2008. A complex geomorphological survey and assessment is under way in delimitation, evaluation and classification of the sections along the valley with environmental hazard. Thematic mapping of engineering and environmental impact of mass movements can be instrumental in physical planning of settlements.
- Geographical investigations into natural, social and economic pro-

cesses in relation with flood control in study areas along the flood plains of rivers in the Alföld (Great Hungarian Plain).

- In the course of studies on hydrogeographical processes emerging as a combined result of human intervention and extreme climatic conditions there is an actual task of geomorphological consequences of river regulation and flood control measures taken in the 20th century. The survey to be implemented in international cooperation has a special reference to flood plain evolution of rivers.
- Involvement of up-to-date geomorphological methods in the medium-term studies comprising the surroundings of the Paks Nuclear Power Plant to identify areas of increased radioisotope concentration. A planned enlargement of the power plant with new blocks in the near future makes these research timely.
- Study of late Cenozoic formations in the Adria Region aimed at the identification of paleoclimatic, lithological and paleogeographic events for stratigraphic and geochronological purposes. The main subtopics are the following: a) A major ecological event during the Upper Miocene–Lower Pleistocene: desertification of the partial basins of the Paratethys and Carpathian Basin; b) A new approach to the interpretation of loess formation and evolution of fluvial terraces; c) Paleogeography of the Holocene related to archeological findings. This international activity is run in

the framework of the INQUA and also form part of several bilateral programmes (in projects established with Austrian, Croatian and Ukrainian institutions).

- Landscape geography of Hungary: geology, mineral resources, relief, climate, hydrology, soil and vegetation cover of the Great Hungarian Plain, the Little Plain and Transdanubian Mountains to be summed up in a monograph as a volume in the series “Landscapes of Hungary” will be published in near future.
- Planned in an international cooperation Paleogeographic Atlas of the World is to present late Pleistocene paleogeography of the southern hemisphere in a series of thematic maps. Compilation and design is supported by UNESCO IGBP Global Change Programme Complex geomorphological research and mapping continued after 2005: geomorphic evolution of the Carpathian Basin with the interpretation of changes in climatic morphology, neotectonism, and those brought about by river regulation and flood control measures. Results are to be presented by a new geomorphological map of Hungary at 1:500 000 scale under preparation. Mapping areas affected by mass movements and their classification are going on with a previous intensity.

Analysis of trends in transformation of the natural environment to be performed in study areas

- Aridification in the Carpathian Basin in the 21st century. This re-

search is aimed at predicting the changes in physico-geographical components under conditions of the assumed climatic change (scenarios for 1–2 decades and for one century) in comparison with the trends in Southern Europe.

- One of the objectives of the research program is the identification and mapping of environmentally sensitive areas. Criteria of the liability to aridification are investigated in study areas located in the SW Hungary, shown in maps, stored in GIS, and the resulting regions are delimited also using GIS methods.
- Another project runs within the TRACE (Trace element loss on conventional and minimum tillage plots) supported by Syngenta. This program is purposed for the investigation of different trace elements, changing the characteristics of upper soils in case of environmental friendly agriculture. The first result: Fe and Al contaminations which are responsible for the sorption of trace elements.
- Studies on soil erosion are continued in the framework of the BORASSUS programme (The environmental and socio-economic contribution of geotextiles to sustainable development and soil conservation – EU FP6 INCO project). The project is to be accomplished with a survey of the applicability of different soil conservation methods.
- Classification of volcanic soils of Hungary according to the international WRB system. This analysis initiates to compare the traditional genetic and soil-based classifica-

tion of volcanic soils with the diagnostic based WRB system, emphasizing the first results referring to the andosols.

Socio-economic transformation in Hungary and the related European trends (a comparative human geographical analysis)

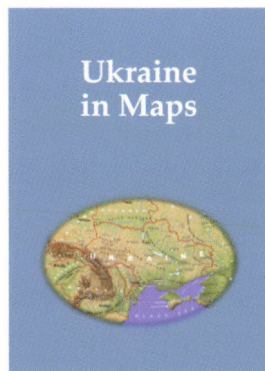
- Relationship between the socio-economic changes and transformation of the urban structure. Studies on Budapest are focused on the identification of socio-economic effects of revitalization of housing estates. Comprehensive studies encompass different levels of urban hierarchy (cities, medium and small towns). Since 2005 these comparative studies have included sustainability of urban green zones (URGE project) and theoretical and methodical issues of urban living spaces.
- An EU project NEHOM started in 2004 deals with the social rehabilitation of declining urban quarters and neighbourhoods.
- An emphasis is put on the human geographical investigation of social tensions in the framework of a broader issue of the emerging fields of tension. These investigations include social effects of large-scale technical projects, regional and structural pattern of unemployment, and various aspects of international migration.
- A project in international cooperation is to reveal interrelatedness of nature conservation, tourism and local social conflicts.

- Historical and political geographical investigations include ethnic geographical studies of Hungarian minorities in the Carpathian Basin, the presentation of the geographical background of the ethnic conflicts in the Carpatho-Balkan region, the collapsing Yugoslavian ethnic structure and the analyses of past ethnic geographical studies and mapping.
- Historical geographical studies have been expanded since 2006 and span a period between 1945 and 1990 focusing on international migrations that had affected Hungary. The two major issues are ethnic Germans expatriated from Hungary (after 1945) and Hungarians escaping from the socialist Hungary to West (after Second World War, in 1956 and later)
- Complex geographical studies of East Central European processes in cooperation with Institute of Geography (Kyiv, Ukraine). The result of this three years collaboration is the atlas-monograph "Ukraine in Maps". It includes more than 60

maps, dozens of figures and tables accompanied by an explanatory text. The book is an attempt to outline the geographical setting and geopolitical context of Ukraine, its history, natural environment, population, settlements and economy.

Education activities

Four scientific advisors and seven senior research workers of the Institute are engaged regularly in higher educational activities at eight universities and five teachers' training schools of the country. The main courses held: Geomorphology of the Carpathian Basin, Models in geography, Landscape geography, Landscape ecology and landscape protection, Global environmental change, Regional and local development, Geography of population, Economic geography, Geography of tourism, Ethnic geography, Geography of settlements, Political geography, Human ecology of tourism, Shopping tourism, Spatial economy of Hungary.



Fields of international cooperation

The Institute maintains a traditional wide range of cooperation with other academic institutions in Hungary relating to interdisciplinary themes (e.g. VAHAVA project) and joint research with universities.

The most important fields of long term international cooperation (selected themes, institutions):

- Off-site Impacts of Soil Erosion and Sediment Transport (EU-Project)
 - Charles University, Prague;
- Accomodating Creative Knowledge: competitiveness of European metropolitan regions within the enlarged European Union (EU-6, ACRE) – University of Amsterdam;
- Zwischen Gentrification und Abwärtsspirale (DFG-HAS common project) – Institut für Länderkunde, Leipzig;
- Searching for neighbours: dynamics of physical and mental borders in the New Europe (EU-6, SeFoNe project) – University of Bern, University of Southampton;
- Ukraine in Maps (HAS-NANU common project) – Institute of Geography, Kyiv.

GEODETIC AND GEOPHYSICAL RESEARCH INSTITUTE

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The main building of the Institute

Scope of activities

Basic research in geodesy and geophysics, establishment and operation of geophysical observatories in the fields of seismology, geodynamics, geomagnetism, ionosphere and atmospheric electricity, support for institutions to solve problems in geodesy and geophysics, participation in international organizations and projects.

Research aims

Geodesy: the field of interest includes geodynamic investigations for studying the structure of the Earth's interior and global and local processes in the Earth's crust, development of instruments and measurement methods for this purpose, modeling of the gravity field of the Earth. The Institute operates the Sopron Geodynamic Ob-

servatory. Research into mathematical methods to be used in earth sciences and geoinformatics helps this aim, too.

Geophysics: the main research field is “Earth electromagnetism”, in a broad sense: from the investigation of electromagnetic structure of the solid Earth to the study of structure and processes of the near-Earth space. The following inter-related domains and their interactions are investigated: Sun, interplanetary field, magnetosphere, ionosphere, atmosphere, electromagnetic structure of the solid Earth (on near-surface-, crustal and mantle scales,

especially beneath the Carpathian Basin and neighbouring regions), Earth’s core. The research is based on observatory data (mainly on data of the Széchenyi István Geophysical Observatory near Nagycenk (Fig. 1), operated by the institute) and field measurements.

Seismology: its task is to run and develop the Hungarian seismological observatory network, to collect the recorded seismological information in the National Seismological Data Centre at the Budapest Seismological Observatory, to operate the all day seismological inspection for information of the public. The seis-

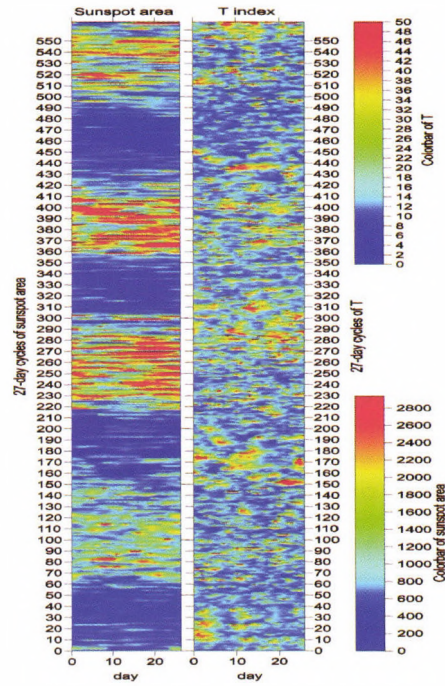


‘Absolute geomagnetic house’ in the Széchenyi István Geophysical Observatory, Nagycenk

mologists of the Institute determine the focal parameters and mechanics of earthquakes in Hungary and in its neighborhood, organizing macroseismic investigations of earthquakes felt in Hungary, update and archive the database of earthquakes recorded by Hungarian seismological stations and participate in international networks and projects. On this basis the research field covers the study of structure, dynamics and physical processes of the solid Earth. The charge of seismologists is assessment of seismic risk and vulnerability of different parts of the country and of high risk engineering structures.

Main topics

Global and local geodynamic processes. These processes are studied using gravimeters, extensometers, tiltmeters and geodetic measurement methods. Results of investigations lead to considerations concerning the Earth's internal structure and tectonic processes in the Pannonian Basin. Special emphasis is laid on the continuous increase of the accuracy of the measurements, on development and calibration of the instruments (Fig. 2) and on the investigation of environmental parameters effects on the measured data. The geodynamic research is based on data obtained in observatories in Hungary and in neighbouring countries within the framework of international cooperation, and on results of geodetic field measurements in different parts of Hungary. Especially, the geodynamic



27-day cycles of sunspot area and T index, as observed in the Nagycenk Observatory

research carried out by multi-sensor observation techniques on areas prone to landslide is very important for the detection of interaction between landslide triggering processes. The results of these studies can be practically used in locating the sites of dangerous industrial objects and in prevention of disasters.

Modelling of the Earth's gravity field. New methods led us to more reliable lithosphere density model in the Pannonian Basin. The results of local gravimetric measurements are used to study the local parameters of the gravity field; thus they contrib-

ute to scientific research connected to the preparation of the measurement of the new high-order levelling network in Hungary.

Deformation and movements of objects. In the frame of international cooperation new measurement and analysis methods are developed for the investigation of deformations and cyclic movements of dangerous industrial objects, building, bridges, etc. and for the health and seismic risk assessment of structures.

Mathematical methods in geodesy. The wavelet transformation of the covariance function of the signal and noise leads to new results in analyzing geodetic time series (e.g. that of pole wandering). The transfer characteristics of trigonometric filtering are studied, too. The application of time series analysis in geodesy gives an answer to the question about the future trend of geologic processes. The Gauss-Jacobi combinatorial adjustment is applied to solve the 3D transformation problem with 7 parameters, and it is also demonstrated that the combinatorial algorithm gives the same solution as the conventional linear Gauss-Markov model.

Near-Earth Space Physics. Long- and short term variations of solar activity, solar wind parameters and geomagnetic activity (Fig. 3). Modeling and observation of solar wind – magnetosphere – ionosphere energy coupling. Effects of near-Earth space to the global changes and human



Laboratory for investigation and calibration of instruments

activity, often referred to as space weather and climate. Study of magnetospheric waves (ULF, VLF), field line resonance, upstream waves. Contribution to the global geomagnetic field modeling. Ionosphere – neutral atmosphere coupling. ELF wave propagation in the Earth-ionosphere waveguide. Electro-optical emissions in the upper atmosphere. Climate change-related ionosphere- and atmospheric electricity studies. Maintaining networks and participating in coordinated campaigns of magnetic, telluric, whistler, ionosphere sounding, atmospheric electricity, radiowave propagation and Schumann-resonance measurements (such as SEGMA, OERSTED, CHAMP, INTERMAGNET, SWENET, EUROSPRITE, etc.)

Solid-Earth Electromagnetism. Investigation of electromagnetic structure of the Earth beneath the Pannonian Basin and neighbouring areas by means of geo-electromagnetic methods at various scales: (1) from

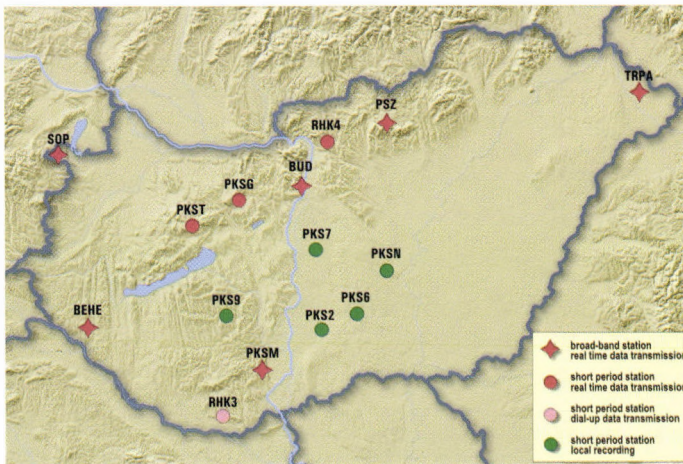
crustal to mantle structures (lithospheric and asthenospheric investigations) by means of magnetotellurics, geomagnetic deep soundings, tellurics; (2) near-surface geoelectric-electromagnetic investigations, in order to be able to get improved images of subsurface (with various, e.g. environmental applications). Research includes both theoretical and practical approaches, possible bio-geo interactions, and also Near-Earth Space Electromagnetism aspects.

Development of the national seismological network. (Fig. 4) The aim of this activity is to record at high level of resolution the seismic events of the Pannonian basin and in the same time to observe all the significant earthquakes worldwide. For this purpose beside the already existing short periodic stations a network of very broadband instruments is also

in operation. The records of newly installed very broadband seismographs through real time data transmission are available for interested institutions within the country and worldwide. The national data centre at the Budapest Seismological Observatory collects all the observed in the country seismological data, accomplishes automatic event recognition service.

Study of the Earth rotation from geological to sub daily time-scale.

The aim of this research field is to investigate temporal variations of geodynamical properties of the Earth and development of the Earth-Moon system due to tidal friction. In the frame of this topic in decadal – sub daily time-scale the influence of seismicity, geomagnetic phenomena, and meteorological processes on Earth rotation vector is also investigated.



Seismological network of Hungary in December 2007.

Focal mechanisms. Having completed the database of Hungarian earthquakes areas will be identified where the type of the earthquakes is similar. Having determined the moment tensors of these areas, the directions of stresses will be obtained which govern recent tectonic processes in the Pannonian Basin.

Seismic tomography is applied and developed for a better knowledge of the three dimensional structure of the Pannonian Basin. Using seismographic records, the velocity distribution is determined in the Earth's crust and upper mantle together with the velocity contrasts. With the use of complete waveform inversion the determination of hypocenters and focal mechanisms of earthquakes can be made more accurate in order to achieve a better idea about the tectonic conditions in the Pannonian Basin.

Seismic risk. Beside the traditional probability based seismic risk evaluations it is now necessary to compute synthetic seismograms for the vicinity of potential earthquake foci and for endangered settlements in their area to obtain more reliable seismic risk values. A two- and three-dimensional pseudo-spectral method is applied for the computation of synthetic seismograms, which allows taking into account local tectonic and geophysical conditions.

Education activities

University of Western Hungary: courses in environmental sciences and courses

for environmental engineers, courses in basic mathematical subjects, advising students in preparing their theses for a degree, committee-work at exams for a final degree and at doctoral exams, advisory work in preparing doctoral theses, participation in committees for state exams. Lorand Eotvos University of Sciences and University of Miskolc: general lectures, lectures in doctoral schools, giving practical lessons for developing skills of students, advisory work for students preparing their final written presentation, advisory work in preparing doctoral theses. Babes-Bolyai University of Sciences in Kolozsvár: teaching subjects in general and applied geophysics. BMGE: PhD exams and doing work as opponents in the PhD procedure. Pal Kitaibel Environmental PhD school for geo- and environmental sciences. Giving lectures to PhD students and making exams for them at the Vienna University of Technology.

Fields for cooperation

International University Bremen, Institute of Atmospheric Physics Prague, Beijing Institute of Geology and Geophysics, University of L'Aquila, Space Research Institute of Austrian Academy of Sciences, Graz University of Technology, Université Neuchâtel, Reading University, Meteorological Department, Anglia, Massachusetts Institute of Technology, Parsons Laboratory- USA, Tel Aviv University – Israel, Vienna University of Technology, Université Paris Sud, CETP, GeoResearch Center Potsdam, Observatoire de Paris, Teheran University, Stuttgart University, Darmstadt University of

Technology, Institut of Oceanography of the Russian Academy of Sciences, Usikov Institute for Radio-Physics and Electronics National Academy of Sciences of the Ukraine, Kharkov.

IAG Comm V: Earth Tides, SC3 Working Group 'Fundamental Parameters', IAG SG 2.2 'Forward Gravity Modeling Using Global Database'. IAG SC4.2 Working Group 'Monitoring of Landslides and System Analysis'.

COST 296, WP1.4, 2.2 'Mitigation of Ionospheric Effects on Radio Systems', COST 625, COST 721, COST P18 'The

Physics of Lightning Flash and its Effects'.

The most of Hungarian seismological stations through the Seismological Observatory are directly connected to seismological services of European countries and vice versa the Hungarian seismologists are using permanently data of foreign observatories. Scientists of the Seismological Observatory are participating in many international projects, initiates and conducts bi- and multilateral initiatives, organizing international workshops and conferences.

INSTITUTE FOR GEOCHEMICAL RESEARCH

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Scope of activities

Basic research in the fields of mineral- and petrogenesis, formation of mineral deposits, isotope, organic and environmental geochemistry. Researches of magmatic, sedimentary and metamorphic rock-forming processes aim at the better understanding of the lithosphere and the geological evolution of the Earth's crust in Hun-

gary and in its wider environment. Geochemical processes of formation and accumulation of certain raw materials (hydrocarbons, subsurface waters as well as ore and other mineral deposits) are also investigated. In the field of environmental science, geochemical processes proceeding in certain geospheres and at their boundaries are studied in order to constrain geochemical cycles of certain bioess-

ential and toxic elements, with special emphasis to protection of soils, sub-surface water resources and cultural heritage.

Research aims and topics of the Institute

With respect to the research topics, continuity as well as opening of new research directions play essential role in the research strategy of the Institute. The main fields described below have been regarded as an appropriate framework for the scientific activity, in which the topics are closely and inseparably connected, easy to plan and follow.

Complex geochemical researches on the formation of minerals, rocks, mineral deposits and fluids in the Earth's lithosphere

The lithosphere beneath the Carpathian Basin is characterized by specific, anomalous physical properties. Its geochemical research comprises the following directions:

- characterization of the geochemical processes in the lower crust and upper mantle by geochemical features of volcanic formations and of their xenoliths and fluid inclusions.
- Reconstruction of processes and their geological, physical and chemical conditions taking place during weathering, soil and sediment formation, diagenesis and metamorphism in typical main tectonic units/geological formations of Hungary and in the surrounding Alpine-Carpathian-Dinaric-Hellenic system.

- For realizing the tasks mentioned above, results of theoretical, methodological and regional studies in the fields of major and trace element geochemistry, isotope geochemistry, rare-earth-element geochemistry and mineralogy, geothermometry and geobarometry and phyllosilicate (clay minerals, etc.) mineral structural and -chemical researches have been applied.
- Organic geochemistry of oil genesis: determination of thermal alterations in function of various organic facies.
- Paleoclimatological researches applying complex methods of isotope geochemistry, mineralogy and petrology.

Geochemical investigations on the state and changes of the environment

- Study of sorption, accumulation and migration of bioessential and toxic trace elements in soils and sediments in various geochemical systems, by laboratory experiments and researches on natural model areas (interrelations of trace metals and clay minerals, organic matter and clay minerals). The investigated trace elements are deliberating by weathering and soil-forming processes and by anthropogenic (contaminating) effects.
- Geochemical analysis of the optimal geological conditions for waste disposal, and study of sedimentation, sorption and migration of nuclear waste.
- Application of isotope-hydrogeochemical methods for the deter-

mination of origin, flow dynamics and eventual mixing of subsurface waters aiming at the protection of subsurface drinking water resources found in vulnerable geological environments.

- Study of organic molecular composition of thermal waters rich in organic matter, with special reference to the determination of reaction mechanisms of degradation processes.
- Geoarcheometry: determination of origin and/or technology of monuments, archeological finds (marble, limestone, other rock types, ceramics, glasses, etc.).
- Study of anthropogenic weathering processes of building materials used for monuments.

Education activities

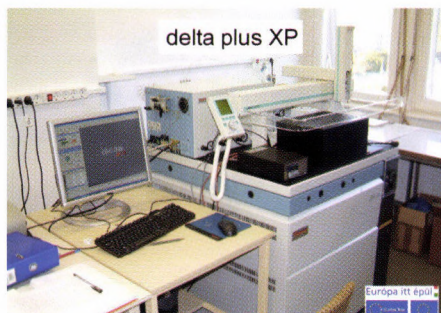
The researchers of the institute take an active role in the education of major universities (Eötvös Loránd University, University of Szeged, University of Pécs, Pannonian University, University of Fine Arts). Their education ac-

tivities are focussed mainly on special courses and supervising diploma work and Ph.D. studies. Several researchers are members of Ph.D. schools.

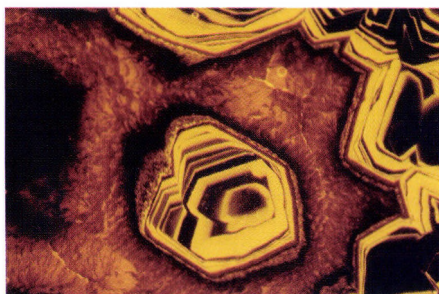
Fields for cooperation

Two main areas should be emphasized among the cooperations with Hungarian partners: paleoclimate and archeometry. In these fields the Institute initiated formal establishments of networks with participation of universities and museums.

As for foreign relations, the Institute for Geochemical Research has several intergovernmental cooperation projects with Croatian, Turkish and Spanish universities in various fields ranging from investigations on metamorphic processes to paleoclimate research. Research fields that could be supported by the European Union are mainly related to environmental studies ranging from water supply bases to airborne dust particles and greenhouse gases.



Thermo Finnigan delta plus XP mass spectrometer used for analyses of stable isotope ratios in H-C-N-O-S bearing materials.



Cathodoluminescence microscopic image of a calcite vug formed in a red clay section (Visonta, Hungary) showing evidences of rhythmic alternation of oxidation condition during carbonate precipitation.

CHEMICAL RESEARCH CENTER (CRC)

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Director General: Gábor PÁLINKÁS, F.M.

E-mail: palg@chemres.hu

Home page: <http://www.chemres.hu>

The research teams of the Chemical Research Center have carried out pioneering work in several fields of science in Hungary. These topics include the preparation of organic compounds labeled with radioactive isotopes and their application in the interpretation of reaction mechanisms; theoretical studies in gas chromatography; investigation of the isomerization and cracking reactions of hydrocarbons; study of liquid phase catalytic reactions; studies on molecular and crystal structure: application of infrared, Raman and NMR spectroscopy, mass spectrometry, X-ray diffraction; investigation of liquid phase polymerization processes; degradation of polymers, synthesis of new polymeric materials and composites; research in bioorganic chemistry; studies on surface chemistry, nanostructured materials and supramolecular chemistry.

After a reorganization process aimed at launching frontier research projects, modernizing research facilities and strengthening human capacity, four research institutes have been established within the Center in 2005:

– Institute of Biomolecular Chemistry,

- Institute of Nanochemistry and Catalysis,
- Institute of Structural Chemistry,
- Institute of Materials and Environmental Chemistry.

The essential mission of the Research Center is to conduct highly innovative, interdisciplinary research in the fields of chemistry and related areas, focusing on chemical structure and reactivity relationships. The Center exploits the multidisciplinary character of the researches conducted and brings together scientists with different background.

The main task of the Center is advancing fundamental knowledge on

- chemistry of biosciences, with emphasis on drug design based on revealing the role of biomolecules in physiological processes, and synthesis of biomaterials,
- chemistry of nanosciences, aiming at the study of new catalysts, surface coatings, interfacial phenomena, nanoparticles, microporous and mesoporous materials, new polymeric materials, ceramics, and composites,
- environmental chemistry studying the processes of green chemistry.

The activity of the Research Center covers also applied researches and to development in various fields of chemistry and chemical and pharmaceutical industry assist introducing scientific results into the practice. It undertakes contract research works and analytical measurements for industrial partners and governmental laboratories.

The Research Center maintains fruitful international relations. Research cooperations are conducted with research laboratories throughout the world. In 2007, 114 (50 per cent of the total) papers published in international journals summarized the results of the common projects.

The Research Center maintains several joint laboratories with universities and is strongly involved in higher education. Recently, 68 PhD students are preparing thesis at the Center, and 61 research associates are permanent lecturers at different Hungarian universities.

The Research Center has a staff of 376, incl. 215 research scientists. The total scientific output is represented by 310 scientific publications in 2007, among them 199 papers in journals referenced by Science Citation Index.

The Chemical Research Center incorporates the Center of Excellence on Biomolecular Chemistry and the Hungarian Network of Excellent Centers on Nanosciences supported by the European Community. The Center takes part in the following European research projects:

- Waste management and recycling of WEEE – Process integrated

thermal-chemical treatment of halogens containing materials

- Carbon nanotubes for future industrial composites: Theoretical potential versus immediate application
- Expanding the durability of stainless steel under microbiological conditions
- Hungarian Network of Excellent Centers on Nanosciences
- Creating competitive edge for the European POLYmer processing industry driving new added-value products with CONDUCTing polymers
- Chiral expression and transfer at the nanoscale
- Glycomic markers for clinical applications
- Network of Excellence: to overcome the fragmentation of European research in multifunctional thin films
- Characterisation of thin films on rough steel substrates
- Creating and disseminating novel nanomechanical characterisation techniques and standards
- Holistic strategies for chromate replacement in aluminium surface treatments and protective coatings (Airbus)
- Functional genomics of complex regulatory networks from yeast to human: Cross-talk of sterol homeostasis and drug metabolism (STEROLTALK)
- Stratosphere-climate links with emphasis on the UTLS-SCOUTO3

The main research areas and topics are given by institute.

CRC INSTITUTE OF BIOMOLECULAR CHEMISTRY

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The research activity in the Institute is focused on the area of pharmaceutical chemistry. This involves development of synthetic procedures, synthesis of original organic molecules with special emphasis on heterocyclic compounds and carbohydrates, recognition of essential physiological functions of some known and unknown target molecules, development of new diagnostic possibilities. Most important fields of pharmacological activity are related to cancerous diseases and conditions of the central nervous system.

In the preparative organic chemistry the following topics seem to be most promising:

- development and application of organocatalysis with special interest to enantioselective transformations,
- design and realization of novel preparative pathways,
- accomplishment of stereoselective procedures, particularly in the field of natural compounds,
- synthesis of fused nitrogen-containing heterocyclic ring systems,
- synthesis of oligosaccharides of biological importance,

- synthesis of biologically active new derivatives in cooperation with the testing laboratories.

The most important types of organic compounds under investigation are: fused heterocyclic systems, oligonucleotides, glycopeptides, heparine like oligosaccharides, and alkaloids. Considerable efforts are made for elaboration of total synthesis of natural compounds. Furthermore, procedures eligible for patent coverage are elaborated.

In the area of biochemical research in the Institute the following trends should be emphasized:

- study of the mechanism of GABA release activated by glial glutamate uptake,
- disclosure and characterization of new targets within the CNS,
- elaboration of novel neuroprotective strategies that are targeted against the modulatory pathways related to epilepsy, ischemic tolerance, cognitive enhancement and light-adaptation,
- study of significance of the amounts of AGP variants with respect to tumor diseases,
- Circular Dichroism spectroscopic studies,

- development of neurosteroid antagonists for GABA receptors,
- application of diagnostic methods for the metabolic activity of human liver in cooperation with the Transplantation Clinic of Semmelweis University,
- diagnostic methods for multidrug resistance by application of a special hepatocyte "sandwich culture".

The current research topics are as follows

Synthesis of diastereomeric aminonitriles from C-glycosides in asymmetric Strecker-reaction in the presence of chiral inductors

Development of new ring closure methodologies to fused pyrazoles

Investigation of reaction mechanisms by means of isotope labeling

Exploring new pericyclic pathways to fused and bridged heterocyclic systems

Synthesis of azole-containing N-alkylphenothiazines as possible lead compounds in the area of multidrug-resistance inhibition

Development of new fluororous methodologies and separation techniques in the organic synthesis

Development of novel organocatalysts and their use in asymmetric syntheses

Use of piperidine-2-carboxylic acid in elaboration of industrially applicable synthetic pathways to some alkaloids

Total synthesis of epiquinamide

Resolution of racemic derivatives of alkaloids by special chiral catalysts

Synthesis of new compounds with polycyclic indole or other nitrogen

containing skeletons with selective activity on muscarinic receptors by computer aided design

Synthesis of base-modified peptide nucleic acid (PNA) monomers

Allosteric regulation of GABAA receptors by neuroactive steroids

Receptor activation: development of a dynamic *in silico* model for channel opening

Effect of succinate on baclophene-sensitive GHB receptors in the *Nucleus Accumbens* (NA)

Selectivity of binding of Imatinib mesylate to the genetic variants of human AGP

Developments of novel methods of isoelectric focusing, capillary electrophoresis, fluorescence labeling, HPLC, CD for the determination of variant-composition in clinical AGP samples

Research on the design, synthesis and *in vitro* characterization of new, potentially neuroprotective compounds
Functional measurements on GABA and Glu transport inhibitors in combination with the development of fluorescence detection-based screening techniques

Investigation of the effect of glucocorticoids on the inducibility of CYP enzymes

Study of inducibility of UDP-glucuronyltransferases and transport proteins

Study of the use of hepatocytes, as models in the activation of xenobiotics in Ames-test

Development and validation of *in vitro* models for assessment of activity of ABC transporters

Study of the accumulation and photodynamic effect of sensitizers devised in international collaboration in *in vitro* tumor cell cultures

Study of the effect of free radicals and cellular signal transduction pathways on the regulation of tumor and neuronal cell attachment

Syntheses of glycosaminoglycan oligosaccharides

Application of the “orthogonal protection” in the synthesis of new oligosaccharides

Development of new glycosylation methods



Binary separation equipment using corundum as an adsorbent for facile separation of reaction mixtures; a unique technique developed in the laboratories of the Institute which provides a revolutionary acceleration of work-up of mixtures obtained by chemical synthesis.

CRC INSTITUTE OF NANOCHEMISTRY AND CATALYSIS

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The main research fields of the Institute are as follows:

- nanostructured materials,
- self-assembled nanolayers,
- surface characterization and modification,
- heterogeneous catalytic reactions.

The main aspects of the research strategy in the nanoscience field are as follows:

- novel approaches of nano-sized particles and layers by surface and interface characterization,
- modeling uniform nano-systems by sophisticated surface spectroscopy of molecular level for understanding the active surface,
- elucidation of surface reaction pathways for the modification of certain properties (e.g., smart coatings).

Creating nanostructuring surfaces and nanostructured coatings and interfaces in films using top-down and bottom-up processes offers great potential for designing and developing next generation materials and structures for applications. One of the main challenges in this area is to devise strategies that integrate nano-scale superstructures (e.g., nanoparticles, nanotubes) and

their assemblies with conventional technologies via traditional and newly evolving variants of techniques such as vapor deposition, laser alloying, and combinatorial approaches.

The chemistry and physics of surfaces and interfaces are among the most challenging and exciting areas of condensed matter science. Moreover, advances in the technology of surface modification have a fundamental impact on industries in diverse fields such as telecommunications, petroleum, superconductivity, computer science, minerals, and chemicals.

Self-assembled monolayers (SAMs) on organic interfaces provide a unique link between the science of organic surfaces and technologies. SAMs are model systems for the study of organic and biological interfaces and are of technical interest for the fabrication of sensors, transducers, protective layers, and for lubrication, and as patternable materials.

Research on heterogeneous catalysts is focused on the knowledge about the optimum surface restructuring that is necessary for the stability of the active sites, functionalizing the surface and development of multi-functional catalysts.

The main fields are as follows:

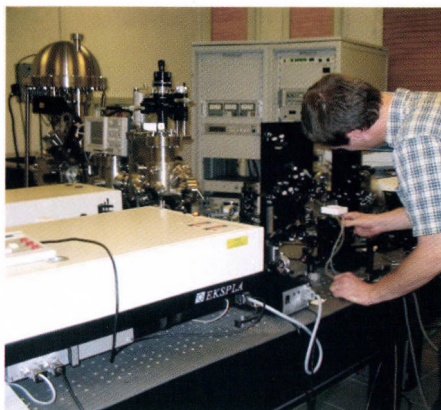
- modification of the nano-environment in catalytically active materials,
 - low temperature oxidation,
 - heterogeneous catalytic activation of carbonyl compounds,
 - asymmetric heterogeneous catalysis.
- Catalytic materials studied are:

- supported nano-structured mono- and multi-metallic clusters,
- anchored metal complexes,
- multicomponent metal oxides,
- micro- and mesoporous materials.

High-throughput experimentation and combinatorial material science for the preparation and testing of different new catalytic materials are preferably applied.

The current research topics are as follows

Design and preparation of nanoparticles for targeted drug delivery
Development of spatially ordered nanotube structures, their optimization and testing for supercapacitor applications
L-malic acid-based biopolymers for pharmaceutical and food industry
Noble metal nanopowders for innovative applications (sensors, filters, catalysts)
Development of gas sensors and detection procedures based on interdigitated arrays and nanocoatings
Functional nanolayer by surface modification – self assembly, inhibition, sol-gel, Langmuir-Blodgett and CVD
Investigation of phosphonates as environmentally friendly components in water-soluble coatings



Sum Frequency Generation Spectrometer for in situ investigations of interfacial phenomena

Applicability of the sol-gel process used to produce magnetic hexaferrite composites

Increase of the efficiency of Langmuir-Blodgett layers by addition of various metal-ions applied in the subphase

Carbon nanotube functionalization by development of chemical and physical methods

Development of characterization methods of the functionalized carbon nanotube

Investigation of polymer-carbon nanocomposite dispersion

Investigation of the local surface energy by using modified AFM sensors

Development of new nano-mechanical and nano-tribological investigation techniques

Development of nano-abrasive techniques based on scanning-probe-microscopy

Mechanistic studies on oxidase and oxygenase models

Study of catalytic bleaching with metal complexes

Studies on the modification of supported metal catalysts and support materials by tin tetraalkyls. Investigation of the formation of nanolayers and surface species by spectroscopic methods

Studies on the CO oxidation over various supported catalysts. Development of highly active, highly selective and stable catalysts for selective CO oxidation in the presence of hydrogen

Investigation of the full oxidation of methane and other hydrocarbons, such as propane and propylene and selective oxidation of propylene to propylene oxide

Research on the hydrogenation of activated ketones in the presence of cinchona-Pt catalysts. Preparation of new types of catalysts containing anchored metal complexes and their testing in asymmetric hydrogenation reactions

Application of methods of combinatorial catalysis and high-throughput experimentation both in the oxidation and selective hydrogenation reactions. Optimization of the activity and selectivity of catalysts and the determination of the optimum reaction conditions

Development of catalytic processes for the production of second generation biofuels

Selective catalytic NO reduction over Pd,In-zeolite catalysts

Preparation of wide-pore metallosilicates from delaminated zeolite [Fe]-, and [Ti]-MCM-22 by thermal treatment or pillaring

Preparation of zeolite membranes and membrane catalysts by solid-state recrystallization of layer silicates

Development of novel Ni/zeolite bifunctional catalyst for selective hydrocracking and isomerisation of straight-chain paraffins in Diesel oils
Preparation of mesoporous nickel silicate catalysts and their examination in the hydrogenation of aromatics

Synthesis, structural and photocatalytic properties of mesoporous titania
Preparation of composites of macroporous and/or mesoporous materials and zeolites

Functionalized micro- and mesoporous sorbents for water purification

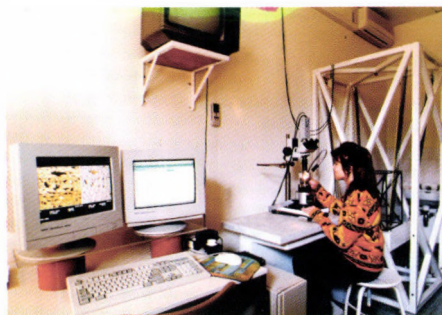
Studies to establish the use of mineral refuse as secondary raw material

Biomolecular adsorption at liquid/air and liquid/solid interfaces

Surface studies of surfactant mixtures and polymer-surfactant mixtures

Characterization of nanostructured Ti and TiO₂ surfaces by electron spectroscopy

Characterization of surface nanostructures by XPS and UPS, and investigations of their gas adsorption properties by SFG spectroscopy



Atomic Force and Scanning Tunneling Microscope for study of surfaces and nano-structures

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The main goals of activity of the Institute are:

- to conduct fundamental and applied research on frontier research topics of structural and theoretical chemistry, and
- to lend support to the respective structural researches within and outside the Research Center in the framework of scientific cooperations.

The unique instruments in the Center (e.g. Sum Frequency Generation Spectrometer, Atomic Force Microscopes, Scanning Tunneling Microscopes and Electron Microscopes, X-ray Diffractometers, Nuclear Magnetic Resonance Spectrometers, Electron Spin Resonance Spectrometers, Mass Spectrometers, ORD-CD Spectrometer with LC etc.) serve the purposes of research laboratories both at the Academy and universities.

The main research fields are:

- surface and interface studies,
- solute-solvent interactions,
- supramolecular studies,
- reaction mechanisms of elementary processes,

- study of biosystems and development of bioanalytical methods,
- medical applications of mass spectrometry and
- proteomics (including glycoproteomics).

The current research topics are:

Spin-label investigation of the structure and dynamics in proteins, spin-trapping studies of reactive oxygen species

ESR study of the co-ordination and chemical equilibria for biologically important ligands to transition metals
ESR and ENDOR studies of the magnetic properties in paramagnetic fullerenes and nano-structures

Photoinduced processes in self-assembled systems

Effect of hydrogen-bonded complexes on photophysical and photochemical processes

Development of fluorescence probes, effect of microenvironment on the fluorescent properties.

Investigation of photoinitiated processes in compounds of biological importance.

Supramolecular receptors for optical sensors

Kinetic analysis of photochromic systems

Sensitizers for photodynamic therapy: spectroscopy, photochemistry and *in vitro* phototoxicity

Spectroscopic studies of laser generated plasmas

Implementation of new NMR methods in the structure determination of organic and bioorganic compounds

Solution- and solid-state NMR investigation of metal-organic compounds with supramolecular structure

Structural- and reaction kinetic studies in organocatalysis

Conformational studies of peptides using high resolution NMR

Application of solid-state NMR methods to material science research

Raman spectroscopic studies of carbon nanotubes, analysis of their vibration spectra and geometry

Investigation of medical and biological applications of infrared and Raman spectroscopy and microscopy with special respect to medical diagnostics and different aspects of biochemical research

Study of surface properties of nanostructural materials, thin films, LB-films and catalysts by special methods of infrared and Raman (emission, reflection, surface enhanced, resonance Raman and FT-Raman) spectroscopy

Application of coupled chromatographic and vibrational spectroscopic techniques (GC/FT-IR, TLC/Raman) in organic chemical analysis

Development of the joint application of IR-LD measurements and quantum chemical DFT calculations to enhance the reliability of vibrational analysis

Investigation of the structure and vibrational spectra of medium-sized (15-40 atomic) organic molecules (e.g. various heterocyclic and condensed polycyclic compounds) and detailed interpretation of their spectra supported by theoretical calculations

Laboratory and open path FTIR spectroscopic study of atmospheric pollutants, with special respect to recent validation methods of the European Union

Synthesis and structure determination of clathrates, isostructurality studies on clathrates

Structural studies on metal complexes, photochemically active metal complexes, structural and thermochemical investigations of metal complexes of thiourea

Structure of biomolecular model compounds such as cyclodextrines and their derivatives, biogenic amines and of compounds from resolution of α -phenylethylamines and oxazolidines prepared by carbamate cyclizations

Structural role of H-bonded water molecules in the crystals of acyclic (α -aminoacids, investigation of heat-affected water loss, solvent associations of large space-filler and pore former C3 symmetric compounds (single crystal X-ray diffraction and thermoanalysis, TG and DSC)

Study of protein glycosylation, development of glycosylation based biomarkers for early diagnosis of cancer

Development of novel bioinformatic techniques for mass spectrometry

Study of metabolomic and pharmaceutical markers based on mass spectrometry

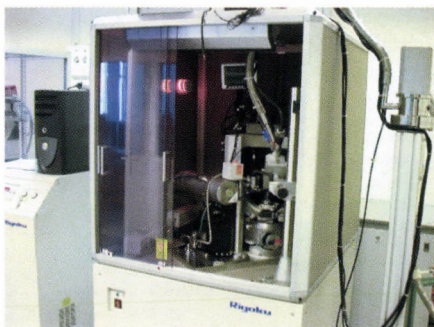
Study on Energy partitioning

Quantum chemical analysis and computation of local properties
Understanding the unusual reactivity of frustrated Lewis acid-base pairs
Mechanistic studies on the reactions of carbon dioxide relevant to its chemical utilization
Theoretical study of homogeneous catalytic hydrogenation processes
Revealing the mechanism of organocatalytic reactions by theoretical calculations
Ab initio simulations of reactions in aqueous media
Theoretical studies of the adsorption of small molecules (CO, methanol, formic acid) on transition metal single crystal surfaces
Quantum chemical characterization of reactive centers on pyrite surfaces
Theoretical study of the photochemical properties of Ru complexes
Study of the UV photodissociation of halomethanes (CH_2BrCl , CH_2I_2 , CH_2BrI és CH_2Br_2) by quantum chemical and quantum dynamic methods

Theoretical study of the dynamics of the $\text{H} + \text{O}_2$ reaction
Revealing the kinetics of reactions of acetyl radical in processes relevant to atmospheric chemistry
Ab initio simulation of XPS spectra
Structural studies on liquids, liquid mixtures, aqueous and non-aqueous solutions – involving extreme conditions – using X-ray and neutron diffraction method combined with simulations
Synthesis, X-ray diffraction and multinuclear NMR-spectroscopic analysis of self-assembled organotin(IV)-complexes
Synthesis and structural characterization of gold containing supramolecular systems
Synthesis and structural characterization of heterobimetallic supramolecules
Study of crystal packing on the solid-state reactivity of metallosupramolecular systems



Nuclear Magnetic Resonance Spectrometer



X-ray Diffractometer

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The main research areas of the Institute are as follows:

- materials chemistry,
- environmental chemistry.

Materials chemistry

The research in materials chemistry in IMEC is aimed at revealing chemical aspects of materials science and technology, a typical scientific field of interdisciplinary nature. In this context, special attention is devoted to correlations among composition, micro- and macrostructure, properties and synthesis routes of functional and structural materials. Models include self-organizing surface layers, surface coatings of special properties, functional micro-gels, different polymers and copolymers, micro- and nanostructured monolithic and composite materials, metallic structural materials, and also micro- and nano-sized ceramic materials.

The main research topics are as follows:

Formation of nanolayers in ion and plasma beams

Synthesis of micro- and nanosized materials in thermal plasmas

Mechanism and kinetics of electrochemical and corrosion processes

Synthesis of metal complexes and studies on their biomedical applications

Studies on correlations among structure, property, synthesis and processing of commercial polymers

Synthesis and characterization of novel polymeric systems

Studies on correlations among synthesis, structure and properties of novel polymer composites

Environmental chemistry

Research in this field is aimed at generating chemical knowledge and developing new methods of environmental protection to decrease environmental impact due to human activities. The research topics cover new analytical methods and devices to be used in complex environmental systems, studies on decreasing the environmental effects of energy production both from traditional and renewable sources, processing of

wastes and hazardous materials, and development of new materials, processes and technologies of minimum environmental impact.

The main research topics are as follows:

Pyrolytic and chemical recycling of plastic wastes

Utilization of biomass materials by thermal methods

Research in environmental technologies

Research on the more efficient utilization of solar energy

Processing of hazardous wastes in thermal plasmas



Measuring the acoustic emission of polymers during tensile test

INSTITUTE OF ISOTOPES

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Entrance of the Institute of Isotope and Surface Chemistry, Chemical Research Center

Scope of activities

The institute pursues research activities in four main directions:

- development and application of nuclear methods for analysis,
- detection and quantitative determination of materials of nuclear origin,

- study of effects of irradiation, dosimetry
- study of surfaces and heterogeneous catalytic processes

Besides these, the institute occasionally contributes to the work of the relevant national authorities (primarily HAEA) by providing them expertise in the fields of nuclear safeguard and

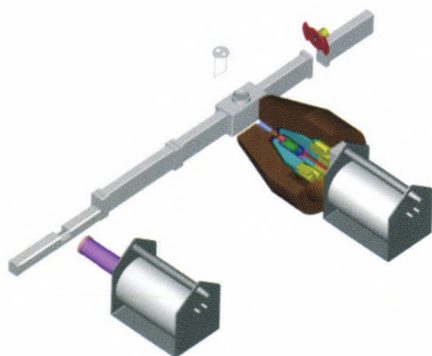
maintaining the national Registry of Radioisotopes (RADIUM).

Research aims and topics

Typical aims and results of activities on the four mentioned fields are listed below:

Development and applications of nuclear methods for analysis,

One of the institute's basic research profile is the maintenance and application of the combined Prompt Gamma Activation Analysis (PGAA) and Neutron Induced Prompt-gamma ray Spectroscopy (NIPS) facilities at one of the neutron beam lines operating with the so called "cold" neutrons (~20 K) at the Budapest Neutron Centre. These unique non-destructive methods have been successfully applied for analysis of various substances, archaeological objects, geological samples. Another advanced application is the determination of



The scheme of the NIPS and PGAA stations at one of the cold neutron beam lines of the Budapest Neutron Centre.

the amount of hydrogen dissolved in metal catalyst particles under in operando conditions. An ongoing project is recently to construct the instrumentation for enabling the determination of the elemental distribution in three dimensions in the samples with a resolution of ca. 1 mm. (The scheme is shown in Fig. 1.)

Another nuclear method used at the institute is the in situ Mössbauer technique. Various substances have been studied so far (supported catalysts, porous ferri- and stannisilicates, etc.). Recently a development is in progress to establish an in beam Mössbauer facility where the Mössbauer source nuclei will be produced promptly by exciting the appropriate isotopes in the cold neutron beam.

Improvement of the methods for detection of the neutron coincidence events is in progress, digital methods are being developed to improve the time resolution.

Detection and quantitative determination of materials of nuclear origin

Gamma-spectrometric methods have been developed and applied for the characterization of highly enriched uranium samples. The emphasis is laid on characterization of potential samples originated from illicit trafficking of nuclear materials. In particular, procedures for determining the ^{234}U , ^{235}U , ^{238}U , ^{232}U and ^{236}U contents and the age of highly enriched uranium have already been tested.

A non-destructive, gamma-spectrometric method have been developed for uranium age-dating which can

be applied to samples in any physical form and geometrical shape. It relies on measuring the daughter/parent activity ratio $^{214}\text{Bi}/^{234}\text{U}$ at low-background. The method does not require the use of any reference materials nor the use of an efficiency calibrated geometry.

Development and application of novel methods based on the determination of isotope ratios of heavy elements with high resolution ICP-MS equipped with laser ablation unit. Methods have been developed for fast quantitative determination of isotopes of Pu and Am in environmental samples (soil, sediments, vegetation).

By determining the appropriate ratios the original source of Pu (fall-out, power plant fuel, weapon, etc) can be identified. Another application is the determination of $^{230}\text{Th}/^{234}\text{U}$ ratio (e.g. in seized nuclear materials) from which the date of production can be specified. Further, the laser ablation has been proven a convenient non-destructive option for the sampling.

Migration of typical radioisotopes of spent fuel of NPP-s in geological media have been studied in order to estimate the retention properties of rock with particular regard to its perspective application as host media for high level nuclear waste deposition.



The high resolution ICP-MS with double magnetic focussing equipped with laser ablation option for analysis of isotopes of nuclear materials

Study of effects of irradiation, dosimetry

Kinetics and mechanism of partial degradation of dye and pesticide molecules are studied during irradiation in waste water with an emphasis on the role of radicals.

Polymer monoliths are prepared from mixtures of monomers by irradiation techniques. They are functionalized and applied as sorbents.

Surfaces of porous polymers have been modified by electron-, gamma-, and plasma irradiation. The developed modified surfaces can be used for cultivation of cells.

Novel solid materials have been developed and applied for TL dosimetry in spaces exposed to high dose mixed (neutron and gamma) irradiation. Various dopants have been evaluated in CaSO_4 and alumina.

Research and development of aqueous and organic liquid systems have also been in progress for application to dosimetry in electron and gamma radiation processing (i.e. for facility characterization, product and process validation as well as for routine dose control in radiation sterilization of medical products, polymer processing, food irradiation).

Study of surfaces and heterogeneous catalytic processes

in the process of CO oxidation (including the preferential CO oxidation in hydrogen (PROX))

- Nanoparticles of gold have been supported on titania, silica and ceria. The metallic gold particles are stabilized and their properties are advantageously influenced by the oxide support.

- Pt and Pd have been supported on ceria. The stages of the reaction have been studied by in situ XPS and DRIFT techniques. The intermediate components in the reaction are proposed.
- The interplay with the complementary water-gas-shift (WGS) reaction has also been studied.
- Supported bimetallic catalysts have been studied in conversions of hydrocarbons. PtRh has shown synergism, Ge modified the properties of various surface sites in various PtGe catalysts, and alloy formation was detected in RhSn bimetallic systems.

Studies on environmental catalysis and activation of methane are also performed.

The presence and role of subsurface hydrogen in partial hydrogenation of alkynes to alkenes have been demonstrated on Pd in measurements with combination of the PGAA detection of hydrogen in the solid phase during the reaction.

Education activities

A number of senior research fellows participate in the post graduate education (seven researchers are members of the staff of various PhD schools of four universities). In correspondence, research work for PhD theses is regularly carried out at the Institute – 6-8 students are hosted in a yearly average. Graduate students are also hosted regularly.

Short IAEA courses have also been organized regularly at the institute to propagate the special experience col-

lected on the characterization and the application of nuclear materials and radioisotopes.

Fields for cooperation

The research work on each of the four main directions has strong ties to the international scientific community. This can be illustrated by the statistics of the ISI publications: out of the communications coauthored by the research fellows of the institute c.a. 50% is prepared within international collaborations.

A specific opportunity for cooperation is established within the EU FP6 NMI3 project: access is provided for various measurements at the cold neutron beam (PGAA and NIPS) facility.

The institute participates in the activities of various international organizations (ESARDA Workgroup for Non-destructive Analysis, and ITWG: International Technical Group for Combatting Illicit Trafficking of Nuclear Materials).

Besides these, the researchers of the institute are involved in a great number of various bi- and multilateral research projects.

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Scope of activities

The main activities of the institute, according to its foundation document and in accordance with the atomic law of Hungary, are research and development in reactor physics, fuel behaviour, thermohydraulics, health physics, real time information and operator aid systems, reactor simulation, deterministic and probabilistic analyses of reactor safety, safety aspects of the transport and storage of nuclear material, severe accident analysis, radiation damage of materials, fracture mechanics, risk assess-

ment, analytical chemistry, reactor diagnostics and leak detection

Further important research and development activities are in the deterministic and probabilistic analysis of dangerous industrial systems, in the environment protection, in risk assesment, in analytical chemistry, physical chemistry, acoustic emission methods, in reactor-electronics and in space electronics.

Operation of the Budapest Research Reactor, according to the atomic law and other regulations, operation of the cold neutron source, organization of the national and international

utilization of the research reactor, including the relevant technical activities, research and development in the field of neutron radiography, neutron reflectometry, neutron activation analysis and study of the biological effects of radiation belong to the activities as well.

Organization of the emergency preparedness at the site, providing the technical basis for emergency preparedness and nuclear accident management of the country, operation and continuous development of the environment monitoring system of the site are important as well.

Participation in gradual and post gradual education.

Research aims and topics

Reactor physics

- investigations in reactor safety
- research of new fuel types
- new methods for spent fuel handling (transmutation)
- calculations for Generation IV reactors

Fuel and reactor material studies

- small scale severe accident experiments
- investigations of the corrosion speed on the surfaces of NPP equipment with the aim to determine the optimal water chemistry parameters
- pressurized thermal shock (PTS) studies
- fuel studies for Generation IV reactors

Thermohydraulics

- investigation of the possible use of CFD codes in reactor safety studies
- feedwater loss experiments (on PMK experimental device) for the validation of the steam generator models, used in thermal hydraulic system codes
- validation research in thermal hydraulic system codes
- investigations for Generation IV reactors

Development of operator aid systems for nuclear power plants

- development of the critical safety function monitoring system
- joining the core monitoring and the reactor protection systems
- development of the information system in the crisis center of the Hungarian Atomic Energy Authority

Simulation studies for nuclear power plants

- development of a joint two-phase 1D thermal hydraulic – 3D reactor physics system
- elaboration of a new finite difference lattice Boltzmann system
- investigation of the phase transition process in finite systems – by two phase flow experiments

Health physics and environmental research

- development of action supporting software for nuclear accidents

- estimation of the environmental effects of fossile electricity production
- dose mapping in space electronics

Material studies

- research of the liquid structure of partially solving fluids
- investigation of the effects of mechanical stresses on general corrosion
- applying neutron radiography for the investiagtion of large objects, usual in industry

- material studies for fusion equipment and Generation IV reactors

Scientific and technical utilization of the Budapest Research Reactor

- development of the research equipment at the research reactor
- development of new neutron polarizers
- more effective inclusion of the scientists from the European Union into the research at the reactor
- more effective use of the time of flight spectrometer



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Scope of activities

Fundamental experimental and theoretical research in high energy nuclear and particle physics, heavy ion physics, plasma physics, thermonuclear fusion, physics of cooled atoms, space physics, nuclear solid state physics, materials sciences, computational neuroscience, application of physics in biology. Applied research and development in the field of laser techniques, fusion technology, ion-beam microanalysis, space electronics, fast data processing, optical and X-ray spectroscopy. Most of the institute(s) work is realized within the framework of international co-operations connected with the so called "big sciences". The Institute is the host institution of the Hungarian Association EURATOM – Hungarian Academy of Sciences participating in the fully co-ordinated European programme for the development of useful fusion energy.

The Computer Networking Centre is working as a department of the Institute. Its responsibilities include the management of the local campus

network, the connection to the wide area networks and the maintenance of the information services to the whole campus. It also operates the "Budapest" LHC Grid system of over 200 processors recognized by CERN as a Tier-2 node and is entitled to act as a Certificate Authority for the Hungarian community for Grid research.

Research aims and topics

Ultra-relativistic heavy ion physics and particle physics

The fact that Hungary is a member state of CERN basically determines the main trends of research of the institute in this field. The main research topics are:

- research for quark-gluon-plasma in the CERN experiment and in the PHENIX experiment (RHIC, Brookhaven)
- development of hardware elements for the planned CERN LHC experiments (ALICE, CMS)
- participation in the LHC Computing Grid Project

- data analysis for the L3 and OPAL experiments (LEP)
- investigation of relativistic heavy ion collisions in GSI-Darmstadt

Thermonuclear plasma physics and laser physics

- pellet-plasma interaction
- plasma turbulence studies
- development and utilization of various neutral particle beams including accelerated Lithium-beam and laser blow-off for plasma diagnostics
- Inertial Fusion Energy research
- the collisions and interaction of atoms and molecules with the laser radiation.
- participation in the ITER cooperation

Space physics

- Scientific interpretation of the data from former and ongoing space missions (VEGA, PHOBOS-2, ULYSSES, SOHO, CLUSTER, CASSINI).
- Development of on-board devices, software and ground support equipment for future space missions (VENUS EXPRESS, OBSZTANOVKA, STEREO, BEPI COLOMBO)
- The institute provides infrastructure and manpower for the Hungarian CLUSTER Data Centre and for the Expertise Centre for ROSETTA Lander software system.

Theoretical physics

- Relativistic heavy ion collisions
- Elementary particle interactions: quark confinement, Higgs-particle, W decay.
- Quantum field theory: integrable models, lattice models.
- General relativity and gravitation: new solutions of Einstein(s) equation, black hole final states, quantum gravitation.
- Few-body problem in nuclear physics.

Materials science

- Utilization of methods of nuclear physics to determine the structure of materials and of microscopic processes determining the macroscopic properties (semiconducting thin layers, surfaces and interfaces in thin magnetic layers, fundamental processes in ion implantation, defect structures in semiconductors and insulators, porous systems with extended internal surface). The sole Hungarian Molecular Beam Epitaxy (MBE) device opens new perspectives in this field.
- Development of the methodology of nuclear condensed matter physics mainly based on the institute(s) accelerators recently upgraded with a proton micro-beam, Mössbauer- and positron annihilation laboratories as well as on external (international) synchrotron radiation laboratories. The methods are based on (partly in situ) ion beam analytical techniques, on resonant

and non-resonant interaction of gamma or synchrotron radiation and that of positrons with condensed matter.

- The application of various nuclear methods including the proton micro-beam for elemental mapping and for the analysis of archaeological, cultural heritage and fine art objects.

Computational neuroscience and nuclear biophysics

- Mathematical modelling and simulation experiments of the functional organization of the hippocampus.
- Multicompartmental single cell modelling considering the time-dependent kinetics of different ionic channels
- Theoretical investigation of the mammalian olfactory system
- Study of the concentration, distribution and binding of essential (or toxic) trace elements in proteins and enzymes in order to clarify their structure and function by combining special nuclear analytical techniques with biochemical separation processes.

Educational activities

The Institute pays great attention to the close contact with the universities. Over 30 co-workers of the Institute give regular or special lectures and direct laboratory courses at the Eötvös University, the Budapest University of Economics and Technology, the Janus Pannonius University, the Szentgyörgyi Albert University, the University of Debrecen, the University of Szeged, the Szent István University, etc. Participation in the PhD School programs of those universities is also an important part of the educational activities. Senior researchers of the Institute are founder or regular members of several PhD Schools, dedicated agreements with these Schools make these co-operations more efficient. In addition to the graduate and post-graduate teaching, research co-operations are also established with those institutions.

Fields for co-operation

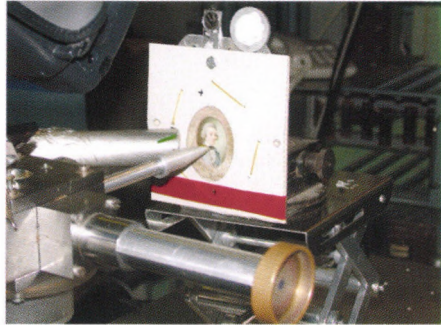
The Institute is open for high-level co-operations in all fields which directly or indirectly relate to the basic



Panoramic view of the KFKI RMKI Tier-2 GRID node

tasks defined in the grounding document, i.e.:

- Basic experimental and theoretical research in high energy nuclear and particle physics, heavy ion physics, plasma physics, thermonuclear fusion, physics of cooled atoms, space physics, nuclear solid state physics, materials sciences, computational neuroscience, application of physics in biology. Applied research and development in the field of laser techniques, fusion technology, ion-beam microanalysis, space electronics, fast data processing, optical and X-ray spectroscopy, fusion energy research, environmental analysis, application of nuclear analytical and material science techniques.
- Development and design of specific electronic and vacuum and detector systems, purpose-design of



Non-destructive external beam
PIXE analysis of a miniature

laboratory apparatus for e.g. particle accelerator applications

- Information technology, software development and design (also for persons with challenged physical abilities), high data transfer techniques, computer GRID system applications, etc.

RESEARCH INSTITUTE FOR TECHNICAL PHYSICS AND MATERIALS SCIENCE

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The institute in its present form at the KFKI Campus was organized in 1998 by a merger of the Research Institute for Technical Physics and the KFKI Research Institute for Materials Science with a *mission* to perform multidisciplinary research on complex functional materials and *nanometer-scale* structures, to explore physical, chemical and biological principles and exploit them in *integrated micro- and nanosystems*, and in

the development of characterization techniques.

Further aim is the dissemination of the results in international programs, education and their utilization in industrial R&D, with special attention to the needs of SME-s or even by newly founded spin-off and start-up companies.

The 150 employee strong institute, with a scientific staff of ninety-five has six scientific departments, and a

yearly turnover of ca. € 6 million. The multidisciplinary materials research institute acts as a regional centre of competence in:

- micro- and nanoprocessing and analysis in conjunction mainly with informatics and solar energy conversion
- integration by CMOS compatible Microsystems technology (MEMS/ NEMS) using Si micromachining
- analysis of thin film nanostructures and low-dimensional structures in general in view of their application specificity (by diverse forms of electron microscopy and X-ray and ion beam techniques)
- preparation, handling and process integration with nanoscopic dimensions by the extensive use of raster-probe techniques

Thin film Department

The department's main efforts are directed towards the exploration of atomic processes taking place in thin films, small particles and surfaces during growth, thermal treatment, ion bombardment and solid state reactions. For this purpose methods like Transmission Electron Microscopy (analytical: EDS, also EELS since end of 2005 and high resolution), Auger Electron Spectroscopy in combination with depth profiling and EPES will be used in own laboratories, and scanning-probe techniques like STM/STS, Scanning electron microscopy and FIB, X-ray diffraction as well as XPS in co-operation with other laboratories of the institute. Thin film growth will be studied by thermal or e-beam

evaporation and DC- sputtering in both HV and UHV systems. The main research topics are:

- Atomic models for structural and morphological development of one- and two-component thin films and composites
- Nanocomposite coatings: structure and properties
- Phase analysis of nanostructures, development of methods
- Process Diffraction program for analysis of diffraction patterns
- Nitride based and other wide band gap semiconductor structures, defect engineering and contacts
- Molecular Dynamics simulation of the atomic mixing of bilayers
- Determination of the electron mean free path by EPES and surface correction
- AES depth profiling
- Investigation of ion induced surface damage by plasmon spectroscopy
- Ion guns and ion milling, TEM sample preparation, cross section samples

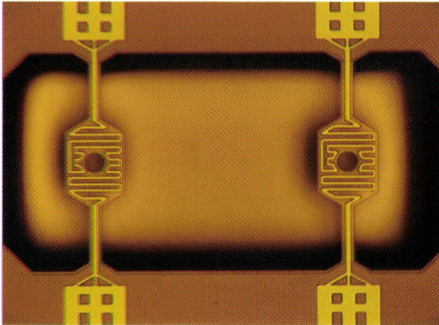
Microtechnology Department

Integration of materials research results in micro- and nanosystems, and their utilisation in the research and development of physical, chemical/biochemical sensors and integrated devices.

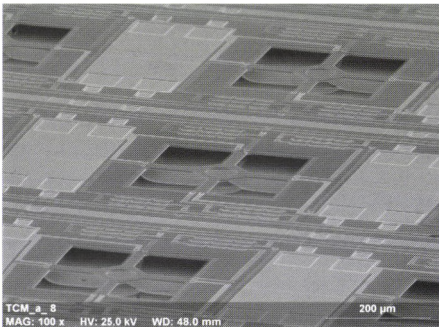
The main topics are:

Fundamental research on

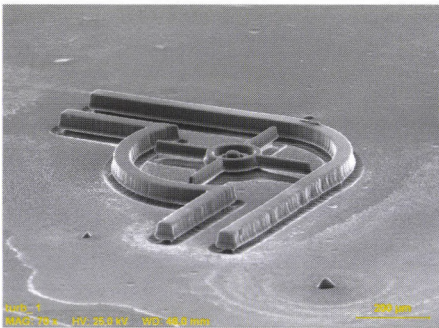
- sensing principles
- noise in sensors
- novel materials and nanostructures
- integration of nano-materials in microsystems
- novel 3D fabrication techniques



Calorimetric gas sensors with microfilament structure.



Three-axial 8x8 taxel array by bulk micromachining.



Microfluidic turbine fabricated by proton direct writing and porous Si etching.

- ion-solid interaction for supporting MEMS development.

Targeted research on

- MEMS and MEMS related technologies, with special emphasis on development of CMOS compatible processes for bulk Si micromachining in 3D Microsystems.
- R&D on different gas-, pressure-, flow-, temperature-, vacuum-, force-, tactile sensors
- Development and applications of near IR light emitting diodes and detectors
- Solar cells and competitive thin-film solar technologies
- Acoustic wave devices and their applications
- Surface modification by laser ablation and ion implantation

Device and materials characterization

- CV, IV, DLTS, Hall, PL, EL and other electrical-optoelectric characterization of Si and compound semiconductors.
- Structural investigation of semiconductor materials, studies on ion implantation process and technology, methodological development and application of various ion beam analysis methods.

Photonics Department

The technology of generating and harnessing light and other forms of radiant energy whose quantum unit is the photon is the subject of research in this department. The science includes light emission, transmission, deflection, amplification and detection by optical components and instruments, lasers and other light sources, fibre op-

tics, electro-optical instrumentation, related hardware and electronics, and sophisticated systems.

The range of applications of photonics extends from energy generation to detection to communications and information processing:

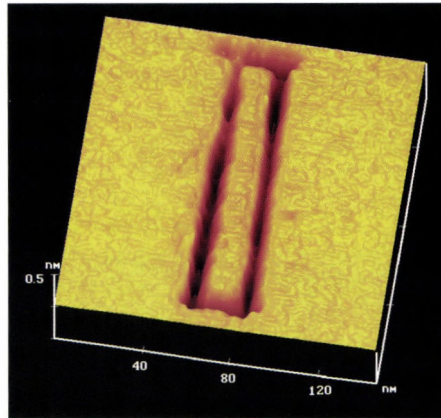
- Spectroscopic ellipsometry on solid and liquid samples using optical modelling
- Study of large wafers by wide angle imaging ellipsometry
- Makyoh topography for wafer flatness testing
- Nondestructive material characterisation by magnetic and induced current measurements
- Determination of fundamental optical properties;
- Characterisation of spectral sensitivity of detectors and sensors

Nanotechnology Department

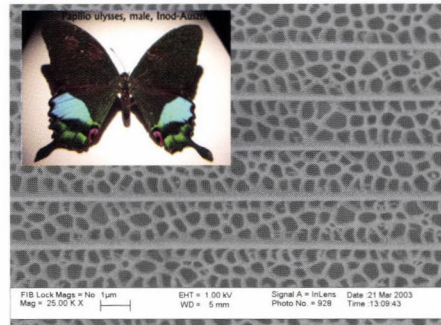
The research activities range from the atomic level characterization and modelling of individual nanostructures, via bio-inspired studies on natural photonic crystals to the growth of carbon nanotubes and CNT-type nanoarchitectures, as well as their applications.

The Nanotechnology department is active in several basic domains of the emerging nanoscience and -technology:

- Study and characterisation of fundamental properties of carbon nanostructures
- Interpretation of scanning probe results by means of quantum mechanics modelling

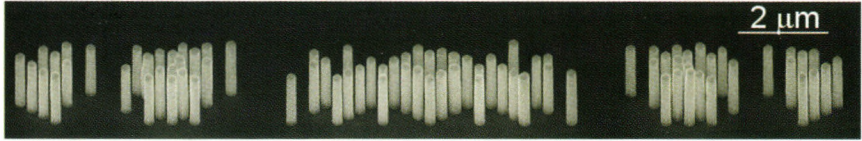
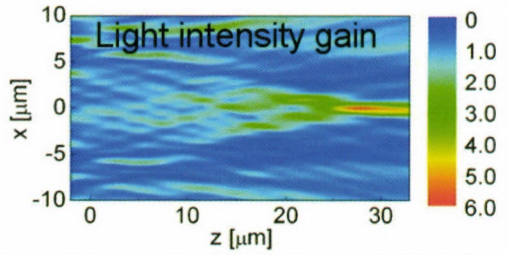
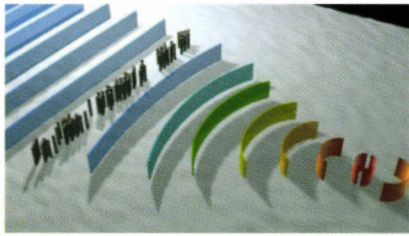


Nanostructured graphene stripe, result of the Nanotechnology Department

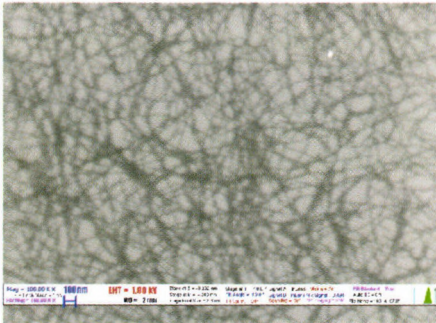
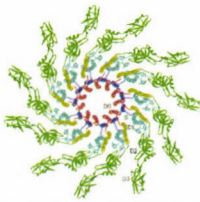


Photonic bandgap-material texture encountered in the wings of certain butterfly species having bright metallic shiny colors.

- Nanostructuring of grapheme by scanning probe techniques
- Study of natural photonic crystals (in butterfly wings and different plants)
- Application studies of the sensing properties of CNTs both in collective (chemical sensors) and singular (force, gas, etc.) form



First experimental demonstration of ZnO nanopillar lens operation for the manipulation of near surface light wave propagation



Functionalised flagellar protein nanofilaments immobilised on the top of waveguide sensors.

Ceramics and nanocomposites Department

The main task of this multidisciplinary laboratory is to elucidate

upon the relationship between processing and functional behaviour of nanomaterials and nanostructures in different applications, a.o. in ceramic nanocomposites.

Most recent activities of the nanostructuring group extend beyond the development of carbon nanotube silicon nitride nanocomposites, 1D, 2D and 3D semiconductor oxides for sensor devices, hydroxyapatite biocomposites for medical and environmental applications to the investigation of mechanical, electrical, optical sensing and biological properties of novel nanosystems (inorganic and protein) by using advanced preparation methods.

- Nanofabrication system comprising SEM/EDS/FIB/gas inlet for IBAD
- Electron-beam lithography
- Silicon nitride tools and parts
- Nanostructuring by Langmuir-Blodgett films
- ZnO nanotubes growth
- Protein receptor immobilisation, surface functionalisation

Complex systems Department

The main activity of the group is focused on the theoretical investigation of the non-equilibrium phase transition on lattice systems, the evolutionary games on lattices and networks, the formation of self-organizing patterns.

A traditional field of investigation is the structural analysis of the development and spread of archetypes of motives in folk music.

The second main activity is more praxis oriented in connection with quantitative microscopy, image analysis and related process-control or surveillance applications. Image analysis based on optical microscopy and computerized image processing is even extended to investigate living cells of certain pathologic human tissues, to solve medical, dosimetric and fabrication-related technological tasks.

In addition to basic studies funded by the Hungarian Academy of Sciences and the National Fund for Basic Research (OTKA), MFA became partner in ten consortia in the 6th Framework program of the European Union and in four new ones in FP7 up to now. MFA participates in numerous technology-oriented research projects funded jointly by the government of Hungary and by the beneficiary enterprises (list see below).

As a daily exercise for the technology labs, the ISO 9100:2001 certified institute runs some limited small scale production of chips for pressure transducers, SAW filters, gas and tactile sensors for TV.

Other activities, like the fabrication of sintered ceramic parts for industrial partners are taken over by its spin-off company, ANTE Innovative Technologies Ltd. MFA is involved in the operation and research backup of two other startup companies, TactoLogic Ltd., and AlbaNANO Ltd., too.

MFA is since 2008 the coordinator of the national precompetitive R&D association: Integrated Micro/Nano-systems Technology Platform. This encompasses thematically the areas of the EU technology platforms for nanoelectronics; ENIAC (www.eniac.eu) as well as that of the European PhotoVoltaic Technology Platform (www.eupvplatform.org). The strategic plans of the national initiative will be adapted to the long-term goals of both above EU platforms, laid out in their respective Strategic Research Agenda.



RESEARCH INSTITUTE FOR SOLID STATE PHYSICS AND OPTICS

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The building of the Institute

The Institute was founded by the Hungarian Academy of Sciences in 1991 as part of the Central Research Institute for Physics (abbreviation in Hungarian is KFKI). In 1998, the Crystal Physics Laboratory of the Hungarian Academy of Sciences merged with the Institute and its name changed to Research Institute for Solid State Physics and Optics.

Scope of activities

The main profile of the Institute is basic research in the field of theoretical and experimental solid state physics, including the physics of condensed materials, nanostructures, thin films and surfaces and also in the field of theoretical and experimental optics, including the physics of optical crys-

tals, nonlinear and quantum optics as well as laser physics.

Applied research, including the development, study and applications of specific new materials, new test methods, new optical crystals, thin film devices and lasers. Development of unique research methods concerning basic research activities. Graduate and post-graduate education.

Research aims and topic

Theoretical solid state research

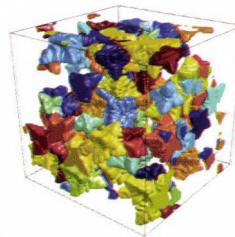
Theoretical study of strongly correlated systems: Properties of low-dimensional magnetic models, using both analytical and numerical methods. Low dimensional fermionic models, especially the one and two dimensional Hubbard and t-J models. Quantum-information theory and behaviour of strongly correlated quantum systems.

- Theoretical study of complex systems: Phase transitions and scaling. Numeric research of systems with stochastic dynamics. Quantum-many body systems. Nonlinear systems; calculation of important - mainly non-linear - properties of gases exhibiting Bose-Einstein condensation.
- Theoretical study of electronic states in solids: Development of band structure methods. Stability of structures and surfaces, elastic properties from first principles. Magnetic properties of surfaces. Properties of spin- and charge density waves. Strongly correlated electron systems. Raman spectra

of metals and superconductors. Electronic properties and vibration modes of carbon nanostructures.

Experimental condensed matter research

- Investigations of non-equilibrium alloys: Study of the magnetic properties of nano-phase materials, e.g. granular alloys, multilayered materials, composites prepared by nanocrystallization from the amorphous phase, mechanically ground or alloyed materials. The bulk magnetic properties measured by a high sensitivity SQUID (Superconducting Quantum Interference Device) are compared to the local parameters determined by a nuclear method, i.e. Mössbauer spectroscopy, in order to understand the effect of the nano-structure on the magnetic behaviour.
- X-ray diffraction: Experimental and theoretical study of atomic resolution X-ray holography. Theoretical study



Phase Field Simulation of dendritic solidification in the Cu-Ni system.

Different colours represent particles with different crystallographic orientations.

By the end of the solidification process
~200 dendritic particles formed.

of atomic level imaging of small non-periodic systems. Structural and spectroscopic study of rotor-stator molecular crystals based on cubane and fullerenes and their chemical reactions. Experimental study of the symmetry, chemical bonding, static and dynamic Jahn-Teller effect in fulleride salts by the combined use of x-ray diffraction, infrared, Raman, ESR and NMR spectroscopy. Study of the optical properties of transparent carbon nanotube networks in the frequency range from the far infrared through the ultraviolet. Field theoretic study of first order phase transformations.

Different colours represent particles with different crystallographic orientations.

By the end of the solidification process ~200 dendritic particles formed.

- Complex Fluids: Study of nonlinear phenomena in nematic and smectic liquid crystals in different applied fields (electric, magnetic, temperature, concentration and velocity gradient). Synthesis of bent core and/or deuterated liquid crystals and polymers. Flexoelectricity in bent core and rod like nematics. Interaction of liquid crystals with polymeric surfaces. Dynamics of granular media.
- Electron crystals: Study of the ground state and collective excitations in strongly correlated metals, especially in low-dimensional systems, by transport and NMR techniques.
- Metal physics: Wide-line NMR spectroscopy investigation of (a) the spe-

cific hydration properties of intrinsically disordered proteins as well as the hydration properties of proteins and their transition to the amyloid state and (b) the hydration numbers of ions, dynamics of hydration water, ion pairing and eutectic phase transition of alkali halides. Research in the field of spin electronics on electrodeposited nanostructures: study of giant magnetoresistance (GMR) in nanoscale magnetic/non magnetic multilayers. Research on soft magnetic nanocomposites prepared by rapid quenching and ball milling for understanding magnetic coupling phenomena and the application of such materials in power electronic devices.

Neutron physics

- Neutron spectroscopy: Materials structures as short and medium range ordering, nanoscale objects and composites as well as atomic/molecular interactions in metals, alloys, composites and soft or liquid materials (solvents, suspensions gels, ferrofluids, micelles etc). Applying diffraction and inelastic scattering of neutrons. Strain distribution, texture and surface properties in model and real materials and objects with industrial relevance, medium and short range structure of ceramics and semiconductors. Energy production, storage and saving problems (materials for artificial photosynthesis, hydrogen storage etc.). Non-destructive structural featuring of objects of cultural heritage. Study of atomic

resolution neutron holography and neutron optical phenomena. The development of novel neutron physical devices and technologies, installation of new experimental stations, preparatory studies for new generation neutron sources.

- Neutron diffraction: Atomic and magnetic structure study of various polycrystalline materials using Rietveld analysis for data treatment. Residual stress investigations in bulk alloys under extreme conditions (temperature, pressure). Development and extended application of inverse methods, mainly of the Reverse Monte Carlo method, for modelling structural disorder in chalcogenide, borosilicate, metallic glasses, and molecular liquid systems. Basic and applied research in the field of neutron radiography. Instrumental developments for neutron diffraction and neutron radiography.

Optics

- Laser physics: Development of deep UV gas lasers using cathode sputtering in segmented hollow cathode discharges. Modelling of basic processes of gas discharges and description of strongly-interacting many-particle systems by means of numerical simulation. Development of multispectral imaging reflectometer. Investigations of the electrolyte cathode atmospheric glow discharge; plasma light emission mechanisms and plasma-electrolyte interface processes.
- Interactions of intense laser fields with matter: Experimental and the-

oretical investigations of strong-field laser-matter interaction processes are carried out, where the laser field exciting the atoms is comparable to atomic fields. These quantised photoelectron and harmonic light emission processes serve as a basis for new research fields, such as attophysics and nanophysics. These phenomena become especially interesting generating them with ultra short laser pulses with femtosecond duration. A further enhancement of these processes can be achieved if they are mediated by so-called surface plasmons, has been discovered in our laboratory.

- Laser applications: Development and utilization of optical measuring devices for the determination of size distribution, concentration, refractive index, absorption and electrical charge of particles of submicron and micron size. Application of these instruments in environment monitoring, biology, medicine and health care. Development of special measuring interferometers for surface testing. Elaboration of photon correlation dynamic light scattering systems and Laser Doppler Velocimetry. Development of experimental equipment for the generation of entangled photon states and study of their statistical properties. Creation of quantum source with pre-programmed number of photons. Determination of quantum efficiency of photodetectors, without standards.
- Research and development on carbon-based materials like amor-

- phous carbon thin films, nanocrystalline diamond and composite materials. By combining different deposition methods and a wide variety of characterization techniques, correlations were found between the film properties and structure as well as the processing methods. Amorphous carbon coatings were developed for various applications.
- The application of a femtosecond pump-probe measuring system for time resolved spectroscopy of semiconductor nanostructures as well as biological and chemical samples. Linear and nonlinear optical studies of photonic crystal structures and nanostructures. Submicron material processing of diamond like carbon films with femtosecond pulses.
 - Optical thin films: Theoretical and experimental investigations on the performance of special dichroic and dielectric chirped mirrors such as bandwidth, smoothness of dispersion function and stability. Investigation of the optical coating materials and their deposition technology used in femtosecond laser mirrors. Development of optical coatings for diode pumped solid state lasers. Development of low loss laser mirrors for UV lasers and wide range polarization beam splitters.
 - Crystal physics: Growth of pure, doped and nano-periodic structured nonlinear optical (NLO) crystals by melt and high temperature solution techniques. Characterisation of the crystals and their real structure by chemical analytical, microscopic and etching methods
- as well as various spectroscopies including optical absorption and emission, Raman, and magnetic resonance and their combinations and space or time-resolved variants. Study of physical properties important in the NLO, scintillator and dosimeter applications as a function of material parameters (stoichiometry, dopants, nanostructure) using also post-growth treatments as ion implantation, irradiation with ionising radiations, electrical poling, and thermal annealing in various atmospheres. Investigation of traditional and resonant NLO processes, photorefractive, photochromic and dielectric phenomena.
- Quantum optics and quantum information: Preparation and detection of nonclassical light. Quantum information theory. Quantum communication. Quantum optical networks. Cavity quantum electrodynamics. Laser cooling and trapping of atoms and ions. Quantum gases. Coherent control of quantum systems. Resonant non-linear optics in phase coherent media. Quantum dynamics of small molecules.

Educational activity

Our Institute puts great emphases on collaboration with different universities in their graduate and post-graduate programs. More than half of our scientists participate in the educational activities of the following universities on regular basis: Budapest University of Technology and Economics, Eötvös University of Sci-

ences, University of Pécs, University of Szeged and the University of Miskolc. In 2007, 53 researchers took part in approximately 56 graduate and post-graduate courses, doctoral schools at: (using Hungarian abbreviations) ELTE, BME, PTE, SZTE and ME. They conducted 18 laboratory practices and seminars, (8 at ELTE, 7 at BME and 2 at PTE). Three students carried out their diploma works at our Institute, and currently 24 PhD students are supervised by scientists from the Institute. As a result, during 2007 eight Ph.D. dissertations and two D.Sc. for HAS were written at our Institute. Year by year the departments of the Institute host international summer schools for foreign participants in the field of neutron spectroscopy and the study of complex fluids.

Fields of cooperation

Besides cooperation with major Hungarian universities the Institute cooperates with foreign universities, academic research institutes and with companies in the field of applied research both within and outside Hungary. Joint research activity is carried out mostly with European, American institutions. Within the framework of intergovernmental agreements our Institute has built relationship with 12 research groups in 8 countries. In the framework of HAS bilateral agreements we are working with 29 research groups in 13 countries.

In 2007, from the 231 publications of our Institute, 200 were published in SCI registered periodicals. About two

thirds of our publications had at least one foreign co-author. Researchers of the Institute held 126 lectures and presented 87 posters in international conferences and events. Foreign visits, scholarships or employment in other countries and inviting researchers from other countries are serving well our widespread international cooperation. About 10% of our young scientists spent longer periods in foreign host institutions, altogether more than 92 men months.

Another important part of the cooperation stems from participation in the European Union Framework Programs (FP) and projects of other international organisations, like European Space Agency – ESA, COST and NATO. Our Institute took part in 8 projects of FP6 and currently is in the negotiation phase of 4 projects of FP7, among them two major projects: Preparatory activities for the implementation of the European X-ray Free Electron Laser Facility and the Extreme Light Infrastructure – Preparatory Phase. Both will be large-scale European facilities with the mission of fostering further cooperation among partner organisations and technology transfer to companies of various sizes.

The leading scientists of the Institute have memberships in more than a dozen international scientific organizations.

In the field of applied research the Institute has many fruitful contacts with several major Hungarian universities, high tech SME-s and spin-off firms.

ALFRED RÉNYI INSTITUTE OF MATHEMATICS

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About the Institute and its activities

The principal purpose of the Institute is to perform high level research in mathematics and its applications, concentrating on theoretical studies inspired partly by the internal development of mathematics and partly by applications of mathematics in other sciences. The scientific output of the Institute is well certified by the research papers published by its research fellows in leading international mathematical journals. The Institute also participates in applied research by cooperating with industrial enterprises.

In addition to research, the Institute provides active support for mathematics education from the undergraduate level to graduate and beyond, as well as it aims to contribute to progress of mathematical culture in general. In particular, its research fellows teach at various universities of the country (including Eötvös University, Budapest, Budapest University of Technology and Economics, University of Debrecen, etc.) participate in postgraduate education and provide for professional development



of mathematicians working at other institutions. Starting the academic year 2001/2002 a PhD program has launched by the Institute jointly with the Central European University.

To promote high level research and education, the Institute often hosts programs of shorter duration such as workshops and conferences, summer

schools, as well as regularly scheduled seminars. It also organizes postgraduate courses, publishes textbooks and offers visiting research positions.

Research topics pursued include

- Algebra
- Algebraic geometry
- Algebraic logic
- Approximation theory
- Bioinformatics
- Cryptography

- Discrete mathematics
- Functional analysis
- Geometry
- Information theory
- Mathematical statistics
- Number theory
- Probability theory
- Set theory
- Statistical physics
- Topology

More information about the Institute and its activities can be found at <http://www.renyi.hu>

COMPUTER AND AUTOMATION RESEARCH INSTITUTE

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Web page: <http://www.sztaki.hu>

MTA SZTAKI is a base of informatics, in the broad sense, a national research center of information technology, computer science and their related fields. Primarily, the technical-scientific and mathematical issues of informatics are investigated, with consideration and attention to fields related to the above fundamental questions, potentially endowing them with incentive, disciplinary bases. Above pursuing comprehensive basic- and applied research, the transmission of the acquired particular experience to R&D, system design and system integration, furthermore, to consulting and software development is a major obligation.

The ability proven and evidenced several times, according to which, the Institute is almost instantly capable of responding – frequently in a proactive manner – to the fresh and subsequent challenges deriving nearly day by day from the revolution of information science, is based on and backed by basic research activity in mathematical and engineering fields pursued at the Institute. Just to emphasize some fields: sensory computers and telepresence, man-machine connections of



new type, bio-computing, molecular computer science, the modelling, control, supervision and diagnostics of complex systems, distributed computing architectures, Grid systems, high speed networks and their security issues, mobile communication, new WWW technologies, reverse engineering, informatics of global firms, e-commerce, agent-based structures,

quality ensurance, financial management and risk analysis, environmental modelling, e- government, but the enumeration could still be continued. In certain fields the accelerated world often requires research attitude, organisation different from those accustomed to in the past, and therefore, another kind of evaluation of the results.

Information-science based development exploitable in Hungary and also abroad, furthermore, the high-level advisory activity are built on *basic research results meeting the international standards*, with the aim of functioning as a center of excellence, which provides challenging themes and promising conditions for talented Ph.D. students in their studies and start.

Research aims and themes

Mathematics and computer science

- Combinatorial computer science, graph theory
- Data-mining
- Theoretical computer science, algebraic research
- Computational methods of statistics
- Bio-computing
- Stochastic systems, financial mathematics
- Machine learning
- Operations research

Informatics

- Cellular wave computing and sensory computing systems
- Distributed events analysis

- Cognitive process of human vision
- Virtual human interface
- Grid systems
- Distributed systems
- Agent-based software technologies
- E-governance
- E-learning
- Network security and monitoring

Automated control systems

- Systems and control science
- Advanced Vehicles and Vehicle Control Knowledge Center
- Process systems and control
- Geometric modelling and computer vision
- Engineering and management intelligence
- Computer integrated manufacturing systems

Foreign contacts

The Institute's participation in the V. and VI. Framework Programmes of the EU was in accordance with what is expected from those granted with the distinguished EU title of *Centre of Excellence*. Namely, more than 30 projects in the V. and more than 30 projects in the VI. Framework were run, taking part in a network of excellence, furthermore, supervising projects. In the VII. Framework Programme we are involved number of subsidized projects.

As the first country in the Central-European region, the Institute has been member of the *European Research Consortium for Informatics and Mathematics* (ERCIM), the organisation brought about for supporting scientific co-op-

eration in Europe, in the field of information-technology. The *European office of the global WWW consortium* was taken over by the ERCIM and the SZTAKI makes the home for the *Hungarian office of the WWW consortium*. In accordance with the efforts aiming at bringing the European research area into existence, we keep on establishing and running international virtual institutes and laboratories. After the Production and Business Management Virtual Institute, established together with Fraunhofer Institute for Manufacturing Engineering and Automation (IPA), Stuttgart, Germany in 2002 with the seat in Budapest, in course of the past years several international virtual laboratories were established together with e.g., the CIM Research Center (Lugano), Center of Industrial Technology Transfer (Seibersdorf), the University of Technology in Sophia, INSA University of Rennes, and the University of Technology in Vienna. MTA SZTAKI is one of the key participants of the network of excellence VRL-KCiP (*Virtual Research Laboratory on Knowledge Community in Production*) as well, which is, perhaps, the most significant network in the field of production, belonging to the VI. Framework project by the EU. As a new element, the Institute is a charter member of the *European Manufacturing and Innovation Research Association (EMIRAcle)*, which may act as an independent body in the field of R&D in Europe. It was the SZTAKI who initiated establishing the *Central European Grid Consortium*, with the aim of co-ordinating the Grid research and infrastructure de-

velopment of the countries in Central-Europe.

Projects in the frame of R&D contracts concluded and to be concluded with RICOH and Hitachi are envisaged with great expectation.

A great number of colleagues successfully co-operate in the management and working group of the most significant scientific organizations (CIRP, IEEE, IFAC, IFIP, etc.). Several of our colleagues are members of editorial boards of major international periodicals. Many of the researchers of the Institute have been invited for co-operation in deciding upon the main directions of the VII. Framework, furthermore, for participation in elaborating themes of co-operation between the EU and the USA (National Science Foundation). Study tours in the frame of bilateral agreements by the Hungarian Academy of Sciences, and in Technology Transfer co-operations are very useful, especially in the basic research phase, researchers grasp the opportunity.

Educational activities

Gradual and post-gradual university education is regarded also in the future as an important task associated with research, and is pursued as an essential condition for future-shaping. Regular teaching activity is continued at the following national universities (using their Hungarian abbreviations): BME, ELTE, CORVINUS, VE PTE, ME, PPKE. There exist various forms of co-operation, full-time or whole employment of researchers at a university, common chairs, acting as the

head of a department, co-operation in establishing faculties in informatics. In the field of electronics-information technology and biological sciences (especially neuro-biology), the *Hungarian Info-Bionic Research Centre* is run by 6 research centers of the Hungarian Academy of Sciences, together with 6 university research laboratories. Also the *Hungarian GRID Competence Centre* (MGKK) was brought about upon the initiative of the MTA SZTAKI, with the participation of the BME and National Information Infrastructure Development (NIIF) Program followed by the joining of the RMKI (KFKI Research Institute for Particle and Nuclear Physics of the Hungarian Academy of Sciences). As a new proof of a long lasting co-operation, in the frame of *Regional*

University Knowledge Centres, the MTA SZTAKI takes part in the project *Advanced Vehicles and Vehicle Control Knowledge Center* superintended by the BME. The Institute's role also in the NKTH (National Office for Research and Technology) project, headed by the BME, titled *R&D and Innovation Centre on Mobile Communication* is to be emphasized.

Generally, about 30 Ph.D. students do research at the Institute, under the scientific leadership of major researchers. Our colleagues contribute to native Doctoral Schools as associated charter members in 25 cases, and as permanent collaborators in 5 cases.

Steps are taken, besides the traditional educational methods, in the interest of using multimedia-tools and towards remote teaching.



**INSTITUTES FOR SOCIAL
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ARCHAEOLOGICAL INSTITUTE

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The scope of the Institute

The activity of the Institute mainly targets the archaeology of the Carpathian Basin and the historically related areas, and the historical Hungary. The Institute aspires to span with its research activity the entire period from the Neolithic to the Late Middle Ages. In an international aspect this means, first of all, research in Central Europe (in all periods), South-eastern Europe (in the Neolithic and the Middle Ages) and Eastern Europe (in the Migration Period and the Conquest period). The study of the Roman Period is logically extended to the entire territory of the Roman Empire, while some research programs reach as far Russia or North Africa. Our colleagues also take part in research into the history of prehistoric religions and the Roman period and medieval numismatics. The Institute is editing a yearbook: *Antaeus*, a monograph series: *Varia Archaeologica Hungarica*, and other books and monographs, in collaboration with the *Pro Archaeologia Hungariae* and the *Archaeolingua* Foundations. The researchers of the Institute frequently publish papers in reputed scientific periodicals of other countries as several monographs are published

abroad. The financial background of the research programs is provided by numerous OTKA and three German, DFG (Deutsche Forschungsgemeinschaft) grants.

Scientific objectives and topics of the Institute

Archaeological Topography of Hungary

The Institute accepted this program to be one of its central projects at the time of its foundation. The repertory of the national archaeological heritage is of crucial importance, scientifically justified and necessary for the protection of sites and landscapes. Ten volumes have already been edited, and further three are being prepared on the sites of Békés, Fejér and – according a renewed contract with the County Museum – of Pest counties. Due to the constant work done in aerial photography, a monography on the earthen fortifications in County Tolna appeared recently.

Archaeological research into prehistoric societies and settlements

The researchers of prehistory take part in international programs mostly with

the intensive multiaspectual study of smaller territories. The monography on the early neolithic settlement at Ecsegfalva published in collaboration with the British Academy in 2007, will raise a strong international interest as not many publications of this period go into details completed with a broad scope of environmental analyses. Similarly, the monography about the huge neolithic site at Balatonszárszó, expected to be a milestone in Central European Neolithic research, has made progress. The neolithic investigations at Fajsz and Regöly, key sites in a region of crucial importance in the formation of food productive societies, are financed by the OTKA and the German DFG programs. A monograph proceeding a fifty-year-old excavation has appeared at last in Oxford: it has been one of the Institute's debts in publications. In the course of a cooperation with the Russian Academy, a chalcolithic burial mound in Eastern Hungary will be investigated. The late Copper Age cemetery of Budakalász is being analysed in cooperation with the Archaeological Institute of the ELTE and the Hungarian National Museum, monographs are being compiled on cultural processes in the early and middle Bronze Age. The extended excavations in the frame of the M6 motorway project result in Neolithic sites of major importance, but one of these, a settlement and cemetery at Alsónyék rose far out of the scopes of rescue work. With its ca. 50 houses and 1500 burials with extremely rich grave goods the meticulous proceeding of the findings together with a thorough scientific analysis has just started.

The Roman Empire and its borderline territories

Besides the geographically varied territories, a similarly diverse research field characterises the work of the scientists who are engaged in this period. The investigations at Almásfüzitő provide new information about the interrelation between the local Celtic population and the Roman conquerors, while the settlement of Zalalövő open a view into the world of Roman villas and roadside settlements. Roman period studies are pursued outside Hungary as well: the researches of the Institute have been conducting excavations at San Potito in Italy for one and a half decade, and the internationally esteemed Nubiologist of the Institute has been studying the African manifestations of the late Roman – early Christian culture.

Avars, Hungarians and their neighbours

The colleagues researching this topic work in a close partnership: several research fellows study the settlement history of the Carpathian Basin and the neighbouring territories in the 6th – 10th centuries, analyse the social processes of the area and their interrelations. The analysis of the Avar sites of Budakalász and Kompolt 15, and the excavation of the 9th century and later remains in the princely centre of Zalavár Mosaburg was continued. Two programs in cooperation with German colleagues (DFG) target the investigation of the Carpathian History of Germans as well as that of post-Roman inhabitants. The se-

ries "Monumenta Germanorum" got enriched with two volumes. Work continued on the find cadastre of the Conquest period in four counties; completed with a new full repertory on a wellknown grave assemblage. Investigations were made both concerning Bulgarian early medieval find complexes as well as the Russian and South East European cultural connections of the Conquest period.

Medieval studies

Colleagues studying the medieval times have achieved significant results in the mapping of the earthen forts of the Árpáadian Era, and in the study of the medieval settlement system, the bronze metallurgy in Transylvania and the find material from the time of the Turkish occupation of Hungary. The profound investigations at the medieval Székely regions in Transylvania continued: the proceedings of the findings from a manorhouse are done, another manorhouse was excavated, work has begun on identifying the physical anthropological remains involved in the research as well as investigations are being done in the Abbey of Csíksomlyó. A large-scale NKFP project won in 2001 has been fulfilled: the first monographies of formerly unearthed castles and royal centres are near to be published. The Transdanubian connections with Slovenian and neighbouring 16th C. pottery assemblages could be cleared in the course of a study trip to Ljubljana. Important research has started into the environmental, climatic and geological-hydrological background and

their impact on late medieval settling. In the next future this research will be made possible by a recently gained major OTKA grant.

Natural scientific studies

Natural scientific research, which stagnated from the beginning of the 90's, have strengthened by the turn of the millennium. An anthropologist, a zoologist, a botanists and a geologist help the archaeologists with conclusions concerning the environment, the climatic and anthropogenetic characteristics of the various periods. A physical anthropologist works on Bronze age and Celtic human bones but also, the analysis of the extended cemetery of Alsónyék has begun (about the significance of the site see the paragraph on prehistoric reseach). In our DNA laboratory, the archaeogenetic analysis of the Alsónyék bones has also been commenced, as well as the DNA analysis of an important 10th C. cemetery at Lake Balaton. The first internationally acknowledged chapter on our genetic investigations was published. Lectures on the environmental archaeology were given in two Academic sessions. An important step to publish our common results is the appearance of the 2nd volume on Environmental Archaeology, about Transdanubia.

Restoration

No research is possible without restorers' work. The metal and ceramic restorers undertake commissions from outside as well beside working

on the finds unearthed by the Institute. Thus the Institute has become one of the centres for the restoration of archaeological finds from excavations preceding the construction of motorways in Hungary. The specialists also restore of some exquisite find units on special requests.

Scientific objectives

It follows from the above what specific scientific programs are foreseen in the near future: most projects are meant for more than one year so they are to be continued and/or fulfilled. Such is the neolithic transition and early centuries of settled life in the Carpathian Basin, such is the research into the late Migration period and that of the Hungarian Conquest with all the broad cultural contacts and impacts unexplored as yet, such is our achaeogenetic program and the reasearch on environmental archaeology. All of these are of an international importance, as it is reflected both in

publications and invitations to West European and American universities. Yet, the main target remains the close cooperation with Central European archaeology: the impact of Hungarian Neolithic cultures to the Northwest, the surviving romanized inhabitants' relations to early migrant, mostly Germanic groups, the repertories on Langobardic, Gepidic, Avarian, Carolingian and earliest Hungarian sites and find assemblages. According to our medieval research, key issues concern with fortifications in the Pest region, findings of the Turkish occupation period as well as the research of medieval Hungarian culture in Transylvania. An important volume on latest medieval archaeology will be the Visegrád conference volume, soon to be published.

Senior researchers also actively participate in lecturing and tutoring at the Doctoral School of universities like ELTE, SZTE. One colleague spends a semester at the Harvard University as a visiting scholar.

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Range of Activities

The Institute is a national research centre, its principal task being research into the history, monuments and documents of Hungarian art and art in Hungary from the earliest times to the present day, and also the publication of research materials in this field. In time and space the range of

the Institute's activities partly overlap the scope of the collections of Hungarian museums and the objects under the protection of Hungarian building conservation, partly exceed it by focusing on the whole of historical Hungary and the activities of Hungarian artists. In the process of fulfilling its tasks concerning the exploration of the national heritage, the

Institute co-operates closely with the public collections. It participates in international research projects, and maintains and initiates professional relations with other countries' research institutes. As a member of the Research Institutes of the History of Art (RIHA), it takes part in research into international, European and central-European art with regard to Hungarian art. As an associated member of the Research Centre of Social Sciences of the Hungarian Academy of Sciences, it carries on interdisciplinary research. Actively participates in the work of the International Committee of Art History (CIHA) and organized one of its last conference in 2007 in Budapest.

Research into the art-historiography, and also methodological and theoretical investigations constitute an integral part of the Institute's activities. With its collections (archives, photographic collection, lexicon of Hungarian artists, collection of archival abstracts, collection of seal replicas, library), the Institute promotes Hungarian and international art historical research. In accordance with the statute of the Hungarian Academy of Sciences, it is responsible for the museological care and conservation of the Art Collection of the Hungarian Academy of Sciences and organises its exhibitions. The Institute and its members are often invited to act as experts and provide special advice. s on different scientific and cultural fields. They are active in university education and post-graduate training, and they support young scholars in their early careers. The Institute orga-

nises professional discussions within the framework of its workshop called Collegium Artium as well as other Hungarian and international professional symposia and exhibitions.

The Institute regularly brings out publications, produces syntheses and other scholarly works in the field of art history. It publishes its own periodical called *Ars Hungarica*, and is responsible for the editing of the non-Hungarian-language journal *Acta Historiae Artium* and the art historical series *Művészettörténeti Füzetek / Cahiers d'histoire de l'art*.

An important international forum for the publication of recent Hungarian research is the entries of new, professional encyclopaedias (*Saur Allgemeines Künstlerlexikon*, *Enciclopedia dell'Arte medievale*, etc.) Besides compiling the national bibliography of art history, the Institute processes Hungarian publications for the international annotated bibliography of the profession (BHA).

Objectives and Research Topics

Further research into Hungarian art history along with the elaboration of new topics, main lines of research and new points of view, as well as expanding our present knowledge and the synthesis of existing research constitute the Institute's main objective. Besides synthesising works (the most recent ones being the volumes on Hungarian art from the beginnings to 1800 and from 1800 until today respectively) eminent subjects are: the art and architecture of the Árpád age, research into the insignia, icono-

graphical research (Saint Ladislás, Saint Martin), codicological research and the art of the illuminated book, within the framework of an international cooperation; the art of Sigismund's age and the Jagiellonian age, research into artistic representation. The more recent major exhibitions Renaissance art have been realised with the scholarly contribution of the Institute.

18th and 19th-century topics include multiplied graphics and book illustrations (basic research and the history of their reception), garden design (Historical gardens in Hungary), the investigation of the dwelling interiors of the bourgeoisie and upper classes, the architecture of Historicism (Art and bourgeois civilisation), Hungarian self-portraits at the Uffizi Gallery in Florence.

A summary of research into 19th and 20th-century art in a synthesising volume (Hungarian art in the 19th

and 20th centuries). Individual research topics with international impact: László Mednyánszky, the Ender brothers, bioromanticism, Hungarian-French relations in art, the transformation of the institutional system, basic research into the activities of inter-war art organisations, comparative study of central-European Neo-classical and post-avant-garde phenomena, art-historiographical investigation from the 19th century on, Pulszky's legacy, Lajos Fülep, Ernő Kállai, Lajos Németh, basic research into Hungarian art criticism and Hungarian art historians' activities, questions of art theory and methodology, new media in the 20th century, topographic survey of the artworks in the province of the Franciscan order, research related to the reconstruction of the Esterházy palace at Fertőd, investigations concerning the whole cultural heritage and the phenomena of contemporary art.

INSTITUTE OF ECONOMICS

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The Institute of Economics of Hungarian Academy of Sciences (IEHAS) is committed to international standards of fundamental and applied research in economics. It has focused increasingly on the analysis of the modern market economy and the transformation of the Hungarian economy. Research findings are

made available for and are regularly used by policy making bodies and universities.

The IEHAS puts emphasis on promoting academic cooperation with Hungarian and European research centres. It also considers as a priority to develop stronger links with university departments and to take part in

the education of the new generation of researchers.

The IEHAS research programme includes

Macroeconomics and Growth:

The link between macroeconomics and economic development, macroeconomic performance and its micro foundations in developed and emerging market economies; growth and disinflation policies, tools and efficacy of monetary and fiscal policy; macro- and microeconomic aspects of sustainable economic development

Empirical Industrial Organisation:

Organization and patterns of markets and industries, market structure, firm strategies and firm performance, market regulation, regulation and sectoral policies, sectoral and firm-level empirical studies, changes in corporate governance, firm size (and mergers), boundaries of the firms (innovation, internal production, outsourcing)

Public Economics and Public Policies:

The interaction of public services and finance, public policies and markets, the role of central and local governments in market economies, intergovernmental fiscal relations, the relationship of social partners

Labour Market:

Evolutions in the Hungarian and Central-East European labour markets, informal economy, pension systems and regional inequalities, evaluation of Hungarian employment policies, employment policies and their economic

and social impact, income and consumption of households

Economics of Education: New and innovative approaches in the field of the theory and economy of education, development of large sample databases, education policy-making, ways and means of the modernization of the Hungarian education system

Globalisation, EU-integration and Convergence:

Impact of globalization, regional integration and economic growth in small open economies alternative paths of development and competitiveness in transition economies, FDI in developing and transition economies; national and international innovation systems and their impact on economic growth; EU-integration and economic transition

Agricultural Economics and Rural Development:

Agricultural policy modelling, international agricultural trade, EU enlargement issues in agriculture, price analysis (price transmission on the food market), vertical co-ordination in agriculture, transformation of agriculture in CEE countries, rural development policy

Dissemination of research output

Regular Seminars: Economic Theory and Policy Seminar Series;

Regular Publications: Discussion Papers New Series; Budapest Working Papers on Labour Market (joint

publication with the Human Resources Department of the Corvinus University Budapest); Labour Research Volumes (one volume per year); Labour Market Yearbook (one volume per year); IEHAS Books (launched in 2005).

Publications can be downloaded from <http://econ.core.hu/>

Education activities of IEHAS and its researchers encompass all major fields of research and are performed at graduate and undergraduate levels in cooperation with universities (ELTE University Budapest, Pannon University Veszprém, CEU Budapest, Corvinus University Budapest among others).



INSTITUTE OF ETHNOLOGY

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Scope of Activities

- Carrying out and coordinating research on popular culture of European (especially Hungarian) societies, on Asian and African cultures, on contemporary problems of the rural population, religious and national minorities;
- Editing and publishing results of Hungarian ethnological research in comprehensive works: handbooks, encyclopaedias, and reference materials (Magyar Néprajzi Lexikon [Hungarian Ethnographical Encyclopaedia], Magyar Néprajzi Atlasz [Atlas of Hungarian Folk Culture], Magyar

- Néprajz [Handbook of Hungarian Folk Culture], Encyclopaedia of Hungarian Folk Culture, digital and extended version of the Atlas of Hungarian Folk Culture).
- Editing and publishing results of thematic research and various book series. (Documentatio Ethnographica, Néprajzi Tanulmányok [Studies in Ethnology], Folklor a magyar művelődéstörténetben [Folklore in Hungarian Cultural History], Occasional Papers in Anthropology, Magyar Etnológia [Hungarian Ethnology]. Editing and publishing of the Institute's yearbook Ethno-lore.
 - Publication of source materials and findings of ethnographic fieldwork: Folklor Archivum (Folklore Archive), Az Mester Emberek Míveinek árazása (Pricelists of Craftsmen's Products).
 - Digitalization of materials recorded on traditional media (film, photo, sound tapes, etc.). Expansion, organization, and Web-accessible digitalization of research records and manuscript collections (Atlas of Hungarian Folk Culture, various narrative genres and traditions, Archive of Shamanism, etc.).
 - Organization of national and international conferences, participation in international projects
 - Organization of Etnológiai Műhely (Ethnological Workshop), which offers a forum for information exchange among researchers of the Institute, and for presentations of our guest-researchers from various countries.

Research aims and topics

- Social anthropological research of the present, the complex examination of local societies. Life and adaptation strategies of individuals and local communities, new forms of community organization.
- Investigation of minority, ethnic and regional identity in various communities. Regionality, community building, diaspora maintenance among Hungarians living beyond the borders.
- Forms of social contact, division of labour and cooperation among generations. The change in value systems, the development of local social networks, continuity and change in community patterns and norms; the man-made environment, the furnishing and utilization of living space. The history of Hungarian folk washing habits in the 20th century, change(s) in personal hygiene and ideals of beauty in the wake of current political, economic and social changes.
- Historical-ethnographic research and processes in the history of the evolution of folk/popular culture: uncovering sources and their publication, socio-historical interpretation. Examination of changes in the cultural landscape on the historical plane, in connection with the effect of various social groups on the landscape. The history and ethnography of Hungarian viticulture and wine culture, sources on vineyard communities. Processes in the evolution of Hungarian peasant dress in light of data from the his-

tory of dress in the 17–20 centuries. Research on memories of the industrial landscape, the people of factories, mines and workshops in the 19th and 20th centuries.

- Folklore texts (tales, legends, proverbs), religious/spiritual beliefs, manifestations of folk religiosity and collecting of customs. Uncovering sources, the expansion and analysis of folklore text corpora, issues of traditionalization, examination of the phenomena of folklorization and folklorism. Tracing the path of textual variation in written literature and folklore, the connection between the apocryphal gospels and folklore. The influence of almanac and pulp literature on the formation of textual tradition of the Hungarian Conquest. The institutionalization of 19th-century Hungarian folklore studies.
- The editing of the series *The Encyclopaedia of Uralic Mythologies* with international collaboration.
- Non-European ethnological research in several fields and research areas/subjects. Prehistoric research connected with the origins of the Hungarian people, contacts and interactions among Hungarians, Finno-Ugrian peoples and Asian peoples. The investigation of shamanism. Modernization, globalization, and examinations of cultural change in Siberia, Inner Asia and Vietnam. Traditions and change in post-Soviet societies, the research on Evenki, Buryat, Kazakh, Kirghiz communities. The status and role of the Church in present-day Mongolia. The ethnography of

Oceania and Southeast Asia, with particular emphasis on the cultures and religion of the mountain tribes of former French Indochina. The economic and anthropological examination of Kikuyu coffee farming.

- History of Non-European ethnological research in Hungary.
- Research into the possibilities of the ethnographic, cultural and anthropological uses of interactive technologies – html, multimedia.

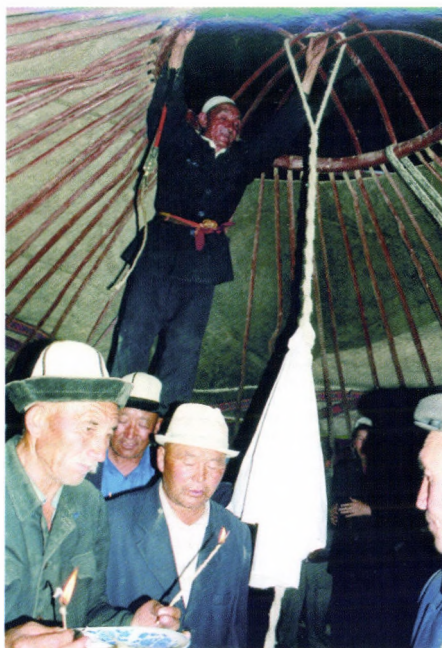
Education

Significant contribution to Hungarian higher education through offering undergraduate and graduate courses in ethnology and cultural anthropology. 14 researchers are teaching at 10 different universities and high schools, our former director is head of the European Ethnology PhD Program at the ELTE University, the Head of the Department of Historical Ethnography has been the so called “Visiting Hungarian Chair Professor György Ránki” in Bloomington (Central Eurasian Studies Department, Indiana University, USA). The Head of the Non-European Studies Department lectures in the Social Anthropology Program of the Babes-Bolyai University, Cluj.

International Cooperation

The Institute receives and sends 12-15 researchers per annum in the frame of International Exchange Programs (China, Poland, Romania, Ukraine, Russia, Bulgaria. Mongolia etc.) As

participant of the exchange programs a researcher has been doing fieldwork in Vietnam financed by the Max Planck Institute for Social Anthropology (Halle). Another researcher takes part in the House of Culture Project (2006-2008) also supported by the Max Planck Institute for Social Anthropology. Our Institute collaborates in the research program Culture contact between cattle breeders and hunter gatherers of Baikal Region with the Centre for Independent Social Research in St. Petersburg. The reception of early European anthropology in Hungary is another topic, with which a researcher takes part in The Humboldt Digital Library: A Global Network of Knowledge Project (Germany – USA). The Head of the Department of Social Anthropology leads a research program “Self-image, Self-representation and “Heritage Institutions” – Research on the Institutional Network of Hungarian Ethnic Communities in the US” in Indiana, Pennsylvania, Ohio, Michigan and Illinois. The institute cooperates with the



EPHE-CNRS Groupe Sociétés, Religions, Laïcités (Paris) in the research program “Modernization in socialist and postsocialist societies in Asia and local responses” in 2008-2009.

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Areas of activity

The Minority Studies Institute of the Hungarian Academy Sciences was originally set up in 1998 as the Minority Studies Programme of the Hungarian Academy of Sciences and became an independent institute of the Hungarian Academy of Sciences in January 2001. Our institute offers

a framework for two autonomous research groups: Centre of Jewish Studies and Migration Research Centre.

The Institute focuses its interdisciplinary research activities on four areas: the minorities living in Hungary, the Hungarian minorities living in countries neighbouring with Hungary and the Hungarian diaspora

in Europe and overseas, the Roma population in the region, the immigrant and migrant population in the region.

The Library of the Humanities Research Centre provides a framework for our institute besides other research institutes.

Our institute works in close co-operation with the Janos Arany Public Fund which aims at supporting Hungarian scholars working in the neighbouring countries. Our institute runs the office of the Fund.

With the financial help of the Janos Arany Public Fund the institute set up research offices in the neighbouring countries in co-operation with local Hungarian research institutions with an aim to study and inves-

tigate the issue of language rights, bilingualism and use of the mother tongue in the system of education.

The institute has similar function regarding the Domus Hungarica grant system which also aims at supporting Hungarian students and scholars living in the neighbouring countries. In addition to that our institute runs the Co-operation Office of the Hungarian and Slovak Academy of Sciences.

Research programs

- The situation of the Roma population in Hungary at the beginning of the 21st century
- Prevention and management of local Hungarian–Roma conflicts
- Hungarian–Slovak–Roma co-existence models in Górnok region



Mongolian Shaman

- Re-learning of the mother tongue in the minority education system in Hungary
- Hungarian language in the Carpathian basin
- Assimilation processes in Transylvania and Slovakia
- Minority Autonomy Conceptions of the Hungarian Communities in the neighbouring countries in the 1990s
- Language border in the Carpathian basin at the turn of millennium
- Chronology of the minorities living in Hungary
- Transformation of the self-identity in German, Chroatian and Bulgarian families living in Hungary
- Motivation background of the elites migrating from Transylvania, Subcarpathia and Voivodina to Hungary
- Bilingual education in the Mura region
- Language rights in the neighbouring countries.

INSTITUTE OF HISTORY

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The Scope of the Activities of the Institute

The Institute of History of the Hungarian Academy of Sciences is a research institute within the framework and under the supervision of the Hungarian Academy of Sciences. It is an independent legal entity the budget of which conforms to the statutes of the Academy. It is the chief workshop of Hungarian historical research, the main Hungarian partner of international historical scholarship. The Institute was founded in 1949 and has been functioning ever since. Its predecessor was the historical section of the Teleki Pál Institute (founded in 1941). Its main task is basic research on Hungarian history in a regional, European and global context. The Institute focuses on particularly work and time intensive projects that can most efficiently be realized within the framework of a research institute.

The Institute's Major Research Goals and Topics

The Institute focuses on themes in Hungarian history that develop his-



torical thinking and at the same time are relevant to international research, and embody national interest. Priority is given to the preparation and publication of reference books and source publications.

The Hungarian State in the Middle Ages

Projects in this field deal with Hungarian developments in context of the mediaeval states on the periphery of Western European Christian culture. It is a central concern of the Institute to present the medieval Hungarian state's role in world history, to reveal its regional social and economic integrative function. Among others it has produced the genealogical corpus of Hungary's leading families, as well as the collection of late medieval Hungarian place names. Work relating to Hungary's medieval lay archontology, royal itineraries, and the historical geography of the Árpád period is in progress. A lexicon of late mediaeval Hungarian history is also in preparation.

The History of Ottoman-Hungarian Cohabitation

The Institute carries on the old traditions of Hungarian Ottoman studies in its effort to reveal the various forms of Turkish-Hungarian political, interethnic and interconfessional cohabitation. Research is carried out in Istanbul on the sources of Hungary's Ottoman occupation and hence the description of the economic and institutional framework of Ottoman-Hungarian coexistence. In addition to collected studies on various aspects of Ottoman history studies they regularly publish newly discovered sources. A detailed list of Ottoman fortresses and garison troupes and a comprehensive monograph on the Ot-

toman military in Central Europe are the most recent results in this field.

Hungary in the Habsburg Monarchy

Hungary's place in the Habsburg Monarchy, its relationship to the various provinces of this empire have been in the limelight of Hungarian historical disputes for one and a half centuries. The Institute devotes substantial resources to the publication of documents relating to two major periods: the 17th century and the so-called Age of Dualism (1867–1918). Most attention is paid to the history of state institutions and social history.

Research on the History of Nationalities and Churches

One of the main features of the development of East-Central Europe is the high degree of ethnic and religious heterogeneity. Research is devoted to the history of Hungarians who were forced into a minority status after 1918. The Institute took an active part in the founding of the Institute of Ethnic and National Minorities of the Hungarian Academy of Sciences, an interdisciplinary research centre on national and ethnic identities. A number of projects in this field are implemented in cooperation with this institute. During the last decade the institute has published a number of source collections relating to the spreading of Protestantism and the role of Counter-Reformation in the Carpathian basin. Other projects deal with the social and political role of churches in 20th century Hungary.

Hungary in the Soviet Zone

Within the framework of a long term project the institute is preparing a series of handbooks on various aspects of Hungarian domestic policy and Hungary's international relations between 1945 and 1990. Through an international network the Institute intends to become the main regional centre of research into the comparative history of the Soviet zone.

The History of Modern Hungarian Society and Culture

Social history projects have been in the forefront of the institute's research work since the early 1980s with the long-term aim of producing a larger synthesis of Hungarian social history. Since 1989 the Institute has been publishing a series of monographs entitled Social and Cultural Studies (three-

four volumes per year). The volumes of this ongoing series serve as the basis of the planned synthetic work. Subjects include urban high and lower culture just as much as rural cultural traditions and key issues of modern Hungarian intellectual history. Special attention is paid to the study of the relationship between politics and historical scholarship in modern Hungary and Eastern Europe

Handbooks

As an ongoing long-term project, the Institute publishes a multi-volume Hungarian analytical historical bibliography initiated by Domokos Kosáry. Since 1991 several chronologies and other standard manuals have been published by the Institute (História Library) that are meant to assist teachers and researchers just as much as mass communication experts in



an objective approach to the study of history. The two-volume chronology of modern Hungarian church history had an especially great, positive echo among experts. Among others a comprehensive historical chronology of the period between 1945 and 1990, and first of all a new, modern four-volume Hungarian historical chronology are in the making. One of the most ambitious projects of the institute is a Hungarian Historical Atlas to be published in several volumes together with an abridged English version.

Source Publications

Ever since it was founded, the Institute regarded it as its central task to publish the annotated sources of medieval to modern Hungarian history. They include documents relating to the activities of mediaeval kings and queens, the history of the Hungarian

state, Hungary's international relations, early modern and modern social, cultural and church history, life and work of key figures of modern Hungary. Several collections of sources come out on CD-ROM, as the Institute has pioneered in exploring new techniques in this field.

The Institute as an Organizer of Scholarly Activities

In 1986 the Institute launched a series entitled "Lectures from the Workshops of Historical Scholarship". In this framework annually 5-8 presentations on larger, important topics are discussed. These debates take place in the presence of the best Hungarian experts of the respective topics and the deliberations are subsequently published. The Institute is also a central national and international "conference organizing workshop". In cooperation



with the Europa Institute Budapest and with the help of the international agreements of the Hungarian Academy of Sciences with foreign academic centres, it hosts or co-organizes 14-16 domestic and international conferences of varying sizes every year. The Institute has its own publishing department that brings out 6-7 books a year, a quarterly review and a popular monthly historical journal.

Educational activities

The majority of the researchers have teaching appointments at various Hungarian and foreign universities, they participate in all kinds of graduate and undergraduate programs. Though teaching is not part of the regular activities of the institute, it is ready to participate in international projects combining research and teaching.

Fields for cooperation

In addition to regular contacts to Hungarian institutions of historical

research (including the Central European University, the Andrassy University and the Collegium Budapest in Budapest) the institute cooperates with research institutes and universities in most European countries, with various chairs and department of Columbia University in New York, Harvard, Toronto University, University of Alberta and a number of institutions in China. The main forms of cooperation: joint research projects, exchange of scholars and publications, participation in conferences. Every year several international conferences are organised by the institute that is also in touch with numerous embassies and cultural institutes in Budapest.

Research fields for cooperation include all periods of Hungarian history in a European and global context. Various aspects of Habsburg and Ottoman history and a comparative history of the countries of the Soviet Bloc are of special interest.

INSTITUTE FOR LEGAL STUDIES

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The predecessor of the Institute for Legal Studies was founded in 1941 by an Order of the Prime Minister; since 1955 it has belonged to the Hungarian Academy of Sciences. The Institute's research activity covers a wide range of legal topics i.e. administrative law, civil law, comparative law, constitutional law, European law, international law, international public and private law, legal philosophy, criminal law, etc. The current research work of the Institute is based on a three-year research programme approved by the Hungarian Academy of Sciences.

The main concern of the Institute is to promote legal sciences in Hungary; in addition it assists in various forms the legislation, legal practice and legal education.

Research objectives and areas

The main research topics are the following

- European law and the Hungarian legal system
- Current issues of business law and private law
- Environmental law at the beginning of XXI. century
- Rule of law and the Hungarian legal order
- Human rights and international relations in the globalizing world
- General questions of the theory of the legal system
- Interdisciplinary questions



European law and the Hungarian legal system. This research stream focuses on the relations between Hungarian law and European law which is relevant to the fulfilment of Hun-

gary's obligations arising from its membership in the European Union. This research field affects different branches of law. Special attention is given to the European Constitution, to the law of competition, to the legal aspects of international cooperation in criminal matters and the struggle against organized crime.

Current issues of business law and private law. Research in this field covers in particular questions of company law, law of bankruptcy, banking law, law of civil responsibilities / torts/, law of insurance, and medical law. In private law research priority is given to studies dealing with the new Hungarian Civil Code, interrelation between private (business) law and public (constitutional) law, in general, public law of economy, administrative law, financial law and criminal law.

Environmental law. This research stream focuses on the link between environmental protection and criminal law, the administrative aspects of environmental protection, questions of international law connected with the preservation of the natural and man-made environment, the economic implications of environmental regulation and the related requirements of harmonization of laws, as well as the status and importance of environmental protection within the ambit of business law.

Rule of law and the Hungarian legal order. Research on this subject examines the following questions: theoretical and practical aspects of constitutionality and legality, study and analysis of the constitutional systems of the Member States of the European

Union. European standards and the Hungarian public administration: protection of individual rights in administrative law.

The European system of protection of fundamental and human rights. This research subprogramme is devoted to the theoretical aspects of human rights on the one hand and, on the other, it addresses problems connected with the functioning and case law of the European Court of Human Rights and to the practice of the European Court of Justice in Luxembourg. As part of the main topic, priority is given to problems concerning the implementation of human rights, motivated by the fact that while the norms of international and domestic law governing human rights have been elaborated in great depth, their implementation lays considerably behind the law making.

General questions of the theory of the legal system. In this domain the Institute is concerned with studying general problems in the operation of the legal system, such as the foundations of the legal system, gaps in law, contradictions of legal systems, legislation with retroactive effect, constitutional aspects of the legal system, and problems of constitutional review. One aspect of this research project is the study of the concept and foundation of legal culture in general and the characteristics of legal culture in Hungary.

Interdisciplinary works cover information communications law and law medical law. The research executed in information communications law deals with the emerging issues of ICT, telecommuni-

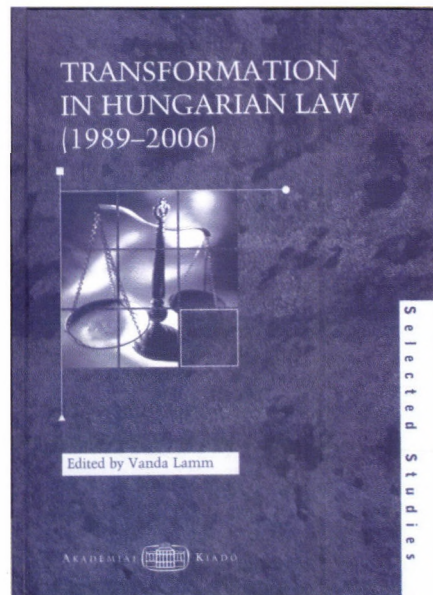


cations, media and online laws. Key aspects are market regulation, liberalisation and competition, public service requirements, data protection, intellectual property, protection of rights, consumer protection, next generation networks, innovation and law, theory of regulation In medical law the ongoing research concentrates on legal aspects of emerging scientific developments in medicine (stem cell research, genetic diagnosis, reproduction technology), and with other, more traditional issues, like medical malpractice, rights of patients, regulation on biomedical research.

Other activities

In addition to research and teaching, the fellows of the Institute are involved in a wide range of projects managed by other academic and governmental organizations, and they advise different governmental and non-governmental agencies as independent

experts. Projects of collaboration are undertaken with Hungarian and foreign universities and research centres in various countries.



RESEARCH INSTITUTE FOR LINGUISTICS

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Scope of activities

Description of the grammar of Hungarian, research into its history and related languages, extensive investigation of the human language capacity, explorations in the theory of grammar, study of the properties of linguistic communication, construction of comprehensive language resources, development of language technology, participation in the education of future generations of linguists, and information service for other research centres of linguistics in Hungary and for the general public.

Research objectives and topics

Grammar and Theory

Description of present-day Hungarian, investigations in the theory of grammar
Investigation of synchronic language systems by applying approaches that can be characterized structuralist in the broad sense of the term (including the generative approaches). Synchronic study of all subsystems of grammar (phonology, morphology, syntax, semantics, and the lexicon) and their interfaces from theoretical,



descriptive, and computational linguistic perspectives. The object of the descriptive work and the source of theoretical innovations is mostly, but not exclusively, the linguistic phenomena of Hungarian.

Upgrading the curriculum of the Theoretical Linguistics Program of HAS/Eötvös University

On the basis of investigations in structural grammar and in theoretical linguistics, a permanent development of the curricula of the Theoretical Linguistics Program and Graduate School in Theoretical Linguistics of the Hungarian Academy of Sciences and Eötvös Loránd University, Budapest, contributing to the education of rising generations of linguists.

Historical Linguistics

Compiling a historical grammar of Hungarian

Producing a synchronic description of the syntax of Middle Hungarian (from the mid-16th century to mid-18th century). Comparisons with the descriptions of Proto-Hungarian and Old Hungarian published in earlier phases of the same project in order to determine the lines of developments connecting them. The chapters are being written on the basis of a corpus of 3,000,000 characters.

Studies in Uralic

Computerized morphological analysis of the following languages: Ob-Ugric, Permic, and Samoyedic (Nenets and Nganasan). Typological description of Ob-Ugric, Permic and Samoyedic morphology and syntax. Overview of the phonotactics of minor Uralic languages. Analysis of the phonological system of Ob-Ugric, and Samoyedic. Semantics of parts of speech in Khanty. Studies on historical lexicology (Nganasan, Khanty). Launching of modern sociolinguistic approaches in the examination of endangered Uralic languages.

Interdisciplinary

Neurolinguistics and psycholinguistics

Investigation of the structure of mental grammar localized in cerebral areas, especially via an analysis of speech disorders (types of aphasia) that are due to injuries of various cortical areas. Research on the organization of mental grammar and on the relationships between the grammar and mental programs of human speech processing and speech production, using Hungarian material based on testing both normal and aphasic subjects. Checking the neurological validity of current grammatical models. Investigation of children with specific language impairment to provide clinicians with tests that make diagnosis and differential training of different subtypes of SLI possible, to learn what aspects of language are susceptible to impairment in Hungarian and to see whether these are different in an agglutinative language with a rich morphology than those in other types of language.

Acoustic-phonetic and perceptual investigation of spontaneous speech

Systematic description of speech production (spontaneous speech, speech monitoring, individual speech properties, disfluencies) and its comparison with types of communication not requiring linguistic planning (laboratory speech recording, reading aloud). The analyses specifically target coarticulation phenomena and formant distributions of vowels in spontaneous speech. The development of a phonetically-based multi-purpose

database of Hungarian spontaneous speech (BEA) starts to accumulate a large amount of recorded speech providing ample material for various types of research and practical applications. Series of experiments are carried out by means of BEA using up-to-date analytical software, in order to gain information about the human processing of spontaneous speech.

Investigations of spoken language

Transcription, encoding, digitalization of tape-recorded interviews with a random stratified sample of 200 subjects representing the inhabitants of Budapest, and the analysis of partial corpora that have been completed so far. Sociolinguistic questionnaire studies involving a sample representing the adult population of Hungary. Sociolinguistic investigation of the linguistic situation of Hungarian minorities living in neighbouring countries: Slovakia, Ukraine, Romania, Serbia,

Slovenia and Austria.

Research on languages spoken by the Roma communities: within the study of Romani, the investigations of certain aspects of language use (e.g. styles of speech, mode of presentation, genres of speech). Producing a modern descriptive grammar of the Boyash language.

Research into minority languages with the primary intention of fostering a multi-disciplinary approach to linguistic minorities in the Central European region.

Studies in normative linguistics

Investigation of linguistic attitudes towards codified linguistic forms and description of linguistic norms of standard Hungarian. The results are put to use in the public information service of the Institute providing members of the general public with expert advice on matters of usage. Cooperation for language management with language offices of Hungarian minorities living in neighbouring countries

Oriental Studies and Turkology

Research on various aspects of the syntax of Mandarin Chinese, with emphasis on issues pertaining to the syntax-semantics interface. The investigation of linguistic politeness phenomena in both the traditional and modern Chinese society, using written text corpora.

Research into the history of Buddhism in Tibet and Mongolia, on the basis of sources written in Tibetan. The study of the morphology and syntax of the Middle Tibetan literary language. Investigations in Old Anatolian/Old Osmanli (14–15th century). Continuation of the publication of a current bibliography of international Turkology (*Turkologischer Anzeiger/Turkology Annual*). Preparing a catalogue of Turkish manuscripts in the Oriental Collection of the Library of the Hungarian Academy of Sciences. Publication of sources on the Osmanli period of Hungarian history. Analysis of Cretan Turkish kadi-registers (*sicils*).

Applications

Comprehensive Dictionary of Literary and Spoken Hungarian

The 'Academy Dictionary' will be an 8-volume corpus-based explanatory dictionary presenting the word stock of more than two centuries with a larger set of headwords and richer structure of meaning specifications than ever before, also tracing the historical development of lexemes. Meanings will be illustrated by specimen sentences, indicating their exact sources. The corpus of the dictionary comes from between 1772 and 2000 taken from works of fiction, popular, science and quality journalism from the computerised Hungarian Historical Corpus (www.nytud.hu/hhc) containing 23 millions of running words. Further tasks include the permanent enlargement of the Hungarian Historical Corpus, the development of analytical processes for old texts, and the digitalization of archival cards. The manuscript of the latest volume of the New Hungarian Dialect Dictionary (vol. 5, Sz-Zs) is now being completed and expected to be published in 2008.

Hungarian National Corpus (HNC)

A 187-million-word balanced reference corpus of present-day Hungarian. It is the first Hungarian corpus covering language variants from beyond the border of Hungary, containing language variants from Slovakia, Subcarpathia, Transylvania and Vojvodina. The HNC is annotated with detailed morphosyntactic information, for every wordform the

stem, part of speech and inflectional description are specified. It is divided into five subcorpora by regional language variants, and into five subcorpora by text genres also. The subcorpus to be studied can be chosen by any combination of these, which makes the HNC an appropriate tool to study the differences not just between text genres but between language variants. A second, extended and updated version of the corpus is currently in preparation.

The HNC is available online at <http://corpus.nytud.hu/hnc>

Development of lexical resources

Construction of a lexical data base that contains a syntactic and semantic description of verbal complementation frames selected on the basis of the frequency data from the Hungarian National Corpus. Development of general and domain specific ontologies/wordnets.

Development of machine translation systems

In the framework of a research cooperation with MorphoLogic Ltd., an English-Hungarian machine translation system has been developed and it is already on the market. The Hungarian-English direction is currently under intensive development and close to completion. See <http://www.webforditas.hu> for a demo of the machine translation system.

Development of a parsing system for Hungarian

In collaboration with the University of Franche-Comté, the Institute has

prepared a comprehensive Hungarian parsing system based on the NooJ linguistics development tool. The system includes a full-scale electronic dictionary as well as a set of local grammars using powerful finite-state transducers. The Hungarian NooJ module has been successfully used in content analysis of narratives by psychologists and is available for general use at <http://corpus.nytud.hu/nooj>.

Development of a language resource repository and infrastructure centre

As a key participant in the CLARIN (Common Language Resources and Technology Infrastructure) project (<http://clarin.eu>), the Institute is working towards setting up a strong infrastructure centre for language resources and its technology, offering scholars the tools to allow computer-aided language processing in the Humanities and Social Sciences.

INSTITUTE OF LITERARY STUDIES

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Scope of activities

Research on

- the history of Hungarian Literature from its beginnings to the present
- literary theory
- the history of literary criticism
- Central and East European literature

Critical editions and source studies in Hungarian and Neo-Latin literature. Editing of reference books and bibliographies.

Publishing of the reviews: *Irodalomtörténeti Közlemények*, *Helikon*, *Literature*, *Magyar Könyvszemle*, *Neohelicon*, *Camoenae Hungaricae*.

Joint research projects with diverse institutions and universities both in Hungary and abroad, incl. the Czech Republic, Croatia, Estonia, France, Germany, Italy, Russia and Slovakia, as well as Hungarian departments of universities in neighbouring countries.

- Textology: critical editions of classical oeuvres of Hungarian Literature, e.g. J. Arany, F. Kölcsey, S. Petőfi, M. Vörösmarty, M. Babits, etc.



- The history of Hungarian literary criticism: monographs of cultural eras and important personalities.
- Critical studies on contemporary Hungarian literature.
- Studies on literary currents, periods and institutions.

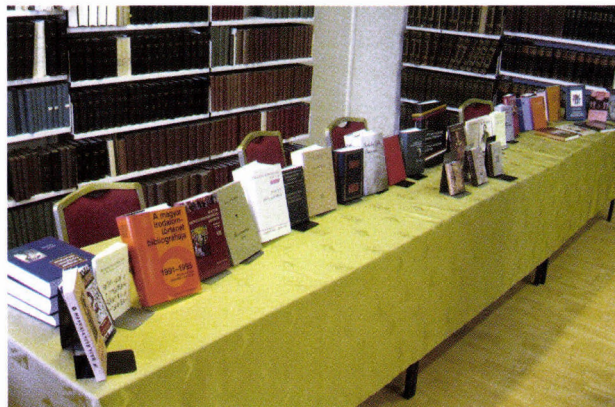
- Comparative study of Central and East European literatures: the relations of Hungarian literature to Central and East European literatures, typological studies.
 - 18th century literature: comparative studies in cultural history.
 - Literary theory: poetics, theory of interpretation, dialogicity, interpreting communities.
 - The history of literary cults.
 - Renaissance studies: joint research programmes and critical editions.
 - Fields of cooperation: Composition of a new history of the Croatian, German, Romanian, Ruthenian, Slovak, and Slovenian literature, written in Hungary.
- Education activities: participation in undergraduate, graduate, and post-graduate courses, doctoral programmes.



International Conference "Militia et litterae"
(October 2007)



Presentation of the new Lituanian-Hungarian
Dictionary by Endre Bojtár (November 2007)



Presentation of the 2007 productions of the Institute

INSTITUTE FOR MUSICOLOGY

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The courtyard of the institute

Scope of activities

- to maintain and enrich the primary collections hosted by the institute: the Hungarian Folk Music and Folk Dance Archives, the Bartók Archives, the Ernő Dohnányi Archives, and the Museum of Music History, all of which are unique to Hungary, and internationally also of outstanding importance in their field;
- to conduct comprehensive research into the music history of Hungary, and in various fields of general music history;
- to carry out research in the domains of ethnomusicology and ethnochoreology, especially in Hungarian and European folk music and folk dance;



The Bartók-Hall

Research aims and topics

Researches in Music History

- study of liturgical music of medieval Hungary and Central Europe (plainchant, early polyphony, notation);
- publication of *Musicalia Danubiana*, a series of critical editions of musical sources, originating in Hungary before ca. 1820;
- preparation and publication of the comprehensive series *Music History of Hungary*;
- critical edition and publication of Ferenc Erkel's operas;
- documentation of, and research into Béla Bartók's life and work, preparation of the Béla Bartók Complete Critical Edition, of the Thematic Catalogue of Béla Bartók's Compositions, and of Bartók's Collection of Hungarian Folk Songs;
- documentation of, and research into Ernő Dohnányi's life and work, preparation of the Thematic Cata-

logue of Ernő Dohnányi's Compositions;

- organological research, temporary exhibitions, planning of the new permanent exhibition of the Museum of Music History.

Researches in Ethnomusicology and Ethnochoreology

- Preparation and publication of the series *Collection of Hungarian Folk Music (Corpus Musicae Hungaricae Popularis)*;
- preparation and publication of the catalogue of the 'New Style' layer of Hungarian folk songs;
- development of a computer-aid catalogue system for the complete folk music material recorded and/or transcribed in the period since ca. 1900;
- collection and recording of Hungarian folk music and folk dances, and audiovisual publication of recorded material;
- preparation and edition of folk dance monographs.



The Bartók-Hall

Educational Activities

- Participation in graduate and post-graduate education in musicology and ethnomusicology in cooperation with the Ferenc Liszt Academy of Music, Budapest;
- participation in graduate and post-graduate education in cooperation with various Hungarian universities.

Fields for cooperation

- Medieval liturgical music in the framework of Cantus Planus Study Group of the International Musicological Society;
- music history of the Central European region between 1500 and 1900;
- computer-aid databases of archives for folk music and folk dance.

INSTITUTE FOR PHILOSOPHICAL RESEARCH

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Fields of activities

Central research project: philosophical questions of the information society. This project is based on broad philosophical foundations and applies traditional philosophical analyses, exploiting the classical philosophical background which has been accumulated at the institute.

Research groups

Research Group for the Philosophy of Science

Activity: Studies on the knowledge based society from the point of view of the philosophy of science. Investigations on the theoretical significance of the new communication technology, with special respect to electronic networks and interactive multimedia; studies on the history of science.

Research group for Social Philosophy

Activity: Studies on the new perspectives provided by the information society for social philosophy, including the new form of social organizations, political and ethical consequences.

Research Group for the History of Philosophy

Activity: Studies on the history of philosophy from the perspective of communication technologies. Investigations on the relationship between the cultural environment and philosophy. Historical analysis of the relationship between the international intellectual trends and Hungarian creativity.

Research Group for the Philosophy of Religion

Activity: Studies concerning the problems of religion as language and a form of communication; verbal and non-verbal religious language and its relation to communication; changes in social values.

Projects

Reception and Creativity: Open Hungarian Culture

Activity: Studies on the problem of how a specific Hungarian creativity occurred in the period between the late 18th century and the end of the 20th century. The project scrutinizes the mechanism how the Hungarian

high culture received and assimilated the European cultural movements. This process gave rise to new original works in several intellectual fields. The multidisciplinary research comprises many fields, including philosophy, literature, science and technology, law and language.

Communication in the 21st century

Activity: Studies on the impact of mobile devices on communication. In the first phase an interdisciplinary approach has been provided to the mobile information society by a group of experts consisting of philosophers, psychologists, sociologists, economists, linguists, political scientists and historians of science. While in all areas of life we witness a radical increase in the demand for mobile internet access, questions as regards further directions of development are at many points open, and need to be addressed by the social sciences. Contrary to earlier expectations, the emergence of computer-based, net-

worked, interactive communication enhances, rather than diminishes, the physical mobility of users. In the second phase, the research will be increasingly directed at the issue of "m-learning." M-learning is learning as it arises in the course of person-to-person mobile communication.

The Institute serves as a scientific background for UNIWORLD

UNIWORLD is a virtual university based on the achievements of the institute's studies on the information society. It tries to apply the experiences of networking in higher education thus attempting to conform to international trends.

UNIWORLD tries to achieve a double aim

- It conducts scientific research concerning the application of the Net in education, in the communication of new knowledge.
- It offers courses on philosophy, ethics and other subjects from the perspective of the theory of communications, and is trying to develop its activities.

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Objectives and goals of the Institute

The Institute for Political Science of HAS was established in 1990, at the same time as the new democracy. It conducts theoretical, empirical and comparative research primarily in the field of political science, and related

social sciences, e.g. philosophy, social theory, sociology and anthropology. Its activities are characterised by a marked inter- and multidisciplinary approach. Its 40 highly qualified research fellows, leading political scientists, study political life in Hungary, describe and interpret the main social and political trends.

The research departments of the Institute:

- Democracy and governance
- Politics and policy
- EU integration and globalisation
- Values and cultural studies

The major topics of the research department for democracy and governance are:

- the European Social Survey is a comparative analysis of the social, demographic, political and moral state of the European countries
- the state of the legal system of the Republic of Hungary between 1989 and 2006
- the predictability of parliamentary elections
- research into the constitutional regulation of the referenda, the litigation practice of the Constitutional Court, and the local governmental elections
- Hungarian participation in the European Parliament
- Analysis of the party systems of the EU member states.

The research department for politics and policy focuses on the analysis of the party system, political campaign, political communications, and public policy.

The research department for EU integration and globalisation conducts globalisation-related research about the evolution of the complex world system, the adaptive sub-systems of the world system, and the methodological issues of interpreting globalisation. The Latin-American Left and the economic policy of the left-wing governments have been analysed.

Research into integration focuses on the systems of EU development policy, including the system of European agrarian development, the connections of sustainability and power, systems of employment policy, and the relations of knowledge forms and power structures. Other research projects deal with the dynamics of local communities, with small regions in a critical position, and the situation of young people in Hungary.

In order to enhance co-operation, research centres have been created, which work independently from the research departments. Each research centre is led by a fellow, who is a great authority of the research field, and they are a network of stakeholders: scholars and students.

The research centres of IPS HAS:

- Centre for Ethno-Regional Studies,
- Centre for Euro-Atlantic Integration Studies,
- Centre for European Employment Studies,
- Centre for Discursive Political Science Studies,
- Centre for Political Communications Research,
- Centre for Innovation Networking.

The Institute has built a broad domestic and international research and academic network. It became the centre for political science networking in Hungary.

The Institute has participated in several EU Framework projects since 2003 (Building new relationships in rural areas under urban pressure; From Welfare to Knowfare – A European

approach to employment and gender mainstreaming in the knowledge-based society; Exit from and non-take-up of public services; Encouraging Collective Farmers' Marketing Initiatives; A cognitive approach to rural sustainable development – dynamics of expert and lay knowledges; Dynamics of national employment models; General approach to the social patterns of relation to work; Scientific indicators of confidence in justice).

Main domestic funding organisations: National Office for Research and Technology, Hungarian Scientific Research Fund, National Cultural Fund, Hungarian Academy of Sciences, National Employment Foundation, Prime Minister's Office, banks and other industrial actors.

Our colleagues are involved in higher education both at graduate and post-graduate levels. They played an active role in introducing political science into the curricula of universities and colleges all over the country, and several of them hold the office of chair professors and lead Ph.D. courses, which strengthens co-operation with the major higher education institutions of Budapest, Győr, Pécs, Miskolc, Debrecen and Szombathely. This creates opportunities for talented young scholars to get involved in research projects conducted in IPS HAS, and, at the same time, serves as a great pool for revitalising the research staff of the institute.

Approximately 80 papers and presentations were given at international conferences abroad last year, mainly in the European Union, but also in the USA, Japan, China, and South-

America. Around 140 papers were given at Hungarian conferences.

Conferences and roundtable discussions are frequently organised around various research projects, or within the framework of bilateral co-operations. Our recent conferences include: European Party Families and their Ideologies in the Early 21st Century, Three Years in the European Union, Four Years from the EU Presidency, The directions of regional development in the EU.

Books and publications

IPS HAS publishes monographs, collections of papers, conference proceedings and working papers. The research fellows boast with an average of 200 publications annually.

European Hungary, 2007. A social survey, published jointly with the Research Institute for Ethnic and National Minorities, the Institute for Sociology, and the Institute for World Economics.

From Transition to Globalisation: New Challenges for Politics, the Media and Society, the English language volume of essays published in 2007, provides insight into the research interests and results of the Institute. The broad and timely subjects elaborated include: analysis of the historic underdevelopment, advancement and regression in Hungary and the region; the ramifications of these changes on the behaviour of the media, political parties and the society, and their impact on regional and trans-Atlantic relations. The challenges posed by globalisation to the new democracies and new

members are also addressed in the volume.

To continue the printed series, the Institute started its electronic *Working papers series* in 2005. Since then 25 high standard papers have been published in English and Hungarian, downloadable from the Institute's website, and also from the Hungarian Electronic Library of the National Széchenyi Library. The latest issue is the proceedings of the conference for young researchers organised in 2007.

The Institute hosts the Hungarian Association for Political Science.

The Institute edits and publishes the *Political Science Review*, the only Hungarian professional journal of the discipline, and the *Central European Political Science Review*, the English-language political science journal of the region.

The research staff actively participates in the professional jury of the Hungarian Scientific Research Fund, and in other academic organisations.



INSTITUTE FOR PSYCHOLOGY

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Scope of activity

- Basic research in psychology that contributes to scientific progress and may be applied directly or indirectly.
- Complex, interdisciplinary psychological studies
- Applying and developing research methods
- Contribution to institutional – gradual and postgradual forms – of professional and scientific training
- Scientific cooperation with Hungarian and international research sites
- Promotion of psychological research
- Comprehensive participation in scientific public life and in the activities of the psychological community.

Research topics and objectives

*Elementary information processing:
Cognitive development
and neurological mechanisms
underlying cognitive processes*

Visual attentional processes

- principles of complex organization in automatic and attentional processes
- changes of attentional processing with advancing age
- Attentional processes in extreme environmental conditions (e.g. hypoxia)

Task-independent representation of the auditory environment

- Processes of acoustic pattern formation

Automatic and attentional change-detection

Components correlating with cognitive psychophysiological phenomena
Chaos theory based and psychopharmacological investigation of spontaneous electric activity of the brain (EEG) in animal and human experiments

Scalp distribution of ERPs in circumscribed cerebral lesions in cerebrovascular patients

- Dimensional map analysis of spontaneous EEG activity in this patient group

Neuronal mechanisms in the formation of ERPs in animal models

- Investigation of regional features of transient and steady state re-

sponses by multichannel intracortical multielectrode analysis of primary-tonotopic and secondary areas of the acoustic cortex in behavioral task situations

Developmental aspects of cognitive functions (acoustic and phonological conditions of speech understanding, processing features of linguistic functions, lexical, morphological and semantic processing, developmental psychophysiology of arithmetics)

Psychophysiological investigations on cognitive aspects of brain pathology and the effects of every-day stimulants

Mechanisms of early cognitive development

- Development of attribution of intentions, goals, beliefs and other intentional mental states
- Mechanisms and functions of imitative learning
- The relation between self-detection and deduction

The role of contingent parental affect-mirroring interactions in the development of emotional consciousness and self-control

- Mechanisms of contingency detection and early sensitivity to response-contingent stimulation in infancy
- Different developmental functions of parental mirroring interactions in infancy

Research of socialization with focus on critical developmental stages and parent-child relations

Longitudinal in the framework of attachment theory (Budapest Infant-Parent Study BIPS)

- Genetic and environmental factors influencing the development of early attachment relationships are studied in collaboration with the Molecular Genetics Group of the Department of Medical Chemistry, Molecular Biology and Pathobiochemistry of the Semmelweis University. The research is focused on interactions of the genetic variability of the dopamine neurotransmission, temperament and parental behaviour in the formation of infant attachment.
- The BIPS will be extended to investigating the long-term continuity of attachment, and to studying effects of attachment on later information processing, especially on the attention system.

Social psychological study of deviant careers

Use of risk drugs and analysis of drug-using at-risk groups with social psychological and qualitative methods

Concepts of competition in cross-cultural comparison and in the mirror of social-political changes in Hungary

- Age-related and generational changes in attitudes to competition
- Relation between competition and personality

Longitudinal study on the identification of high ability and outstanding skills

- Follow-up of careers of chosen children
- New methods for the determination and early detection of high ability

Processes of information gathering and utilization, decision making and judgement

- Research of personal and person perception determinants of questioning strategies
- Effect of emotional states on information gathering
- Changes in cognitive processes in old ages
- International comparison of the perception of societal risk profiles

Esthetic judgement in the visual arts

Theoretical and empirical assessment of theories of esthetic experiences.

Social information processing, social representations, text understanding, communication

- Comparative psychological study of literary, Freudian and historical text understanding by mapping mental representational networks
- Prototypical concepts of literature and history
- Distinction between literary and historical texts

- Relations of reading motives and textual characteristics in both types of texts
- Understanding of literary texts
- Perception and evaluation processing in fine arts

Relations between texts (with focus on narrative texts) and psychological processes (with focus on personal and social identity)

Methodological developments in computerized and computer-aided psychological content analysis

The use of such developments in the research of

- Personality development (with focus on deviant forms of behavior)
- Identity (with focus on national identity and identity traumas)
- Social and cultural memory (with focus on social representation of history)
- Dynamics of social representation

Social psychological research of the organization of personal and social identity

Narrative construction, autobiographical structure and social representation of identity

- Computer-aided content analysis of interview texts (with focus on coping with autobiographical traumas and crises)

Relation of political attitudes, human rights awareness and prejudice (with focus on attitudes toward Romas, strangers, and on anti-Semitism)

Longitudinal study of ideological contents and social psychological structures of prejudices, and their effects on institutional and legal practice

Problems of body picture and self-picture

- Analysis of body-related popular and scientific discourses
- The role of body representations in the formation of personal and social identity.

CENTRE FOR REGIONAL STUDIES

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Institutes of Centre for Regional Studies

Great Plain Research Institute

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Central and North Hungarian Research Institute

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West Hungarian Research Institute

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Research institutions and departments

Mission

The Centre for Regional Studies, which is an institute of complex social science researches, was founded in 1983 and operates in the form of a network. It is a base of the Hungarian regional development researches, played and

still plays a dominant role in the creation, carrying out and training of regional sciences, in co-operation with the European system of science.

The strategic objectives of the Centre

Research of the long term Hungarian and international processes of regional and urban development, the globalising (European, Euro-regional, Central-Eastern European, Hungarian) spatial structures, their division of labour, their system of institutions and tools; Establishment of decisions concerning regional development in Hungary and the country's accession to the European integration; Training and further training of the experts of regional and urban development.

The Centre for Regional Studies, by research organisation based on programmes, acts as a framework institute in theoretical researches and in the implementation of strategic programmes. The CRS initiated the setting up and operation of the Committee for Regional Sciences of the Hungarian Academy of Sciences. The research fellows of the institute direct the special committees of regional and urban development in the regional committees of the Academy, also, they lead graduate and postgraduate and PhD courses on regional economics in Hungarian higher education institutions.

Scientific profile of the institutions

Great Plain Research Institute

- Study of the economic, societal and environmental renewal of the Great Hungarian Plain
- Methodology of micro regional researches
- Rural development strategies
- Development concept and strategy for the Great Hungarian Plain
- Survey of the Carpathians Euro-region and the Tisza-Maros-Danube cooperation

Transdanubian Research Institute

- Survey of Hungarian and international regionalism
- Regional development and policy in Europe
- The institutional system of public administration and regional development
- Methodology of regional development programming
- Regional requirements of sustainable development
- Complex survey of the infrastructure systems and networks
- Regional development strategy for South Transdanubia
- Analysis of the regional development of the Central and Easter European region

*Central and North Hungarian
Research Institute*

- Study on the regional structure of urban network and of society
- Analysis of the spatial structure of urban functions and urban network
- Survey of Budapest and its agglomeration based on international comparisons
- Survey of rural areas and creations strategies for them
- Development strategy for North Hungary

West Hungarian Research Institute

- Survey of the spatial spreading of innovation
- Analysis of regional financial and income processes
- Study of the Vienna–Bratislava–Győr cooperative region
- Comparative analysis of success regions, cities
- Regional development concept and strategy for North Transdanubia

**Research programmes
and fields for cooperation**

*Regional development and policies
in Europe*

- Driving forces of regional development in a Western Europe
- The systems of regional policy tools and institutions in the advanced market economies
- Structural and cohesion policy of the European Union

*Regional transformation
in East-Central Europe*

- Regional development processes in East-Central Europe
- Transformation of the urban network
- Cross-border co-operations
- Euro-regions
- Directions of development in the Danube regions (VISION-PLANET programme)

*The regional development strategy
of Hungary*

- The impact of the European processes on
- The Hungarian spatial structure
- The development of the regional economic structure in Hungary
- Spatial types in Hungary
- Transformation of the settlement structure
- Success settlements and regions
- Regional policy and the EU accession
- Environment protection and regional development

*The institutional system of territorial
administration and regional policy*

- The institutional system of regional development
- New functions of the territorial administration
- The role of local governments in regional development
- Regions as an institute and their functions
- Co-operation of the actors in regional development

Regional development concepts and strategies

- National Development Concept of Hungary
- Regional development concepts
- County development concepts
- Urban development concepts
- Regional establishment of sectoral and business development strategies

Education activities

- Joint PhD programme on regional policy and economics with the Faculty of Economics of the University of Pécs
- Post-graduate courses on regional and urban development
- Institute of Sociology and Social Policy, Faculty of Arts of Eötvös Loránd University, Budapest
- Faculty of Economics of the University of Pécs (graduate training)
- Faculty of Economics of the University of Pécs (two-year specialisation on regional economics)

- Széchenyi István University, two-year training of urban economics, Győr
- Training of the subjects of regional science and participation in the PhD training in the following higher education institutes: Faculty of Arts and Faculty of Science of University of Pécs; Faculty of Economics, Miskolc; Faculty of Natural Sciences of József Attila University, Szeged.

Publishing activity

Book series: Területi és Települési Kutatások (Regional and Urban Studies), Régiók Európája (Europe of the Regions), A Kárpát-Medence Régiói (Regions of Carpathian Basin), Alföldi Tanulmányok (Great Plain Studies)
Periodical: Tér és Társadalom (Space and Society, with English summary)
Series in English language: Discussion Papers (more than 60 have been published)



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Activities

The Institute

- conducts the empirical study of social processes with aspirations of developing sociological theories and methodology;
- participates in elaborating the different sociological contexts of social policy and economy, in the development of different types of reform concepts and also in their critical analysis;
- undertakes applied research commissioned by various types of organizations and institutions;
- cooperates with local and foreign social science institutions and universities in interdisciplinary research;
- participates in the planning and implementation of comparative research projects initiated by international organizations;
- is involved in several EU-, OECD- and NATO-projects;

- organizes workshops as well as national and international conferences for the discussion of scientific issues;
- is home to associates who teach in all the larger Hungarian universities or their doctoral schools. Their studies are published in books or in relevant journals;
- edits and publishes the following periodicals: *Social Research*, *Community and Culture*, *Booklets of Methodology*, *Working Paper series*.

Research aims

The basic aims of the Institute are twofold: Firstly, to conduct ‘classical’ sociological research, that is, basic research on theoretical and methodological sociological issues; and secondly, to examine the dynamics of changes in Hungarian society, and to work out methods for solving current social problems and conflicts. Consequently, it carries out empirical and interdisciplinary social research on the one hand, while it also pursues policy-oriented research on the other. It applies both analytical and normative research methods. The greater part of the institute’s work is of dual use due to the demand for empirical data processing and analysis. The results can be used for the preparation and testing of social-political strategies, while the collected data are an impulse for creating basic research synthesis.

Research areas

In the past few years, the great international projects and the data surveys of the strategic work dominated the institute’s research. A prominent role has been designated to risk management and the preservation of the environment as well as the technology and knowledge economy, work and organization sociology and the research of culture. Considerable time has been devoted to research concerning social roles and politics as well.

Climate change

- Social aspects of climate change
- Specific issues of adaptation to, and mitigation of climate change

Cultures, policies, lifestyle

- Social consciousness
- Analysis of social and cultural change
- Attitudes and values of the economic elite
- Cultural aspirations of the new elite
- Alternative life strategies
- Everyday life culture
- Cultural patterns
- Behavioural patterns of the middle class in mass culture
- Media, media habits
- Methodological bases of the analysis of symbolical phenomena
- Cultural encounters in the European economy and society after the accession

Equal opportunities, poverty

- Equal opportunities
- Subsistence strategies of poor families in regional and ethnic aspects
- Child abuse in the family
- Relations between minorities and majorities in local communities
- Immigrants
- School segregation in a new perspective
- MOBILITATA
- SOCRATES ARKS: Catch-up programme for deprived adults

Environmental policy, sociology

- Sustainable consumption, production, communication
- Views of the future: social and economic strategies for Hungary
- Extreme weather
- Condition of water
- Radioactive waste

Gender issues and social minorities

- Transformation of family and gender roles; family policies
- Work-life balance (WLB) issues
- Roles and responsibilities of men in creating more equal gender opportunities
- Equal treatment policy-making concerning gender, gender expression and sexual orientation
- Social exclusion of LGBT people
- HIV prevention, AIDS intervention research

Knowledge and innovation

- Systems of knowledge creation and distribution: science, innovation, technology, communication
- Emergence of the information society
- Institutionalisation processes of technology and innovation
- Future views of Hungary in 2015 and 2020
- Brain drain of Hungary
- The reform of the state
- Ministries and ancillary institutions in the process of reorganisation
- Local government policies
- Civil society
- Relations between NGOs and local governments
- Co-operation between public and private institutions in social policy
- Adaptation processes related to joining the European Union
- The effects of EU accession and security policies on East Central Europe
- Globalisation impacts on Hungarian society
- Transformation of the system of public administration
- Transformation of health-care system
- Hungary's CIS strategy: Russia, Ukraine, Kazakhstan
- Cultural differences in environmental consciousness

Research of values

- European Social Survey (ESS): data-survey of 28 countries
- Changes of values in Hungary
- Survey of family values and attitudes

Risk Society

- Distribution and re-distribution of risks
- Macro level risk management
- New deprivation related to knowledge distribution

Social structure, welfare policy

- Dynamics in the transformation of Hungarian society
- Activity structure of Hungarian society
- NGOs
- Old and new poverty
- Aging population, pension, inter-generational equity
- Changing family structures
- Modernisation processes
- The Roma/Gypsy population in Hungary;
- Post-socialist welfare systems
- Social background of deprived people receiving welfare payments
- New social risks in the European knowledge society and higher education
- Social inclusion strategies for schools

Sociology of work and organisations

- The new information economy
- Work organisation and restructuring in the knowledge society
- Cultures and values of organisations
- Characteristics of knowledge and manpower use
- Flexible adaptability of enterprises and employees
- Measuring the dynamics of organisation and work
- Management methods of domestic and international multinational corporations

Urban development policy

- Spatial structure of society and settlements
- Regions in Hungary in 2020
- Changing rural societies
- Social-economic relation systems between cities and their rural heartlands
- Urban areas, socio-spatial inequalities and conflicts
- Equal opportunities, development paths in rural regions
- Housing estates
- Urban regeneration.

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The purpose of Research Center for Social Studies working since January 1st 2001 is to organize and coordinate the accentuated scientific tasks, to vivify and aid multi- and interdisciplinary projects and to provide them with the conditions necessary for execution. Another important goal of the center is to organize conferences and joint scientific projects of nine academic in-

stitutes of social sciences working in the Buda Castle area, to cope with all the control and managing tasks and to run the Academy building in the Buda Castle quarter. What's more, some projects even include researchers and institutes from other scientific areas like natural science.

The organizational base of the Research Center for Social Studies is the

group of the social science institutes of the Academy, above all the nine institutes in the Buda Castle quarter (Sociology, History, Archeology, Minority Studies, Art History, World Economics, Ethnology, Legal Studies, Political Sciences). Within the Center for Social Studies there are three research teams, namely:

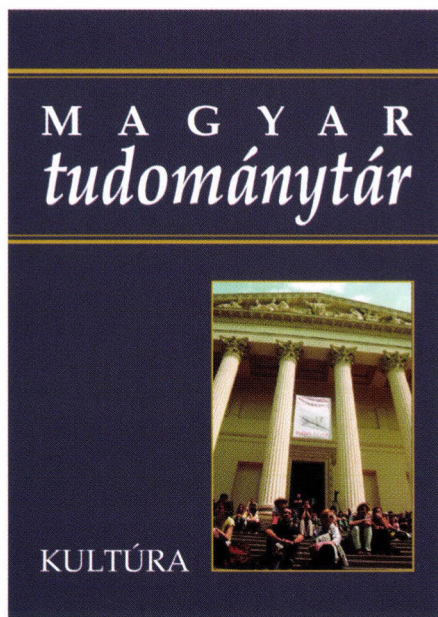
Science bank

Activities of the Science bank working within the frames of the Research Center for Social Sciences are: to establish and replenish databases of academic and scientific history, bibliographies, chronologies and a network of connections with every research institutions where researches of scientific history are in progress. Mem-

bers have been constantly working on the remarkable and significant book series *Store of Hungarian Science*.

Program Bureau of Strategic Studies

Based on Government Resolutions 2184/1996 and 2269/1996 several strategic research projects have been launched in 1997 at the Hungarian Academy of Sciences. Their base institution, Program Bureau of Strategic Studies was established in 2001. The Bureau coordinated an average of 20 research programs per year until 2005, since then a radical reduction in financial possibilities limited this number to an average of 10 programs. The bureau now publishes 3-4 books a year.



European History Workshop

This team has been working since May 2002, with the coordination of Hungarian research projects on European history as its main task. The workshop also establishes and develops international cooperations and publishes studies on European history. For 3 years this team deals with the so called Balkans Project supported by the Hungarian Academy of Sciences and the Prime Minister's Office. They are organizing their 11st conference in 2008.

Education activities

Every second researcher at the Center teaches in the higher education; our colleagues work at Eötvös Loránd University, Corvinus University of Budapest, University of Debrecen – Medical Center, Gödöllő University of Agricultural Sciences; some of them also work in post-gradual education.

Fields for cooperation

Besides institutions of social sciences Research Center for Social Studies established a living and intensive relationship with several natural science communities, Eötvös Loránd University and the National Office of Cultural Heritage.

INSTITUTE FOR WORLD ECONOMICS

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A view of the institute

History

The Institute for World Economics of the Hungarian Academy of Sciences (IWE) has operated in its present form since 1973. Its predecessor was the Afro-Asian Research Centre, founded in 1965.

The institute pursues policy-oriented research activity independently of political influences. Its purpose is to

draw conclusions and make recommendations for Hungarian policy-makers, based on its research findings. These concern economic policy and the main lines of economic development, especially in relation to occurrences in Europe – in the European Union (EU) and the Central and Eastern European (CEE) region – and to the challenges of the global economic system.

The pillars of the institute's scientific philosophy are of a strategic character, an interdisciplinary approach, and a forcefully international framework in its main activity.

The importance and influence of scientific institutions engaged in international economic research have been increasing all over the world. This is due to the accelerating processes of globalization, and nearer home, to the transformation of Central and Eastern Europe and the return of the region to the international mainstream. The IWE has possessed since its foundation a dynamic, internationally active staff of researchers who are open to the world. They have reacted successfully to the professional challenges posed by the decisive political and economic processes of the last decades.

Fields of research

General issues of the world economy

- main sources of global development,
- dominating trends and the strategies of the main actors,
- new forces and patterns of global competition,
- global energy-economy,
- strategies of the transnational corporations and their influence of the patterns of investments, output and trade,
- trends in the world economy and their effects on Hungary,
- macroeconomic theories; development theories on the role of market and state.

The European integration process

- The deepening and enlarging process of the European Union,
- strategic questions of the future of the European Union:
 - the prospects of the political union,
 - the Economic and Monetary Union,
 - European reactions on the challenges of the globalisation
 - institutional reforms and constitutional process,
 - common policies, budgetary policy, reforms and progress;
 - international competitiveness;
- comparative analysis of the economic performance of the new and old member states,
- labour market and employment policies in the European Union,
- East-West migration and demographics trends,
- the European Union and its external relations:
 - The EU and South-East Europe
 - The EU and its direct neighbourhood
 - The EU and other poles of the world.

Central, South-Eastern and Eastern Europe: EU integration, modernisation, catching-up and adjustment

- Economic modernisation in the Central, South-Eastern and Eastern European countries, strategies for catching up, modernisation process, integration prospects, political and economic relations, trade, FDI movements;

- Poland, the Czech Republic, Slovakia, Slovenia and the Baltic States: comparative study of the economic performance in the European Union, cooperation and competition;
 - Bulgaria, Romania: catching up and adjustment within the EU;
 - strategic issues of economic development in the new member countries:
 - conditions and strategies for sustainable development
 - reform of distributive systems;
 - taxation policies;
 - global, European and regional competitiveness,
 - exchange rate policies before the Euro introduction;
 - regional development within and across the countries;
 - demographic challenges and pension reforms in the region.
 - Eastern and South-Eastern Europe: opportunities and challenges within the framework of the EU's Neighbourhood Policy;
 - Mediterranean politics, relations with Turkey;
 - Commonwealth of Independent States (CIS): geopolitical position and reintegration, Ukraine and Russia, strategic aspects of energy economy;
 - Russia as a global player;
 - Trade relations within and outside the EU.
- Economic and social developments in the Middle East, in North Africa and in Central Asia,
 - World trade and the WTO, trade liberalisation, agricultural policies, The EU's Common Agricultural Policy and its reforms,
 - World agricultural system and products, the food problem,
 - Development co-operation policy of the EU and that of Hungary,
 - Foreign direct investments,
 - Specific domestic policy issues:
 - competitiveness,
 - R&D and innovation, economic challenges of the knowledge society,
 - infrastructure networks,
 - urban- and regional development,
 - environment,
 - sustainable development.

Asia research

- Main economic and social developments in the Asia- Pacific region,
- ASIA-Europe Dialogue (ASEM),
- Successful "smalls" (e.g. South-Korea, Singapore) – promising "biggs" (India, China),
- China's external relations (including China-EU relations), its role and importance in the globalised world, China in the regional cooperation,
- China's internal development and challenges,
- Strategic issues of Hungarian-Chinese relations: interests, cooperation: trade, agriculture, education, R+D, cultural relations,
- Japan, China and India's likely role in technical development, interna-

Key economic aspects of development and catching up

- Developing countries in the globalised world,

tional flow of goods, capital and labour until 2013.

The institute bases its activity on a global network of cooperation. It has comprehensive, institutionalized relations with similar institutes in Hungary, Europe and the rest of the world (especially in Japan, Southeast Asia, Latin America and the United States).

Structure and operation

The institute's research work is conducted in decentralised research centres organized on regional and/or functional bases. Flexible research teams from different research centres assemble within the institute to perform specific research tasks and projects. The institute also has a network of partners contributing to its research activity from outside the institute. The institute also accepts and actively seeks research commissions from outside. An increasing part of its income derives from funding obtained by competitive applications.

Library

One of the main aids to the researches in the institute is the Scientific Information Service. Since January 2000, this has been part of the United Library for Social Sciences of the Hungarian Academy of Sciences, along with the libraries of research institutes for political studies, sociology and minority studies.

The scope of the library is decided by the research directions being pursued at the institute at any time. A great proportion of the new acquisitions

is received on the base of exchange. This means that a decisive proportion of the stock consists of items not commercially available or found elsewhere. The good relations with international institutions mean that the library has sizeable collections of publications, statistics and handbooks from the EU, the World Bank, the IMF, the OECD, specialist UN agencies, and other bodies.

A comprehensive library information service is available for readers by telephone, on +36 1 224 6759. The computerised catalogue can be accessed via www.etk.mtapti.hu.

Publications

The institute's research findings appear in its own and outside publications. Prominent institute publications include the internationally well-known *Working Papers* series, appearing for more than ten years now. The series in Hungarian are entitled *Kihívások* (Challenges) and *Műhelytanulmányok* (Working Studies). The institute publishes every year since 2005 a *Monitoring Report* on the performance of the Central and Eastern European Member States of the European Union (in Hungarian, with tables and summary also in English). In 2007, a new series called *Kelet-Európa Tanulmányok* (Eastern European Studies) has been started (in Hungarian). Beyond that, occasional volumes of studies in English or Hungarian also appear. The institute's publications form the basis for the extensive international programme of exchange mentioned in the previous section.

OFFICE FOR ACADEMY RESEARCH GROUPS ATTACHED TO UNIVERSITIES AND OTHER INSTITUTIONS

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Council of the Research Group's Representatives
President: László LÉNÁRD, F.M.
Vice president: Miklós MARÓTH, F.M.
Imre DÉKÁNY, F.M.

Research Groups According to Universities and Institutions:

HAS – CORVINUS UNIVERSITY BUDAPEST (CUB)

Adaptation to Climate Change Research Group

Head of the research group: Zsolt HARNOS, F.M.

Research topic: The effect of climate change to biodiversity as well as to human and animal hygiene

Demographic Research Group

Head of the research group: Ferenc MOKSONY, D.Sc.

Research topic: Population challenges in Hungary at the beginning of the 21 century

HAS – BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS (BUTE)

Research Group for Physical Geodesy and Geodynamics

Head of the research group: József ÁDÁM, F.M.

Research topic: Determination and analysis of the Earth's gravity field based on satellite gravimetry, satellite gradiometry and torsion balance observations

Stochastics Research Group

Head of the research group: Imre CSISZÁR, F.M.

Research topic: Research of stochastic processes

Research Group for Organic Chemical Technology

Head of the research group: Ferenc FAIGL, D.Sc.

Research topic: New diastereo- and enantioselective chemical methods and applications

Research Group for Metals Technology

Head of the research group: János GINSZTLER, F.M.

Research topic: Research of special materials for medical technology, automotive industry and machine-tool industry, investigation of their microstructure and functional properties towards their technology intensive industrial application

Materials Structure and Modeling Research Group

Head of the research group: István HARGITTAI, F.M.

Research topic: Molecular structure and modelling

Research Group for Technical Analytical Chemistry

Head of the research group: György HORVAI, C.M.

Research topic: Investigation of supramolecular interactions and analytical application of them

Research Group for Alkaloid Chemistry

Head of the research group: Péter HUSZTHY, D.Sc.

Research topic: Research of biologically active natural organic compounds (e.g. alkaloids, feromones) and their analogues

Research Group for Condensed Matter Physics

Head of the research group: András JÁNOSSY, F.M.

Research topic: Physics of condensed materials

Controll Engineering Research Group

Head of the research group: László KEVICZKY, F.M.

Research topic: Optimal Modeling and Control of Dynamic Systems

Cognitive Science Research Group

Head of the research group: Ilona KOVÁCS, D.Sc.

Research topic: Cognitiv Science

Water Resources Research Group

Head of the research group: László SOMLYÓDY, F.M.

Research topic: Sustainable water resources management

Research Group on Dynamics of Machines and Vehicles

Head of the research group: Gábor STÉPÁN, F.M.

Research topic: Dynamics of machines and vehicles

HAS – UNIVERSITY OF DEBRECEN (UD)

Public Health Research Group

Head of the research group: Róza ADÁNY, D.Sc.

Research topic: Adherence of the application to the structural preferences of the Hungarian Academy of Sciences (HAS)

Carbohydrate Research Group

Head of the research group: Sándor ANTUS, C.M.

Research topic: Structure determination, synthesis and chemical modification of flavonoid- and carbohydrate type biologically active compounds of natural origin

Ethnographic Research Group

Head of the research group: Elek BARTHA, D.Sc.

Research topic: The Identity of Coexisting Peoples and the Conventions of Inheriting Their Lore and Culture in the North-Eastern Part of the Carpathian Basin

Critical Editions of 18th and 19th Century Hungarian Literatura Research Group

Head of the research group: István BITSKEY, C.M.

Research topic: Critical editions of 18th and 19th century hungarian literature

Apoptosis and Genomics Research Group

Head of the research group: László FÉSŰS, F.M.

Research topic: The third synapses: molecular regulation and medical significance of the cell of it

Cell Biology and Signaling Research Group

Head of the research group: Pál GERGELY, C.M.

Research topic: Cell surface receptors and the protein kinase/phosphatase signaling cascade

Number Theory Research Group

Head of the research group: Kálmán GYŐRY, F.M.

Research topic: Diophantine number theoretical research

Research Group of Homogeneous Catalysis

Head of the research group: Ferenc JOÓ, F.M.

Research topic: Homogeneous Catalysis. Modern applications of organometallic catalysis

Research Group for Theoretical Linguistics

Head of the research group: András KERTÉSZ, C.M.

Research topic: The problem of evidence in theoretical linguistics

Neuroscience Research Group

Head of the research group: Zoltán KISVÁRDAY, D.Sc

Research topic: Sensory processing in the CNS: from spinal cord to cerebral Cortex

Haemostatis, Trombosis and Vascular Biology Research Group

Head of the research group: László MUSZBEK, F.M.

Research topic: Blood coagulation factor XIII (FXIII) and its role in vascular diseases

HAS – EÖTVÖS LÓRÁND UNIVERSITY (ELU)

Systematic Zoology Research Group

Head of the research group: Klára DÓZSA-FARKAS A., D.Sc.

Research topic: Taxonomical and biogeographical studies on the soil fauna in Hungary, and in threatened sub-tropical and tropical regions

Immunology Research Group

Head of the research group: Anna ERDEI, C.M.

Research topic: Formation and regulation of normal and pathological immunoprocesses; development of active substances and diagnostical processes

Egerváry Research Group on Combinatorial Optimization

Head of the research group: András FRANK, D.Sc.

Research topic: Combinatorial optimization

Atelier, European Histography and Social Sciences Research Group

Head of the research group: András GERGELY, D.Sc.

Research topic: Spatial frames in the history of identity: civilization, nation, regions and towns

Parties, Partysystems and Parlamentarism Research Group

Head of the research group: Jenő GERGELY, D.Sc.

Research topic: Parties, Party systems, parlamentarism 1867-1990

Geological, Geophysical and Earth Science Research Group

Head of the research group: János HAAS, D.Sc.

Research topic: Geohazard

Research Group of Theoretical Physics

Head of the research group: Zalán HORVÁTH, F.M.

Research topic: Theoretical investigations in the fields of theoretical-, statistical-
partical- and quantum physics

Research Group of Peptide Chemistry

Head of the research group: Ferenc HUDECZ, D.Sc.

Research topic: Biologically active peptides and their bioconjugates: Synthesis
and analysis of structure-activity relationship

Communication Theory Research Group

Head of the research group: György HUNYADY, F.M.

Research topic: Social communication

Legal History Research Group

Head of the research group: Lajos IZSÁK, D.Sc.

Research topic: Regions, parliamentarism, constitutionality

Philosophy of Language Research Group

Head of the research group: János KELEMEN, C.M.

Research topic: Nature of mental- and linguistic representations

Geolinguistics Research Group

Head of the research group: Jenő KISS, F.M.

Research topic: Geolinguistic. Follow-up survey of the Atlas of Hungarian
Dialects

Research Group of Literary Theory

Head of the research group: Ernő KULCSÁR-SZABÓ, F.M.

Research topic: Philology as a Cultural Technique.

Research Group of Protein Modelling

Head of the research group: András PERCZEL, D.Sc.

Research topic: Characterization of protein-ligand interactions using static and
dynamic structure-determination methods

Research Group for Interdisciplinary Archeological Studies

Head of the research group: Miklós SZABÓ, F.M.

Research topic: Interdisciplinary archeological studies

Research Group for Theoretical Biology and Ecology

Head of the research group: Eörs SZATHMÁRY, C.M.

Research topic: Population dynamics – ecology

Research Group for Online Critical Editions

Head of the research group: Mihály SZEGEDY-MASZÁK, F.M.

Research topic: Online Critical Editions Projekt

Research Group of Historical Russian Studies

Head of the research group: Gyula SZVÁK, D.Sc.

Research topic: State and Nation: Russian and East-European Doctrines of Power in the Context of national and cultural Peculiarities throughout the 10th-20th Centuries (Sources and Historiography)

Research Group of Central Asian Studies

Head of the research group: István VÁSÁRY, D.Sc.

Research topic: Past and present of Middle-Asia

Statistical and Biological Physics Research Group

Head of the research group: Tamás VICSEK, F.M.

Research topic: Collective phenomena in the physical and biological systems

HAS – UNIVERSITY OF KAPOSVÁR (UK)

Research Group of Animal Breeding and Hygiene

Head of the research group: Peter HORN, F.M.

Research topic: Animal and human health risk analysis of environmental contaminants introduced into the food chain

HAS- HUNGARIAN NATURAL HISTORY MUSEUM (HNHM)

Animal Ecology Research Group

Head of the research group: László PAPP, F.M.

Research topic: Diversity and structure of animal populations and assemblages: towards integrated applications in nature conservation and epidemiology

Research Group for Paleontology

Head of the research group: Attila VÖRÖS, C.M.

Research topic: Great changes of the biosphere in the last 250 million years

HAS – UNIVERSITY OF MISKOLC (UM)

Earth Engineering Research Group

Head of the research group: István LAKATOS, C.M.

Research topic: Theory of environment friendly technologies for research and exploitation of natural sources

Materials Science Research Group

Head of the research group: András ROÓSZ, C.M.

Research topic: Development of Cu-based amorph alloys

HAS – UNIVERSITY OF JEWISH STUDIES (UJS)

Research Group for Jewish Cultural Studies

Head of the research group: Endre KISS, D.Sc.

Research topic: Community-faith-education. Complex identities in the latest history of the hungarian jews

HAS – NATIONAL SZÉCHÉNYI LIBRARY (NSZL)

'Res libraria Hungariae' Research Group

Head of the research group: Edit MADAS, D.Sc.

Research topic: Res libraria hungariae

HAS – UNIVERSITY OF PANNONIA (UP)

Air Chemistry Research Group

Head of the research group: András GELENCSÉR, D.Sc.

Research topic: Origin of the aerosols in the atmosphere, effect of them ont he climate

Networked Research Group on Regional Innovation and Development Studies

Head of the research group: Ádám TÖRÖK, F.M.

Research topic: Study of the regional innovation and development of the hungarian economy with special emphasis on the Lisbon process

HAS – PÁZMÁNY PÉTER CATHOLIC UNIVERSITY (PPCU)

Research Group for Ancient Studies

Head of the research group: Miklós MARÓTH, F.M.

Research topic: Ancient studies

Infobionik and Neurobiological Plasticity Research Group

Head of the research group: Tamás ROSKA, F.M.

Research topic: Neural plasticity and its infobionical application

HAS – UNIVERSITY OF PÉCS (UP)

Hungary, Europe and Ibero-America Research Group

Head of the research group: Ferenc FISCHER, D.Sc.

Research topic: The Picture of Hungarians in Central-Europe and in Iberia-America in the Second half of the 20th Century

Neurophysiology Research Group

Head of the research group: László LENÁRD, F.M.

Research topic: Hunger and satiety motivation, maintenance of body weight, learning

HAS – SEMMELWEIS UNIVERSITY (SU)

Inflammation Biology and Immunogenomics Research Group

Head of the research group: András FALUS, F.M.

Research topic: Immunogenetical investigation of inflammatory mechanisms in allergic- and cardiovascular diseases

Neuromorphological and Neuroendocrine Research Group

Head of the research group: Ida GERENDAI, D.Sc.

Research topic: Structural bases of regulatory functions of the central nervous system

Pathobiochemical Research Group

Head of the research group: József MANDL, C.M.

Research topic: Influence of signal transduction in pathobiochemical processes.

Membrane Biology Research Group

Head of the research group: Balázs SARKADI, C.M.

Research topic: Structure and functioning of biological membranes

Research Group for Neurobiochemistry and Molecular Physiology

Head of the research group: András SPÁT, F.M.

Research topic: Mechanism of action of the Ca-mobilizing hormones and neurotransmitters in nerve- and endocrine cells

Research Group for Pediatrics and Nephrology

Head of the research group: Tivadar TULASSAY, F.M.

Research topic: Importance of the cytokine cascade-, vasoactive mediators and the immunomodulation in the formation of short- and longterm vascular and nephrological complications

Molecular Medicine Research Group

Head of the research group: Zsolt TULASSAY, C.M.

Research topic: Acquired and inherited diseases of the gastrointestinal-, endocrine- and epidermal systems

HAS – UNIVERSITY OF SZEGED (USZ)

Turkological Research Group

Head of the research group: Árpád BERTA, D.Sc.

Research topic: Linguistic relationship investigation of the Turkic and Mongolic languages

Research Group on Laser Physics

Head of the research group: Zsolt BOR, F.M.

Research topic: Lasers in the material science, medical science and environmental protection

Chromatin Structure and Gene Expression Research Group

Head of the research group: Miklós Imre BOROS, D.Sc.

Research topic: Role of epigenetical mechanisms in the regulation of gene functions, especially in the case of onkogenesis.

Research Group on the Development of Competencies

Head of the research group: Benő CSAPÓ, D.Sc.

Research topic: A Longitudinal Study of Students' Development in School Context

Research Group on Artificial Intelligence

Head of the research group: János CSIRIK, D.Sc.

Research topic: Artificial intelligence and its applications

Stereochemistry Research Group

Head of the research group: Ferenc FÜLÖP, C.M.

Research topic: Enantioselective catalytic hydrogenizations

Dermatological Research Group

Head of the research group: Lajos KEMÉNY, D.Sc.

Research topic: Genomical-, immunological and cellbiological investigations of the multifactorial dermatological diseases

Research Group of Hungarian Medieval Studies

Head of the research group: Ferenc MAKK, D.Sc.

Research topic: Medievalist studies

Supramolecular and Nanostructured Materials Research Group

Head of the research group: Botond PENKE, F.M.

Research topic: Proteine aggregates of toxical nature. Interdisciplinary research of drug-candidate compounds for treatment of neuro-degenerative disorders

Cortical Microcircuits Research Group

Head of the research group: Gábor TAMÁS, D.Sc.

Research topic: Role of the identified nerve cells in the human- and rat neuronal systems

Analysis and Stochastics Research Group

Head of the research group: Vilmos TOTIK, F.M.

Research topic: Analysis and stochastic

Division of Cardiovascular Pharmacology

Head of the research group: András VARRÓ, D.Sc.

Research topic: Recess of repolarization in healthy and pathological heart and the mechanism of proarrhythmic drug effects

HAS – SZENT ISTVÁN UNIVERSITY (SZIU)

Mycology Research Group

Head of the research group: László HORNOK, F.M.

Research topic: Sexual and clonal reproduction in plant pathogenic fungi

Plant Ecological Research Group

Head of the research group: Zoltán TUBA, D.Sc.

Research topic: Aut- and synecophysiological processes under different climatic conditions and increasing air CO₂ concentrations

Associated groups

HAS-CORVINUS UNIVERSITY BUDAPEST (CUB)

Together for Europe

Head of the research group: Attila ÁGH, D.Sc.

Research topic: Hungarian adaptation and catching up to EU, institutional and policy Europeanization, European Governance

HAS-BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS (BUTE)

Research Group for the Study of the Law of Information Society

Head of the research group: Tamás SÁRKÖZY, D.Sc.

Research topic: Effect of the information society on the legal system – with special emphasis on the e-government.

HAS-UNIVERSITY OF DEBRECEN

Regional Development Research Team

Head of the research group: János NAGY, D.Sc.

Research topic: Sustainable laesehold and food safety

HAS-LISZT FERENC UNIVERSITY OF MUSIC

Ecclesiastical Music Research Group

Head of the research group: László DOBSZAY, D.Sc.

Research topic: History and theory of ecclesiastical music

HAS-KÁROLY RÓBERT COLLEGE

Regional Research Group of North Hungary

Head of the research group: László DINYA, D.Sc.

Research topic: Conception of sustainable development in the North-Hungary Region

HAS-SEMMELWEIS UNIVERSITY, BUDAPEST

Research Group of Neuropsychopharmacology

Head of the research group: Zsuzsanna FÜRST, D.Sc.

Research topic: Central- and periferial regulatory mechanisms as potential drag targets

Mental Health Sciences

Head of the research group: Mária KOPP, D.Sc.

Research topic: Mental Health Sciences: epidemiological and psychophysiological investigation of different indicators, role of the mental and behavioral factors in prevention

Neurochemical Research Group

Head of the research group: Kálmán MAGYAR, F.M.

Research topic: Investigation of the neuro- and vasoprotective mechanisms

Research Group for Biophysics

Head of the research group: Györgyi RONTÓ, D.Sc.

Research topic: Measurement of the environmental- and therapeutic effects of the optical radiation, investigation of its mechanism.

HAS- UNIVERSITY OF SZEGED (USZ)

Bioinorganic Chemistry Research Group

Head of the research group: Tamás KISS, D.Sc.

Research topic: Interactions of metal ions and complexes with biomacromolecules

Reaction Kinetics Research Group

Head of the research group: János KISS, D.Sc.

Research topic: Surface chemistry and heterogen catalysis

HAS-SZENT ISTVÁN UNIVERSITY, GÖDÖLLŐ

Agronomy Research Group

Head of the research group: Márton JOLÁNKAI, D.Sc.

Research topic: Cultivation factors of the environmental- and climate protection



