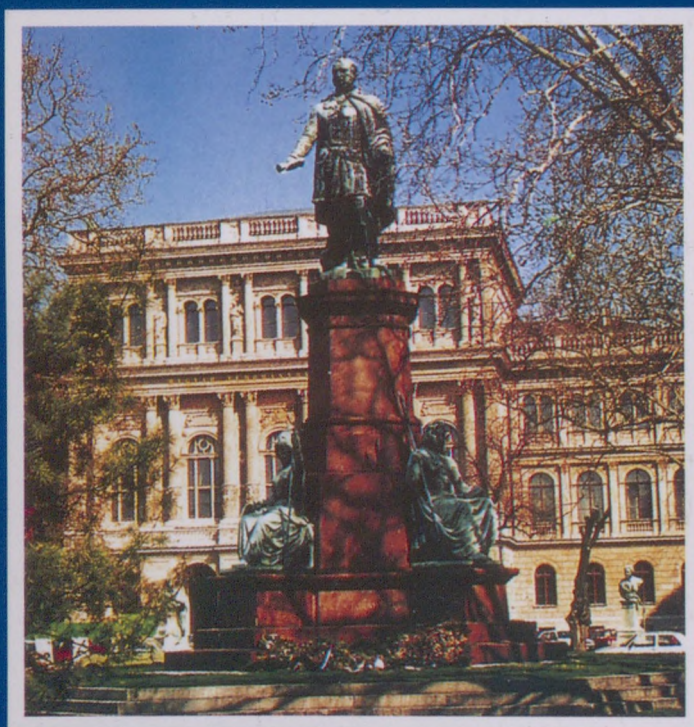


HUNGARIAN ACADEMY OF SCIENCES



**RESEARCH INSTITUTIONS
AND THEIR ACTIVITIES**



2003

HUNGARIAN ACADEMY OF SCIENCES

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2003

The text of this publication was prepared and approved by the institutes themselves

RESEARCH INSTITUTIONS
AND THEIR ACTIVITIES

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ABBREVIATIONS

Scientific degrees:

- Ph.D. = Doctor of Philosophy
- C.Sc. = Candidate of Sciences
- D.Sc. = Doctor of Sciences
- C.M. = Corresponding Member of the H.A.S.
- O.M. = Ordinary Member of the H.A.S

PREFACE

“In the beginning God created heaven and earth. And the earth was void and empty and darkness was upon the face of the deep.” From the very first days of human society man has been induced to search the unknown. Knowledge has always been a fundamental power of mankind. Science - as an essence of knowledge comprises that profound intellectual activity which is manifested in studying natural and social phenomena of our universe.

The Hungarian Academy of Sciences for almost two centuries now, has a three-fold task concerning its activities. In the first place, as a scientific body, it has a role in directing of research going on throughout the country, and in the elaboration, execution and supervision of research programmes. It coordinates research, and evaluates the progress being made in the field of sciences. Secondly, the Academy owns and manages the biggest network of research institutions in Hungary. The third task of the Academy is related to the responsibility in improving the intellectual power of the nation by rendering a service to all endeavours of progress in knowledge.

At the porch of the third millennium the Academy has to face new challenges as well. Hungary, as a prosperous fellow country of the international community has to have a share in that enormous scientific work which is being done in favour of fighting poverty and famine, violence and evil, and which may contribute to the physical and mental development of the world's wealth.

According to some rudiments of medieval wisdom, books have their own fate. All books are believed to carry information from writer to reader. This booklet was compiled and written upon a decision 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, January 2003

Norbert Kroó



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

**PRINCIPAL OFFICERS
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Director: Dr. J. H. Tarr, D.V.M., Ph.D., Veterinary Medicine

INSTITUTES FOR NATURAL SCIENCES

The Institute for Natural Sciences is a research center for the study of the natural sciences. It is a part of the National Institutes of Health, Department of Health, Education and Welfare, Washington, D.C. The Institute is a part of the National Institutes of Health, Department of Health, Education and Welfare, Washington, D.C. The Institute is a part of the National Institutes of Health, Department of Health, Education and Welfare, Washington, D.C.

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Research areas and topics

Areas of research include: *Developmental Biology, Cell Biology, Molecular Biology, Biochemistry, Immunology, Microbiology, Neurobiology, Physiology, and other areas related to the natural sciences.*



Figure 1: A dark, rectangular area, possibly a scan artifact or a very dark photograph.

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VETERINARY MEDICAL RESEARCH INSTITUTE

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Scope of activities

The mandate of the Institute is to investigate the viral, bacterial and parasitic diseases of farm animals and fishes by using both classical and state-of-art molecular biological approaches. The overwhelming part of the work is basic research. In particular, molecular and genetic aspects are increasingly emphasized. However, the duties of the Institute also include the improvement of diagnostic and vaccination methods, and participation in different forms of graduate and postgraduate training, promotion of international collaborations, informing the public about scientific achievements, and assisting 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 proteins of various pathogens. Among the viruses, primarily the adeno-, herpes-, paramyxo-, and certain avian tumor inducing viruses are investigated. Among the bacteria,



The main building of the Institute

members of *Escherichia*, *Pasteurella*, *Salmonella*, *Bordetella* as well as *Mycoplasma* genera are studied to gain information especially about virulence characteristics. An important direction of the research is the elaboration of modern diagnostic methods based on the detection of nucleic acids or proteins 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 the diseases and to the biology of myxosporean species. 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

- Molecular epidemiology and genetic engineering of Newcastle disease virus for the elaboration of better vaccines.
- Gamma herpesviruses of cattle and horse; monoclonal antibody and DNA based diagnostics (PCR) for their detection.
- To develop a negative-marker vaccine against IBR virus for its eradication.
- The genome analysis of fish, snake, monkey and ape adenoviruses to study adenoviral evolution, to produce diagnostics, vaccines and gene delivery vectors.
- Development of a bivalent *in ovo* vaccine against infectious bursal disease and Marek's disease virus to immunize chicken embryos before hatching.
- The study of the proteins of chicken anaemia virus expressed in bacterial vectors.

Bacteriology projects

- The pathology of *Mycoplasma bovis*; improvement of diagnosis; the mycoplasma infection of wild 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, foodborn 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.

Fish parasitology projects

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

Postgradual and gradual training

There are generally about 14 PhD students supervised by scientists of the Institute in their program, on the subject of molecular virology, bacteriology and fish parasitology. Lectures on veterinary microbiology, molecular evolution, bioinformatics and fish diseases are regularly given at the Szent István University, Faculty of Veterinary Sciences, Budapest. Numerous veterinary and zoology students make their diploma work in the Institute.

BALATON LIMNOLOGICAL RESEARCH INSTITUTE

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Scope of activities

The Institute was opened in 1927 and since 1951 it had belonged 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 best studied lake 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 eletrophysiological techniques, but it also deals with the accumulation of environmental pollutants and their effect on neuronal regulation.

Research aims and topics

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



Partial view of the institute

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 physiological and membrane effects of antropogenic 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
- Effect of algae toxins on the transmitter and receptor systems of invertebrates and fishes
- Effect of environmental pollutants on the neuronal regulation of aquatic organisms
- Monitoring of toxic pollution of living organisms in Lake Balaton and its catchment area



The research vessel "Balaton"

INSTITUTE OF EXPERIMENTAL MEDICINE

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Scope of activities

The Institute was established in 1952. The Institute is the only research institution in Hungary dedicated exclusively to medical research. Its activity focuses on basic biomedical research, primarily in the field of neuroscience, including studies on neurotransmission, learning and memory, behaviour, ischaemic and epileptic brain damage, as well as the central and peripheral control of hormone secretion. The research teams of the Institute employ multidisciplinary approaches: traditional, well-established methodologies (e.g., in anatomy, electrophysiology, neurochemistry and pharmacology) are combined with novel cellular and molecular biology techniques. The main purpose of the basic biomedical research is to provide answers to various theoretical as well as clinical problems, with the aim of improving the quality of human life.

In 2000, the Institute was recognized as a *Centre of Excellence* - for three years - by the decision of independent experts of the European Commission, Research Directorates General (5th Framework Programme).



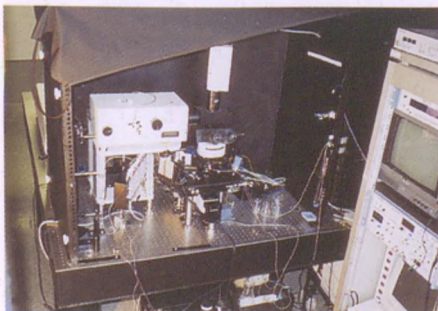
The view of the institute

Research aims and topics

Neuropharmacological studies

- Synaptic and non-synaptic communication between neurons.
- Features of neurotransmitter release under physiological and pathological conditions.
- Receptor-mediated pre- and postsynaptic modulation of neurotransmitter release.

- The role of extracellular nucleotides and nucleosides in signal transmission.
- Ischemia-induced neurochemical changes in the brain.
- Regulatory function of neurotransmitter uptake systems.
- The role of calcium permeable transmitter-gated channels and receptors, influencing $[Ca^{2+}]_i$ in the pre- and postsynaptic modulation of transmitter release: $[Ca^{2+}]_i$ imaging and neurochemical analysis in brain slices.
- Interface role of the sympathetic nervous system in neuroimmune communication.
- Interactions between the nervous and immune systems: *in vivo* and *in vitro* models.
- Bidirectional connections of the noradrenergic neurotransmission and cytokine production.
- Modulation of myelomonocytic differentiation by neurotransmitters.



Using two-photon microscopy, it became possible to study both the physiology and morphology of different cellular compartments in the time window for physiological changes

Cellular neurophysiological research

Understanding the roles of extrasynaptic GABAA and glutamate receptors. Elucidating the mechanisms underlying short-term plasticity at GABAergic and glutamatergic synapses in the brain.

Understanding how sensory information is coded and transmitted in the olfactory pathway.

Revealing functional interactions between ligand- and voltage-gated ion channels at defined subcellular compartments of nerve cells.

Studies in endocrine and behavioral physiology

- Endocrine physiology: the neuroendocrine regulation of the chronic stress response in disease models (adjuvant induced arthritis, streptozotocine-induced insulin deficiency, bacterial lipopolysaccharide administration) as compared with chronic physical stress (e.g., repeated restraint). A special attention is given to the role of vasopressin in these processes.
- Neural and hormonal regulation of behavior: the role of the stress response in controlling aggression and anxiety. Changes in neural activity patterns induced by aggressive behavior and anxiety-provoking situations under the influence of various endocrinological (stress) states.
- Behavioral pharmacology: the interaction between stress and the effects of behavioral pharmacological interventions. A special attention is given to the serotonergic and cannabinoid systems.

Molecular neuroendocrinological studies

- Investigation of stress-related functions at systemic and molecular levels.
- Studying stress-related neural circuitries that mediate physical, psychogenic and immune challenges

using functional neuroanatomical techniques.

- Characterization of mechanisms and transcription factors that regulate the expression of stress-related genes *in vivo*.
- Studying the effect of stress and stress hormones on neurodegenerative processes.

Gastrointestinal research

- Studies on the physiological role of endogenous bioactive regulatory substances in controlling salivary, gastric and pancreatic secretion, as well as gastric and intestinal motility.
- Studies on differential gene expression in normal and transformed human pancreas to understand the alterations at the molecular level.

Functional neuroanatomical studies

- Anatomical, electrophysiological and neurochemical analysis of neuronal networks in archi- and neocortical regions.
- Changes in hippocampal neuronal circuits in animal models of epilepsy and in the temporal lobe of human epileptic patients.
- Light and electron microscopic localization and function of K⁺ and Cl⁻ transporters, phosphatases, kinases and their anchoring proteins involved in the regulation of neurotransmitter receptors.

Molecular neurobiological studies

- Studies on the developmental-dependent, as well as neural activity-dependent expression of the GABA-synthesizing enzyme glutamic acid

decarboxylase (GAD65 and GAD67) at the level of gene regulation.

- Studies on the role of the truncated embryonic GAD forms (GAD25 and GAD44) in embryonic patterning, neuronal differentiation and plasticity of the adult nervous system.
- Generating genetically modified mouse models by using stem-cell and transgenic mouse technology to study the GABA signaling and to test potential drugs for treatment of neurological disorders.

Neuroendocrinological studies

- Neural and humoral mechanisms regulating the hypothalamo-hypophyseal system.
- Chemical identity, plasticity and synaptology of hypophysiotrophic neurons.
- Modulation of gene expression by steroid hormones in the diencephalon.
- The neuroendocrine centers of the human brain.
- Neuropathology.

Cellular neurobiological studies

- Studies on the *in vitro* neurogenesis using immortalized neural progenitor cells derived from embryonic mouse brain.
- Studies on the postnatal neurogenesis, *in vivo*, after implantation of neural progenitor cells into different regions of adult mouse brain.
- Selection and characterization of implantable neural stem cell populations.
- *In vivo* and *in vitro* analyses of neural tissue reactions to mechanical injury.

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. The investigations 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

1. 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.

2. 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.

3. 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.

4. 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).

5. 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.

6. 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).

7. 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.

8. 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.

9. Cereal breeding research

- Breeding of winter wheat varieties with excellent milling and breadmaking 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.

10. Crop production research

- Use of growth analysis, eco-physiological 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.

11. 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

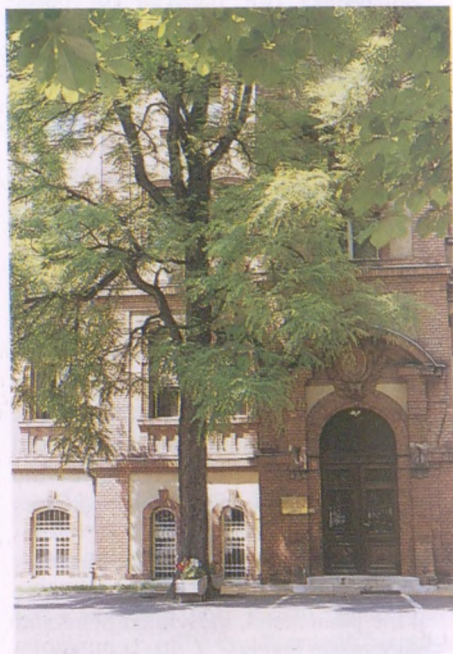
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Director: Tamás KÖMÍVES, D.Sc. (Agric.)
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Scope of activities

The Institute is the research centre for plant protection and it is involved mainly in basic research in the fields of plant pathology, entomology, 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 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 as well as resistance of pests to pesticides. Research also covers the genetic manipulation of crop plants



The view of the institute

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 resistance to bacterial pathogens.
- Characterisation of viruses infecting crop plants. Physiology of virus infected plants.
- Wheat rust resistance.
- Role of free radicals in necrotic disease symptoms and the action of anti-oxidants 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 and Ecotoxicology

- 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.
- Behavioural ecological and autecological studies.
- Life history and reproductive biology of predatory arthropods.
- Monitoring of the effects of pesticides on the environment and non-target organisms.
- Testing the side effect of pesticides on beneficial organisms.

Chemical Aspects of Pest Control

- Development of new selective anti-insect agents.
- Design and synthesis of selective anti-fungal agents.
- Design and synthesis low-dose herbicides and herbicide safeners.
- Natural compounds as potential pest and disease control agents.
- Development of immunodetection systems for environmental monitoring.

RESEARCH INSTITUTE FOR SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

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View of the main building of the research institute

Scope of Activities

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 maintenance 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:

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

Soil Science

1. 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 (in the recently established GIS Laboratory), geostatistical analyses and remote sensing.
2. Identification of various soil function and their multidisciplinary evaluation from the viewpoints of

sustainable biomass production and environment protection.

3. Description, quantification and modelling of the mass and energy regimes of soil, their determining and influencing factors and mechanisms for an efficient prediction and control

Agrochemistry

1. 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.
2. Determination of the nutrient uptake and fertilizer response of the main cultivated crops and – on this basis – the development of the modern plant nutrition system and advisory service based on soil tests, plant analyses and long-term field experiments.
3. Prevention and reduction of soil pollution and its unfavorable agricultural and environmental consequences.

Soil Biology and Biochemistry

Analyses of the role of microorganisms in soil processes and identification and quantification of the existing relationships between soil microorganisms, soil and plants in various natural, semi-natural and agro-ecosystems.

INSTITUTE OF ECOLOGY AND BOTANY

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Fax: (36) 28-360-110
Director: Gábor VIDA, O.M.
E-mail address: vidag@botanika.hu



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

The Institute's scope of activities

Basic and applied research at an international level in the field of ecology and botany. Research is carried out in the following topics including nature conservation and conservation biology:

- Organisation and dynamics of terrestrial plant communities;
- Diversity patterns at various scales;
- Hydrobiology of running and standing waters;

- Conservation biology and restoration ecology;
- Exploring and utilising new floristic resources;
- Molecular phylogenetics;
- Maintenance and development of the collections of the Botanical Garden as a special task.

All the above research topics are based on specific problems and are dealt with in a multidisciplinary manner in close national and international co-operation.

Research aims and topics financed by the Institute's budget

Budget financing ensures the functioning of the Institute and the Botanical Garden, but does not cover the expenses of research in itself. It supplements the salaries of the researchers, the development of the equipment park and the infrastructure of the Institute. It also promotes the development of botanical and ecological databases, and the improvement of GIS methodology in vegetation studies.

Major research topics financed by national and international projects

- Study of the ecological effects of climate change in the sand forest steppe biome
- Forest reserves research programme
- Survey of the natural vegetation heritage of Hungary
- Research in conservation biology and restoration ecology
- Exploring and utilising new floristic resources
- Molecular phylogenetic research

The middle-term research concept of the Hungarian Danube Research Station of the IEB HAS

The middle-term research activity of the Hungarian Danube Research Station comprises two major fields. The majority of researches deal with running waters, especially the River Danube and its tributaries, and streams. The other field embraces the hydrobiological study of some standing waters (e.g. Lake Fertő, Lake Velencei, and some small ponds in the Hanság region). Research is focused on the

structure (species composition, abundance), functioning, material cycles of the aquatic biota assemblages, and the ecological factors affecting them, with respect to the viewpoints of water quality regulations and nature and landscape protection.

The research programme of the Botanical Garden Department

Introduction of alien species

Introduction of alien species and varieties, development of the live plant collection, and extension of native garden and ornamental plant selection. Specifically, the extension of 8-10 genera in the four major groups of our collection, and the augmentation of the dendrological collection.

Registered stand of the national collection

Maintaining and developing the collection in the Botanical Garden, which gives home to the registered population of nearly 800 native plant species and kinds

Conservation biological research

Pursuance of *ex-situ* protection experiments with Hungary's protected plant species.

Ecological Centre

The Centre has been established to join research efforts of four research units of the Hungarian Academy of Sciences in specific fields, to promote the establishment of an Ecological Centre for Central and Eastern Europe. In the

framework of this co-operation, successful ecological and nature conservation research programmes have been carried out in the framework of and financed through a research contract between first the Ministry of Environment and Regional Development and the Hungarian Academy of Sciences, and then between the Ministry of Environment and the Hungarian Academy of Sciences. It seems, however, that effective functioning of the Centre will, on the long run, not be ensured through this type of co-operation but rather by operating the Biological Station in Göd of the Eötvös Loránd University of Science in the framework of the Academy, within the Institute. This would necessitate certain extension and development moves – with temporary financial support from the Ministry of Environment –, leading to the establishment of a Department for Applied Ecology. The relevant research groups of the RISSAC (Research Institute for Soil Science and Agricultural Chemistry) of the Hungarian Academy of Sciences would also be permanently involved in the work of this unit.

The most important ecological research programmes of the Institute are long-term ecological experimental research projects for which experimental stations are essential. It is therefore imperative that the Experimental Ecological Station in Orgovány in the Kiskunság National Park, the plans of which have already been prepared, be set up in the near future in agreement with the Ministry of Environment. This could be carried out in the framework of a further agreement between the Ministry of Environment and the Hungarian

Academy of Sciences. With regard to future trends in research – and not least for the ecological assessment of economic effects of the climate change –, establishment of a Mediterranean Experimental Station by the extension of the scope of activities of an existing station has been considered.

Major Research Trends

In the field of terrestrial ecological research, long-term ecological experimental research projects are at the forefront of international trends. The most cutting-edge specialties in this field are describing, analysing, and modelling changes in biodiversity and the reaction of vegetation structure and plant production to climatic factors and human intervention. The most actual issues concerning rational management of natural resources and sustainable development arise in the field of landscape ecology, where recent ecological research needs to be supplemented with historical ecological research, complex application of biological indicators, the study of populations, and complex mapping methodologies to form a single multidisciplinary research framework.

With respect to the study of water ecology, key trends concern monitoring of the ecological conditions of running and standing waters, also based on a landscape management and landscape ecology approach. For this, the scientific foundations of hydrobiological principles in modern floodplain management have to be laid down.

Management of floristic resources is based on the development of various

modern branches of taxonomy. Two current lines in this field are applying molecular techniques in phylogenetic research and exploring biochemistry and plant chemistry resources.

These branches of research lay the foundations of the successful long-term management of the country's natural

resources, including eco-tourism and nature conservation tourism, the appropriate management of biological resources of waters and floodplains, as well as the exploration and utilisation of yet uncovered resources for the plant and pharmaceutical industry.



The valuable dendrological collection in the Botanical garden of the institute is especially attractive in autumn

BIOLOGICAL RESEARCH CENTER

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General director: Dénes DUDITS, O.M.

E-mail: dudits@nucleus.szbk.u-szeged.hu

Scope of activities

Basic research in molecular and cellular biology. Initiation and realization of the practical applications of the results obtained in basic research in agriculture and in the pharmaceutical, food and chemical industries and in medicine. Participation in organized scientific postgradual training, higher education and work of the International Training Course. Publication of the scientific results. Closest possible cooperation with related institutes of Academy, 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 in 2000.



The Biological Research Center of the HAS in Szeged



Silicon Graphics workstation used displaying Protein structures

BRC INSTITUTE OF BIOPHYSICS

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Director: Pál ORMOS, C.M.

E-mail: pali@nucleus.szbk.u-szeged.hu

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 the protein dynamics and the details of the relationship between structure and function.
- Implementation of high time resolution (10 ns) infrared spectroscopy.
- 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*.

- Investigation of the origin of biological asymmetry.
- Single molecule manipulations by laser tweezers; dynamic studies of the DNS molecule.
- Technical applications of bacteriorhodopsin: development of bio-electronic and nonlinear optical devices.
- Dynamics of the electron transfer in proteins, particularly in cytochrome c and azurin. Effect of the protein structure on the rate of electron transfer.
- Nanobiotechnology. Design of microscopic devices by the laser tweezers. Design and possible biological applications of micro-machines manufactured and driven by light.

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 thermostabile methanotroph isolate and the methane monooxygenase (MMO) enzymes found within.
- Implementation of the biogas intensification system for practical applications.

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.

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 neuro-glial plasticity and neuroprotection.
- Studies of the transport processes in the brain.
- Cell adhesion molecules and the neuro-glial plasticity

BRC INSTITUTE OF BIOCHEMISTRY

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Director: László VÍGH, D.Sc
E-mail: vigh@nucleus.szbk.u-szeged.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 places in living matter and laws governing life phenomena.

Research aims and topics

1. Membrane-lipid and molecular stress biology projects

1/1. Composition and molecular architecture of phospholipids in relation to environmental temperature

1/2. Laboratory of Molecular Stress Biology: The role of membrane physical state in temperature perception and signaling; regulation and molecular architecture and function of chaperones

2. Neurobiology projects

2/1. Structural and functional analysis of opioid (morphine) receptor

system: molecular basis of the heterogeneity

2/2. Synthesis and radioactive labelling of biological active compounds

2/3. Laboratory of Molecular Neurobiology

3. Eukaryotic molecular biology projects

3/1. Regulation of intracellular protein breakdown

3/2. The role of cytokines in immune defense and in autoimmune diseases

3/3. Eukaryotic transcription regulation

3/4. Structure, expression and regulation of genes coding for extracellular matrix proteins

4. Nucleic acid research projects

4/1. Sequence-specific DNA recognition by type II restriction endonucleases and modification methyltransferases

4/2. In vitro evolution studies on enzyme thermotolerance and stability

4/3. Genome manipulations in prokariotes

BRC INSTITUTE OF ENZYMOLOGY

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Director: Peter FRIEDRICH, O.M.
E-mail: friedric@enzim.hu



The main building of the institute

Scope of activities

Basic research aimed at elucidating the role of enzymes and other proteins in biological processes, regulation of these processes on molecular level, studies of proteins and polypeptides. Improvement of experimental methods and development of their theoretical basis.

Research aims and topics

– Structure-function relations in enzymes (proteins).

- Studies of new protease families.
- Structure-function studies of the components of the proteolytic cascade playing a critical role in fibrinolysis and tissue remodelling.
- Relationship of protein flexibility, stability and function.
- Molecular structure-function studies in multidomain enzymes.
- Structure and molecular mechanism of multidrug resistance transporters of tumor cells.
- Novel methods for DNA-diagnosis of inherited diseases.

- Theoretical studies of protein primary and three-dimensional structures, stability, dynamic properties and protein design.
- Organization of enzymes and proteins in complex life processes.
- Protein structural basis of neuronal plasticity.
- Calpain system in health and disease.
- Molecular immunology. Molecular mechanisms of the complement system activation.
- Role of dynamic enzyme associations in the regulation of mitosis and glycolysis.
- Enzyme deficiency.
- Mechanism of action of drugs.



BRC INSTITUTE OF GENETICS

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Director: István RASKÓ, D.Sc. (medicine)
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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.
- Molecular mechanisms of *de novo* chromosome amplification.

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.

BRC INSTITUTE OF PLANT BIOLOGY

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Director: Imre VASS, D.Sc

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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 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 studied by DNA microarrays
- Mutagenesis program for the identification of UV-B photoreceptor(s) 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

Regulation of the plant cell division cycle

- Identification of the key elements, which participate in the regulation of stress- and hormone-induced signal transduction
- Isolation and characterization of plant histon-dependent kinase 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 with the cell cycle
- The effect of stress factors on cell cycle followed by cell division markers

Studies on the role of non-coding RNAs in plant cells.

INSTITUTE OF NUCLEAR RESEARCH

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The main building of the institute

Mission statement

The institute is devoted to

- basic and applied research in atomic, nuclear and particle physics,
- the applications of physical methods and knowledge in other fields of science (materials research, environmental and earth sciences, biological and medical research etc.) and in solving practical problems (for industry, agriculture, medicine etc.),
- developing techniques and instruments for basic and applied research,
- taking part in higher education.

Research program

Reseraches in subatomic physics and in applied nuclear physics

- Study of few-body problems in quantum mechanics. Analytical and numerically exact solutions of quantum mechanical problems and their application to atomic, solid state, nuclear and subnuclear physics.
- Experimental and theoretical study of exotic nuclear systems and states, such as
 - nuclei outside the stability region and near the nucleon dripline,

- highly deformed nuclear shapes,
- special resonances, exotic types of nuclear decay,
- the formation of nuclear clusters,
- the neutron skin and neutron halo phenomena.
- Study of nuclear reactions relevant to astrophysics.
- Participation in the analysis of experiments at the accelerators of CERN, preparations for the participation in subsequent experiments.
- Study of multiple jets with perturbative quantum chromodynamics.
- Measurements of nuclear data for nuclear techniques.
- Production of isotopes and labelled compounds for medical purposes.

Basic and applied research in atomic physics

- Electron- and X-ray spectroscopy and theoretical studies related to special effects appearing in ion-atom collisions, such as
 - multiple collision phenomena,
 - rare and higher order processes.
- Study of effects of atomic physics, surface physics and plasma physics generated by the beam of multiply charged heavy ions produced in an electron-cyclotron resonance (ECR) ion source.
- Study of the electronic structure of surfaces, micro- and nanolayers by Auger and photoelectron-spectroscopy.
- Study of the magnetic and structural properties of superconductors of high transition temperature.

- Study of the properties of nanostructured alloys and composites produced by mechanical techniques.
- Research of the environment, in earth sciences and archaeology*

- Investigation of the composition and propagation of atmospheric aerosol contaminants.
- Examination of heavy metal environmental contamination with ion beam analysis.
- Studies in isotope hydrology, investigation of the sensitivity of natural water reserves against contamination.
- Studies related to the safety analysis of nuclear waste depositories.
- Investigation of the propagation of atmospheric radon and of its presence in the human environment.
- Geochronological studies with the potassium-argon technique.
- Archeometry with the radiocarbon technique, characterisation of archeological finds by their trace element composition.
- Trace element studies on geological samples with a scanning proton microprobe.

Development of methods and instruments

- Further development of accelerator based analytical methods (PIXE, DIGE, RBS, etc.).
- Radiation-hardness tests of electronic components.
- Studies related to the optimization of the parameters of semiconductor and scintillation particle detectors.
- Development of electronic signal processing instruments.

KONKOLY OBSERVATORY

(founded by Miklós Konkoly-Thege in 1899)

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

Scope of activities

Carrying out observational astronomical studies, mainly related to the physics of the variable stars, galactic structure, solar activity and the terrestrial upper atmosphere. 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 of the upper atmosphere of the Earth and Mars with space-borne equipment. Studies on solar activity, investigation of the problems of sunspots and prominences.



The main building of the Astronomical Institute (Konkoly Observatory) of the HAS (designed by Gyula Sváb) and János Pásztor's sculpture: "Sic itur ad astra"



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

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

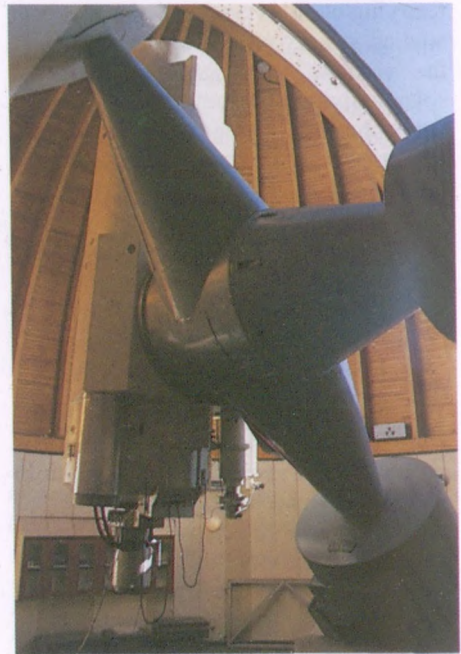
Studies of galactic structure and processes of star formation in Milky Way, mainly from the observational point of view.

Upper atmosphere

A better insight into the physical condition of planetary atmospheres (Earth, Mars), correction of the atmospheric models.

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.



The 1 m RCC (Ritchey-Chretien-Coudé) telescope equipped with a five colour photoncounting photometer

RESEARCH CENTRE FOR EARTH SCIENCES (RCES)

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General director: György PANTÓ, O.M

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The Building of the Institute

The main task of the Research Centre for Earth Sciences is to run basic research in the field of geography (physical - and social geography), geodesy, geophysics and geochemistry as well as environmental sciences related to earth sciences.

The research centre provides a chance for common research programmes involving its research institutions. A

major issue is to cooperate with other research institutes and with universities in research, graduate and postgraduate education.

The two research institutes and the research laboratory form a common conception in research aim, which may manifest in a higher efficiency in the field of a broader interdisciplinary scientific activity.

RCES GEOGRAPHICAL RESEARCH INSTITUTE

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

E-mail: schweidf@helka.iif.hu

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 propagation 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 requirements.

Priorities should be given to the following topics:

In the field of physical geography:

- the analysis of the geographical consequences of global natural processes;

- studies on the use of domestic natural resources and environmental issues;
- investigations into the degradation of the natural environment and related local tensions.

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

- International processes exert an 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.
- With the turn of the millennium 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 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 geographical information system (GIS). An internal computer network has been developing continuously under the supervision of the *department of cartography*. Based on the system built so far the publication of a series of maps showing the changing ethnic pattern in the Carpathian Basin was launched in the mid-1990's (Transylvania, Slovakia, Transcarpathia). These activities are to be continued (map sheets on Croatia and Slavonia, Voivodina, Burgenland). In the present decade a development of GIS in the physical and human domains is to be going on.

The *library* serves research, education and culture and scope of its activities has expanded since 2000 (due to the application of Tinweb 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.

1. 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. Sometimes these slides and slumps cause serious material and financial

damage to settlements, industrial establishments, farming areas. 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 slides and slumps can be instrumental in the preparation of masterplans for settlements.

- Geographical investigations into natural, social and economic processes 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.
- Study of late Cenozoic formations in the Carpathian Basin 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, Russian, Chinese institutions).

- Landscape geography of Hungary: geology, mineral resources, relief, climate, hydrology, soil and vegetation cover of the North Hungarian Mountains to be summed up in a monograph as a volume in the series "Landscapes of Hungary".
- 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 (PAGES), INQUA and by bilateral cooperation projects.

Complex geomorphological research and mapping are to be continued after 2001: 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.

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

- Aridification in the Carpathian Basin. Investigations into the physico-geographical consequences of an assumed climatic change.
- Studies on the above physico-geographical processes are continued in the framework of the MEDALUS IV programme (in cooperation with the experts from Mediterranean and other EU countries).
- One of the objectives of the research programme is the identification and mapping of environmentally sensitive areas. Criteria of the liability to aridification are investigated in study areas located in the Kiskunság, shown in maps, stored in GIS, and the resulting regions are delimited also using GIS methods.
- Another project within the MEDALUS IV programme is purposed for the application of the MEDRUSH model in a medium-sized catchment the largest part of which is situated within the area most affected by aridification. Parameters of the model are to be established by a detailed field survey. This research is aimed at predicting the changes in physico-geographical components under conditions of the assumed climatic change (scenarios for 1-2 decades and for a century) in comparison with the southern European trends.
- Studies on soil erosion. After having completed the survey in the northern catchment of Lake Balaton a project was launched to investigate the role of soil erosion and of the related water pollution in the siltation and contamination of the lake. The project

is to be accomplished with a survey of the applicability of USLE models.

- An analysis of changes having taken place in state of the environment of Lake Fertő and its medium-term forecast (an Austro-Hungarian project on the territory of the national park). The project is targeted to establish the extent to which environmental pollution of agricultural source poses a hazard to the ecological balance of the lake.

3. 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 privatisation (housing market, industrial structure). Comprehensive studies encompass different levels of urban hierarchy (cities, medium and small towns). Since 2001 these comparative studies have included sustainability of urban green zones and theoretical and methodical issues of urban living spaces.
- An EU project launched in 2001 deals with the social rehabilitation of declining urban quarters
- An emphasis is put on the social 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 establishments, regional and structural pattern of unemployment, 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, analyses of past ethnic geographical studies and mapping.
- Historical geographical studies have been carried out since 2000 and span a period between 1918 and 1950 focusing on international migrations that had affected Hungary. The two major issues are Hungarians escaping from the successor states of the Austro-Hungarian Monarchy and to the home country (after First World War) and ethnic Germans expatriated from Hungary (after Second World War).



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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 Observatory. Research

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

Geophysics: the main topics are the geomagnetic field and the role of its temporal variations in the study of the Earth's interior and in research of processes in near-Earth space (ionosphere, magnetosphere). These problems are closely connected with electromagnetic geophysical exploration methods and with the operation of the Geophysical Observatory István Széchenyi at Nagyecenk. The field of interest includes all processes in connection with terrestrial electromagnetism, starting at the Sun and ending in the Earth's core.

Seismology: its task is to operate the Hungarian seismological observatory network, to determine the focal parameters of earthquakes in Hungary and in its neighborhood, macroseismic investigations, to update and archive the database of earthquakes recorded by Hungarian seismological stations and participation in international networks.

Main topics

Global and local geodynamic processes: are studied using gravimeters, extensometers and tilt measuring instruments. The recorded data lead to considerations concerning the Earth's internal structure and tectonic processes in the Hungarian territory. Special emphasis is laid on the continuous increase of the accuracy of the measurements, on the development of instruments and on the effects of environmental parameters on measured data and their accuracy. This research is based on data obtained in observatories

in Hungary and in neighboring countries in the framework of international cooperation. The results of this research can be practically used in locating the sites of dangerous industrial plants.

Modeling of the Earth's gravity field. New methods led to get a more reliable lithospheric 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 contribute to scientific research connected to the preparation of the measurement of the new high order-leveling network in Hungary.

Development of GPS measurements. New methods are being developed and introduced into the processing of GPS measurements which apply the information offered by the International GPS Service for Geodynamics – precise coordinates of IGS stations, precise ephemerides of clock errors of satellites - with possible highest accuracy. Advantages from the use of time differences are also incorporated into this processing method, which are only insufficiently taken into account in present processing methods. This research will lead to software at a scientific level.

Research of processes leading to landslides. In the framework of international cooperation (Austria, Germany, Italy, China, Bulgaria) and in an interdisciplinary effort, test areas are being found where processes leading to landslides and to rock collapse. Geodetic and geodynamic measurement methods will be developed for this purpose; recorded data are to be interpreted for the detection of

interrelations between processes, which lead to landslides. The practical benefit of this research is realized in catastrophe protection (proposed EU project).

Mathematical methods in geodesy. The wavelet transformation of the covariance function of 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 introduction of Kálmán filtering in the geodetic practice may bring new results in the study of geodynamic processes and in the analysis of orbit parameters of artificial satellites.

Development of photogrammetric methods. The importance of photogrammetric methods has significantly increased nowadays; that is why new image processing methods and photogrammetric programs are to be developed which are able to solve the new tasks of measurement techniques.

Solar activity, space weather. Knowledge about the corpuscular radiation has increased very rapidly in recent years and the Institute played a significant role in this development. The results of this activity are important for understanding space weather and for its forecasting.

Short period variations of the geomagnetic field. A traditional field of research of the Institute is geomagnetic pulsations. At present, the latitudinal fine structure of the pulsations is being

studied in international (Austria, Italy) cooperation.

Practical use of geomagnetic observatory data. The data recorded in the observatory are used as references when applying different geophysical exploration methods. In order to ensure the survival of this role, the operation of the observatory should be continued.

Structure and phenomena of ionosphere and magnetosphere. The better knowledge of the processes in the near-Earth space leads to new facts about the structure, composition and physical processes there. The basis for this research is again the observatory data.

Schumann resonances get more and more important in recent years as they allow conclusions about global warming. There is a very wide international cooperation in this topics.

Electromagnetic environmental geophysics. This is a new topic and has many different applications. The electromagnetic field can be used on the one hand to study environmental conditions; on the other hand electromagnetic "pollution" causes certain problems, especially on the case of modern technologies.

New electromagnetic exploration methods. These new methods enable the solution of problems, which could not be solved by traditional methods. Several such methods were experimentally used, their possible fields of application should be found by future experiments.

Electromagnetic structure of the Pannonian Basin and other

neighboring areas. Research in this field has also a long history in the Institute. Several problems, as e.g. the exact location of conducting formations, their material, geological processes and their results (faults, fractures) are only partly cleared, they need further investigations, and namely there are areas practically unknown both in Hungary and in surrounding countries.

Connection between geomagnetism and rotation of the Earth. This is a new research field, but there is international interest in it. Connections between long-term processes of the Earth are more supposition than proven facts. New results are expected just in this field.

Paleoquakes and historic earthquakes. The determination of the focal parameters of these quakes is important from the point of view of the seismicity of the Carpathian Basin. A database is being planned which will include all paleo-, historic and recent earthquakes observed in the Carpathian Basin. The data will be available in a space informatics system.

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 topography is applied and developed for a better knowledge about the Pannonian Basin. Using seismographic records, the velocity distribution is determined in the Earth's crust and upper mantle together with

the velocity contrasts. Using 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.

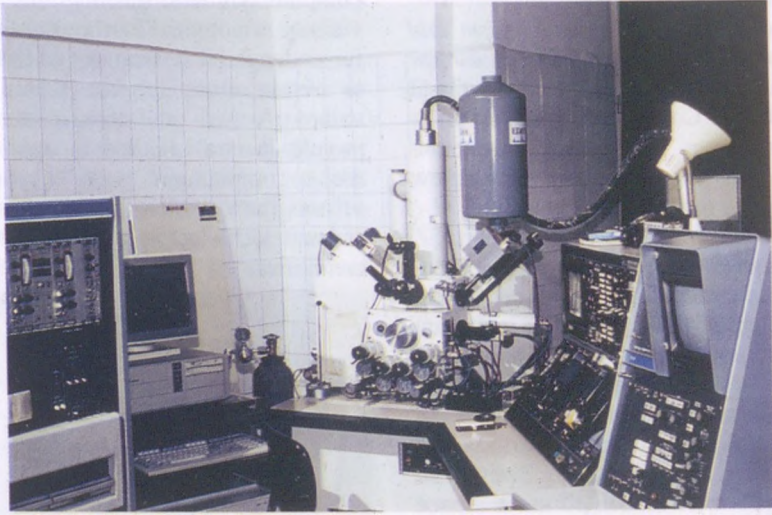
Seismic risk. Up to now, seismic risk evaluations in Hungary was based on probabilities. It is now necessary to compute synthetic seismograms for the vicinity of potential earthquake foci and for endangered settlements in their area to obtain more reliable seismic risk values. A two- and three-dimensional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



Preparation of an electromagnetic experiment
(Photo Kisalföld)

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JEOL Superprobe 733 electron microprobe for analyses of chemical composition of mineral phases and microtexture of rocks

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 Hungary 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 bioessential and toxic elements, with special emphasis to protection of soils, subsurface water resources and cultural heritage.

Research aims and topics of the Laboratory

With respect to the research topics, continuity as well as opening of new research directions play essential role in the research strategy of the Laboratory. 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 Tertiary 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 deliberated 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 determination 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.
- Geochronometry: 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 historic monuments and buildings.

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The view of the research center

The Chemical Research Center incorporating the former Central Research Institute for Chemistry, the Institute of Isotopes, and the Research Laboratory of Inorganic Chemistry was established by the Hungarian Academy of Sciences in 1998.

The laboratories of the Chemical Research Center have carried out pioneering work on several scientific fields in Hungary. Their recent

activities cover fundamental as well as applied research topics.

Fundamental scientific activities of the Chemical Research Center involve: research in vital fields of chemistry and related scientific areas, with special regard to correlations between the function and the chemical structure of new functional materials such as medicines, polymers, composites, catalysts, nanostructured materials and isotopes.

The main research areas are as follows

Medicinal chemistry,
Surface chemistry,
Materials chemistry and environmental
chemistry,
Structural chemistry,

Nuclear chemistry.

The total scientific output is represented by 350-400 scientific publication, annually. The Chemical Research Center has a staff of 430, inc. 238 research scientists.

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The main research areas are as follows

Medicinal chemistry,
Surface chemistry,
Materials chemistry and environmental
chemistry,
Structural chemistry.

Medicinal chemistry

Research in the area of organic and
biomolecular chemistry

One of the main goals of the research
activity at the Chemical Research
Center is the elaboration of new
preparative



X-ray laboratory for structural studies of polycrystalline and amorphous materials
Institute of Chemistry, Chemical Research Center



In situ Mössbauer spectrometer
Institute of Isotope and Surface Chemistry, Chemical Research Center

methods to allow the synthesis of new types of organic compounds and, thereby, to recognize the essential physiological functions of some known and unknown target molecules. In the preparative organic chemistry field the following methods seem to be the most promising ones: stereoselective transformations, application of metal organic reagents, reactions with transition metal catalysis and, also, application possibilities of selective protecting groups.

Three types of organic molecules are in the focus of the investigations: new heterocyclic systems, oligonucleotides, and oligosaccharides. Research of synthetic heterocyclic chemistry is concentrated to two main fields: natural organic compounds (mostly ergolin, oxaindole and indoloquinolizidine alkaloids) and polyfused unsaturated skeletons of intercalating ability.

The field of recognition and design of new biologically active molecules is at present undergoing major restructuring within the framework of the nationwide consortial project (1/047 NKFP 2001-2003) on "Design of drugs and diagnostics based on validated target molecules (MediChem)". As the home institution, the Chemical Research Center - in close cooperation with the other nine members of the MediChem Consortium - focuses its activity on the design of drugs and diagnostics in the field of neuroprotective and antitumor areas. These developments have provided new opportunities for gaining data from series of experiments on molecular, biochemical and complex biological models with the aim of designing molecules interacting specifically with the pathological processes in the diseased organism. In parallel with these developments, biostructure-based drug design in the

field of experimental epilepsy, ischemia and light-adaptation are areas of growing importance. Application and development of the following methods relating to biological activity are planned: exciton labeling for the characterization of protein structure, simultaneous imaging and electrophysiological data acquisition, quantitative luminometry of antioxidants, spin-trapping of free radicals as well as testing mutagen chemicals.

Surface chemistry

Investigations on the field of surface chemistry and heterogeneous catalysis. Thematic groups of the research direction:

- Structure and catalytic activity of *non-metallic materials*, having ordered structure, such as, zeolites, mesoporous oxides, nanoporous inorganic materials.
- The catalytic effect of these materials comes from the active centers generated within the materials or on their surface. Moreover, these materials can have significance as catalyst supports.
- Structure and catalytic activity of *metal surfaces*.
- The research concerns the preparation and catalytic properties of single crystal surfaces, polycrystalline foils and clusters, furthermore, supported metal particles, structured on the nanoscale.
- Investigation of *amorphous materials*, particularly, multicomponent metal oxides that are active catalysts or catalyst supports.

The *hydrocarbon conversions* proceeding over the above-mentioned

materials are of both scientific and commercial importance. Reactions that can be used to decrease the emissions of stationary or mobile sources are the main subjects of the *environmental catalysis* research. Regarding the catalytic reactions of organic compounds priority is given to the selective hydrogenation and oxidation. Distinguished attention is paid to the investigation of the asymmetric catalytic reactions.

The research of interfacial phenomena is considered as very important. Macroscopic and nanosize gas/solid and liquid/solid interfaces are to be examined using physical and chemical methods. Combinatorial approach and high-throughput reactor systems are used for the examination of some catalysts and reactions, including both the catalyst preparation and the catalytic testing.

The topics of the current research on the field of corrosion inhibitors are as follows:

- Investigation of the corrosion and inhibition processes on atomic level by the joint use of electrochemical and conventional surface characterization methods.
- Studies of the correlation between the structure/electron structure of inhibitors and the inhibition effect.
- Development of new environment-friendly inhibitors and inhibitor compositions using structure-efficiency relationships.

Investigation on functional materials obtained by nanoscale surface modification:

- Structure of self-assembling monolayers, the kinetics of layer

formation, possibilities of applications.

- Preparation of nanocomposite materials, which are of special optical properties, using the sol-gel technique.
- Modification nanotube surface for the application in nanocomposite research.
- Generation of mono- and multimolecular films.

On the research field of nanostructured layers the following projects are to be noted:

- Formation mechanism and properties of intermetallic nanostructured layers.
- Studies on the feasibility of preparing nanolayers, having biomimetic structure.
- Investigation of the nanomechanical properties of composites and thin layers by nanoindentation.

Materials chemistry and environmental chemistry

Polymer chemistry is undergoing a rapid and extensive development nowadays. Manufacturing, processing and utilizing polymers is a major factor of the industry and the economy of countries all over the world.

The fundamental aim of research in the field of polymer chemistry and material science thereof is developing new polymerization methods which can be utilized for the synthesis of new complex structures with new exceptional properties. The structure and properties of these materials are then examined using material science techniques, and potential applications of these new materials are also investigated. Research efforts are

typically focused on quasiliving polymerizations, synthesis of the thus obtainable macromolecules and nanophase separated amphiphilic conetworks, the structure and characteristics of these materials, and the environmentally friendly degradation of certain polymers such as PVC.

At present the applied plastics research focuses on four main areas: stability and degradation of polyolefines, heterogeneous polymer systems, biologically degradable polymers and polymer composites, preparation and characterization of nanocomposites.

Laboratory of Environmental Chemistry has been working as accredited laboratory at the Institute of Chemistry since 1996. The experiments focused on environmental protection and environmental chemistry can be divided into the following fields:

- Adsorption and desorption of surfactants in different types of Hungarian soils, examination of effects of the processes influencing their conditions.
- Evaluations of synergic or antagonist effects of environmental pollutants responsible for the inhibition of biological and microbiological processes on the fertility of the soil.
- Investigation of the mechanism of binding of pesticide residues and environmental pollutants to agricultural plants.
- Development and application of novel analytical methods in environmental protection.

Structural chemistry

The aim of the activity on structural chemistry is two fold:

- conducting fundamental research,

-lending support to the respective structural researches within and outside the Center in the framework of scientific cooperations.

The unique instruments in the Center (e.g. Sum Frequency Generation Spectrometer, X-ray Diffractometers, Electron Spin Resonance Spectrometer, Mass Spectrometer with Ion Chromatograph, ORD-CD Spectrometer with LC etc.) serve the purposes of topics of both research institutes of the Academy and the universities.

Some of the most important topics are as follows:

- Application of infrared and Raman and NMR spectroscopy in structure elucidation of peptides, synthetic compounds, isolated natural products and their semi-synthetic derivatives, and in metabolism research.
- Vibrational spectroscopic investigation of surfaces, thin layers and nanostructures by means of SFG, IR reflection methods and IR and Raman microspectroscopy.
- Experiments toward the adaptation of on-line coupled HPLC/FT-IR measurement method and its analytical applications. Application of chemometric evaluation of data to the analysis of vibrational spectra of multicomponent mixtures.
- Study of gas phase ion structure and reactivity by MS methods.
- Application of the Masskinetics program for calculating internal energy effects, energy transfer, kinetic energy release.
- Application of quantum chemistry in mass spectrometry.
- Analysis of the structure of biomolecules (peptides, glycopeptides, carbohydrates, nucleotides) by MS methods.
- Decomposition of multi-substituted ESR spectra by two-dimensional analysis. Application for studying the co-ordination of biological important ligands to transition metals.
- Detection and dynamics of free radicals investigated by spin trapping techniques.
- ESR study of the co-ordination of iron(III) ions in zeolites.
- Investigation of decomposition kinetics of bis-benzimidazole clathrates and their isostructurality. Crystal structure determination of calixarene host-guest systems and those of derivatised thiourea metal complexes.
- Structural investigation of nitrene-complexes by X-ray diffractive methods.
- X-ray diffraction analysis and Mössbauer spectroscopic investigation of organotin(IV) cupferronato complexes with potential biological activity.
- Experimental investigation of the structure of liquids and amorphous materials: comparative studies for non aqueous solutions by X-ray- and neutron diffraction, computer simulation and quantum chemical methods.
- Structure of liquids at extreme thermodynamic conditions: investigation of structural changes of hydrogen bonded networks in simple alcohols and amides, their solutions by X-ray diffraction.
- Structure determination of poorly crystallizing materials: search for model compounds and methodical studies based on powder X-ray diffraction technique.
- Determination of product branching ratios as a function of temperature for the reaction of OH-radical with

- acetone using direct experimental methods and *ab initio* quantum chemical calculations.
- Kinetic studies of the elementary reactions of freon replacement fluoroalcohols in relevance to atmospheric chemistry.
 - Development of laser flash photolysis and fast flow methods to generate acetyl radicals and procedures.
 - Solvent and temperature effects on ion pair formation via photoinduced proton transfer in excited hydroxynaphthalimide-N-methylimidazole hydrogen bonded complex.
 - Kinetics and mechanism of the reaction between triplet excited C_{60} and calixarenes in the presence of pyridine derivatives.
 - The consequence of the H-bond formation on the photophysics: interaction of naphthalimides with fluorinated alcohols.
 - The effect of number and position of condensed aromatic rings on the dual luminescence properties of phenanthridinone derivatives.
 - H-bond formation with aromatic hydrocarbons and the effect of complex formation on the photophysics.



Laboratory of Mass Spectrometry
Institute of Chemistry, Chemical research Center

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

The Institute contributes to the following main research fields of the Chemical Research Center:

Surface chemistry and catalysis

Structural chemistry

Nuclear and isotope chemistry

The research activity of the Institute is focused on the field of surface science and catalysis and the nuclear chemistry, with special emphasis on the

multilateral cooperation of the two disciplines: application of nuclear techniques in the surface chemistry and other research, utilization of the knowledge gained by nuclear chemistry on the fields listed above.

In the last years in the surface chemistry and catalysis the interest towards the nanoparticle containing catalyst systems increased, on the other hand the extensive application of Mössbauer spectroscopy is also enhanced. In the

nuclear field the cold neutron research and the development of novel methods of nuclear safeguard is emphasized. The latter is motivated by the demands of defence against the nuclear terrorism and the requirements formulated in the Additional Protocol to the Agreement between Hungary and the International Atomic Energy Agency in the framework of the Treaty on Non Proliferation of Nuclear Weapons.

Surface chemistry and catalysis

The main concern is the relation between the structure of the catalyst, in particular, the surface structure and the catalytic properties. The research topics are as follows:

- Preparation of nanostructured model catalysts, mono- or bimetallic clusters, atomic/molecular level investigation of their morphology and electron structure and their structural changes (restructuring, segregation etc.).
- Study of the metal/substrate interaction in chemisorption of CO, NO, CH₄ and other hydrocarbons;
- Investigation of relations between surface composition, electronic state, adsorption ability and catalytic activity of zeolite supported mono- and bimetallic catalysts in CO hydrogenation and reaction of environmental interest (e.g. decomposition of NO_x).
- Study of synergism on supported bimetallic nanoparticles prepared by different methods (including colloid chemical methods) in C-H activation (e.g. CH₄ homologation), oxidation of CO or hydrocarbons, hydrogenation of monoenes.
- Investigation of the effect of catalyst modification by adspecies on chemo- and regio selectivity in selective hydrogenation reactions.

- Study of molecular structure – catalytic properties relationship in metal/MO_x and WO_x systems to reveal the role of sulfur uptake in hydrodesulfurization and hydrodeoxygenation.
- Study of hydrogenolysis, isomerisation, aromatisation, dehydrocyclisation of hydrocarbons on supported and unsupported catalysts and the dependence of catalytic characteristics of mono- and bimetallic (Pt-Pd, Pt-Ir, Pt-Ge, Pt-Sn, Rh-Ga, Ir-Ca) catalysts on the chemical composition and physical properties.

Structural chemistry

- Study of supported catalysts by FTIR emission technique.
- Determination of atmospheric pollutants in the atmosphere in vicinity of chemical factories and laboratories by high-sensitive, accurate and reliable FTIR spectroscopy.
- Application of FTIR microscopy for medical diagnoses.
- Study of gas phase mechanism of the reactions $M+NO_2 \rightarrow MO+N_2O$ and $M+NO_2 \rightarrow MO+NO$ (M: Sc...Cu).
- Quantumchemical studies of catalytical reaction CO₂+C₂H₄ for determination of elementary steps acrylic acid formation.
- Polymerkinetical studies on some acrylic and methacrylic esters by pulsed radiolysis.

Nuclear and isotope chemistry

Nuclear analytical and chemical research and study of fissionable nuclear material:

- Development of PGAA technique: improvement of the selectivity and

sensitivity, development of portable version.

- Extension of PGAA techniques for the study of fissionable nuclear materials (fissionable materials, fission products, matrix).
- Development of new techniques for studying materials with cold neutrons (Mössbauer-spectroscopy with sources excited by neutrons, positron annihilation).
- Determination of Pu content of a Pu-Be sources by coincidence counting of neutrons. Detection of fissionable materials in smuggled samples using neutron-interrogation techniques with measurement of delayed neutrons. The goal of these works is to determine the fissionable content of unknown composition (confiscated, discovered) samples for national safety control.

Interaction of ionizing radiation and matter: gamma and electron irradiation:

- Study of the kinetics of radiation induced chemical reactions (hydrocarbon reactions, reactions of inorganic and organic substances,

polymerization in aqueous solutions and in organic solvents).

- Radiation purification of waste waters.
- Development of new dosimetry systems using optical absorption, emission or conductivity readout for radiation technological, medical and environmental applications.
- New solid-state dosimeters, aim: development of LET dependent dosimeters.
- Radiation resistance of optical and electronic devices with aiming at the development of radiation resistance tests.

Isotope Chemistry:

- Synthesis methods of labelled compounds for medical application in diagnostics and therapy.
- Development of application of radioimmunoassay methods.
- Research on new isotope separation methods.
- (In cooperation with Institute of Isotopes Co. Ltd.)



Kratos XSAM-800 type X-ray photoelectron spectroscopic (XPS, ESCA) instrument
Research laboratory Materials and Environmental Chemistry, Chemical Research Center

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The main research areas are as follows

Materials chemistry
Environmental chemistry

Materials chemistry

The research in materials chemistry in the Center is aimed at revealing the chemical aspects of materials science and technology, a typical field of science of interdisciplinary nature. In this context, special attention is devoted to the chemical details of correlations among the composition, micro- and macrostructure, properties and production of functional and structural materials. Models studied include self-organising surface layers, surface coatings of special properties, functional micro-gels, different special polymers and copolymers, micro- and nanostructured monolithic and composite materials, metallic structural materials, and also micro- and nanosized ceramic powders and ceramic materials produced from them.

The research topics are as follows:

– Synthesis and modification of nitride and polymer model surfaces with ion and laser beams

- Development of surface analytical method for quantitative characterization of ultra thin layers
- Kinetic and spectroscopic studies on carbon plasmas by modelling and LIP spectroscopy
- Studies on carbon plasmas generated by laser ablation of graphite using numeric modelling and LIP spectroscopy
- Synthesis of carbon nanotubes in laser induced carbon plasmas and analysis of products by Raman spectroscopy
- (Synthesis of micro- and nanosized ceramic powders of special morphology in thermal plasma
- Studies on relaxation processes at metal/electrolyte interfaces
- Development of electrochemical impedance spectroscopy extended to medium perturbation and its application to corrosion research

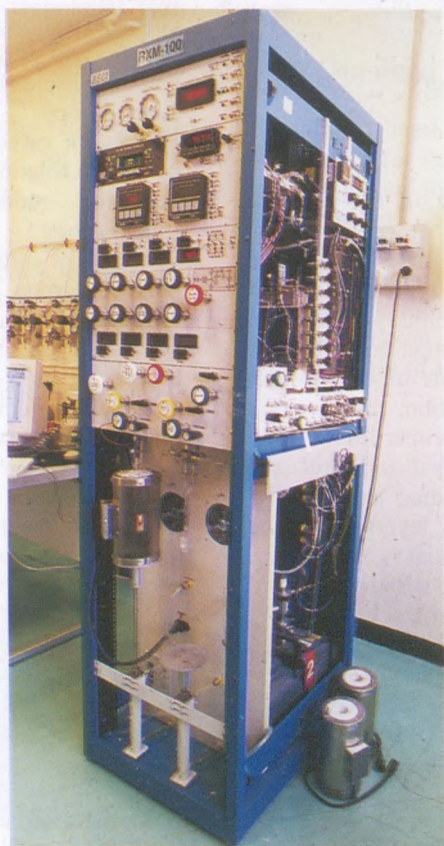
Environmental chemistry

Research in this field is aimed at generating chemical knowledge and also developing new methods of environmental analysis and measurement which can be applied to decrease the environmental impact due to human activities. Ongoing research topics cover development of analytical

methods and measuring devices to be used for complex environmental systems, studies on decreasing the environmental impact of energy production both from traditional and renewable sources, revealing the chemical basis of processing and utilisation of hazardous materials, and also development of new materials, processes and technologies of minimum environmental impact.

The research topics are as follows:

- Studies on chemical reactions promoting the pyrolytic recycling of plastic wastes
- Studies on the utilization of biomass materials by thermal methods
- Research in environmental analysis
- Chemical engineering research on the utilization of solar energy
- Thermal plasma processing and vitrification of hazardous wastes
- Decomposition of halogen-containing organic materials in thermal plasmas



RXM-100 multifunctional catalyst testing and characterization machine Institute of Chemistry, Chemical Research Center

KFKI ATOMIC ENERGY RESEARCH INSTITUTE

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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 assesment, 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



The main building of the research reactor

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.

The last activity to mention is the 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)
- calculation for the neutron fluence of the reactor vessel

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
- investigations to what extent the phosphorus contamination causes the thermal and neutron induced ageing damage



Control room of the Budapest Research Reactor

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

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

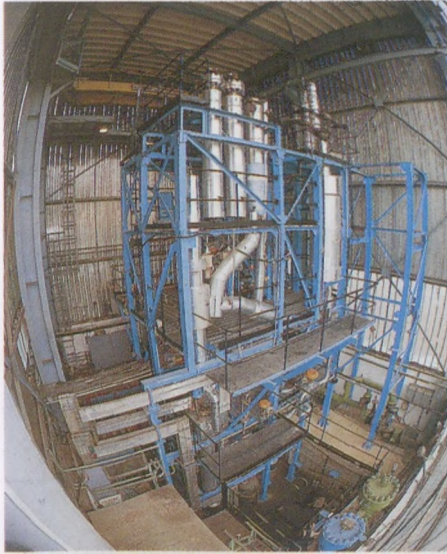
- development of action supporting softer for nuclear accidents
- estimation of the environmental effects of fossil electricity production
- dose mapping in space electronics

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 investigation of large objects, usual in industry

Scientific and technical utilization of the Budapest Research Reactor

- optimization of the operation of the cold neutron source
- 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



The PMK-2 Thermohydraulics experimental facility

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

KFKI RESEARCH INSTITUTE FOR PARTICLE AND NUCLEAR PHYSICS

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Scope of activities

Fundamental research in high energy nuclear and particle physics, plasma physics, space physics, theoretical research, materials science and biophysics. Applied research and development in the field of laser techniques, nuclear analytics, space electronics, fast data processing, and optical and X-ray spectroscopy. Most of the institute's work is connected with the so called "big sciences", which are realized within the framework of international cooperation.

The Computer Networking Center is working as a department of the institute. Its responsibility includes the management of the local campus network, the connection to the wide area networks and providing information services to the whole campus.

Research aims and topics

Ultrarelativistic heavy ion physics and particle physics

The fact that Hungary is a member state of CERN basically determines the main trends of our research. The previously separated nuclear and particle research groups are coming closer to each other.



Van de Graaf type particle accelerator

Research topics:

- investigation of relativistic heavy ion collisions in GSI-Darmstadt
- research for quark-gluon-plasma in the frame of CERN NA49 experiment
- development of hardware elements for the planned LHC experiments (ALICE, CMS)

- data analysis for the L3 and OPAL experiments (LEP).

Thermonuclear plasma physics and laser physics

Continuing the research activity that started in 1975, the institute envisages cooperation in various research projects of the European Communities. Research subjects:

- the movement of neutral and charged particles in the plasma
- the movement and the interaction with laser beams of plasmas produced by laser radiation
- the collisions and interaction of atoms and molecules with the laser radiation.

Space physics

- Scientific interpretation of the data from former and ongoing space missions (VEGA, PHOBOS-2, PIONEER VENUS ORBITER, ULYSSES, SOHO, CLUSTER, CASSINI).
- Development of on-board devices, software and ground support equipment for future space missions (ROSETTA, CESAR, SPECTRUM-X-GAMMA, NETLANDER).

Theoretical physics

- Relativistic heavy ion collisions: phenomenology of the NA49 experiment at CERN and related problems.
- 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.

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).
- Development of the methodology of nuclear condensed matter physics mainly based on the institute's accelerators, Mössbauer- and positron annihilation laboratories as well as on external synchrotron radiation laboratories. The methods are based on (partly in situ) ion beam analytical techniques, on resonant and nonresonant interaction of gamma or synchrotron radiation and of positrons with condensed matter.

Neurobiology and nuclear biophysics

- Computational neuroscience: multicompartmental simulations of various types of neurons; application of a kinetic model to the description of the behaviour of large neural populations.
- 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 biomechanical separation processes.
- The application of nuclear methods for the analysis of archeological and fine art objects.

RESEARCH INSTITUTE FOR TECHNICAL PHYSICS AND MATERIALS SCIENCE

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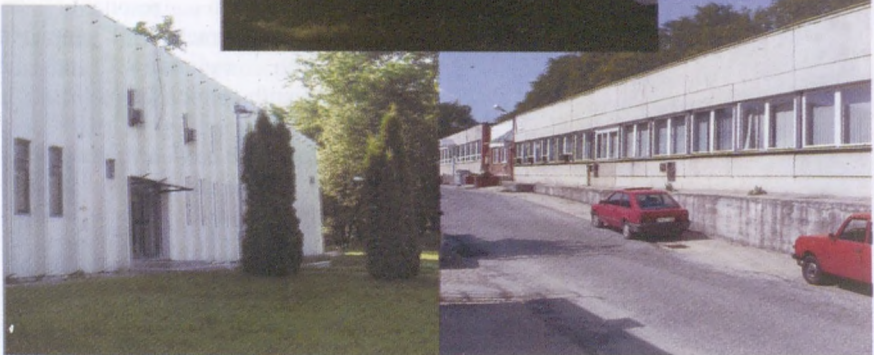
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General research building

The institute in its present form was organized in 1998 at the KFKI Campus by a merger of the Research Institute for Technical Physics and the KFKI Research Institute for Materials Science with a *mission* to perform basic, targeted and applied research in modern materials science with a focus on

complex functional materials, integrated micro- nano-devices and systems, for studies of physical, chemical bases, applications and development of experimental techniques for preparation, modification, and for analysis of structures. Intense participation in

undergraduate and graduate education at major Hungarian universities, scientific contacts with SME-s and with other industries are of high priority.

The institute (main building on top), with a scientific staff of eighty, and a technical/financial staff of fifty, has two divisions named as "Semiconductor and Sensorics" and "Structure Research". Laboratories for preparation of thin films and their modifications by ion- and laser beams, of lower dimensional structures including a laboratory with Class 10 to 10000 areas for semiconductor and sensorial device preparation and micromachining (lower left), a mask laboratory, and well-equipped laboratories for structural research (lower right). The latter includes different electron microscopes with leading sample thinning techniques, Auger Electron Spectrometry unique in profiling, sophisticated ion beam analyses and modifications.

The institute aims at acting as a regional centre in the following areas:

1) micro- and nanotechnology in conjunction mainly with informatics and telecommuni-cations,

- integrated and micromachined sensoricsresearch of thin films and lower dimensional structures with their applications
- structure analysis with tools handling nanoscopic dimensions, especially, in
- diverse forms of electron microscopies and in ion beam techniques

Selected laboratories belong to the Condensed Matter Research Centre at the Campus, which bears the title of

'Centre of Excellence' donated by the European Union.

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 5th Framework programs (three pending) of the European Union, runs and participates in three NATO projects. Heads one and is part of thirteen further consortia for technology-oriented research projects funded jointly by the Government of Hungary and by the targeted enterprises. Also, as a daily exercise for its technology labs, MFA runs some small scale production and delivers chips for pressure transducers, SAW filters for TV, and sintered ceramic parts for products of GE Lighting.

Main research areas are

- *Research on semiconductors and sensorics, including structural research on compound semiconductors (SiC, GaN) and quaternary structures of III-V-s for IR emission; in sensorics mainly on micromachining (e.g., pressure, acceleration, gas - "artificial nose" - tactile sensing, magnetism, optics-based, e.g., Fabry-Perot interferometric filters and Bragg reflectors).*
- *high frequency device physics is also a goal. MFA is a planned demo centre for solar panels based on CuInSe₂. In gas sensing, a micro heater was also developed. Studies on GaN are part of a large international project on lighting. Two starting projects are in the line of development of the*

next and last generation of silicon integrated circuits.

- *Research on structure of functional materials*, this area includes studies on diversely prepared thin films, on "fullerene-like" materials, e.g., CN_x , on preparation of (single walled) carbon nanotubes with diverse forms, like Y-shaped or precisely curled.
- towards hydrogen storage; studies on structures in the range of quantum confinement and optical bandgap materials is in focus; ion beams as modification tools, e.g., for surgical prostheses, special ceramics, special surface acoustic filters, SAW, for telecommunication. *Application and research on analytical techniques*. An important knowledge of the institute concerns with different measurement techniques. Two areas bear long tradition and international reputation, the ion beam analysis (Rutherford and other scattering, nuclear reaction analysis) helping research on ion implantation and the electron microscopy with pioneering work on in situ thin film formation. In the latter, leading position was ensured by newer and newer generations of a proprietary ion gun for advanced sample preparation. From this gun, also Auger profiling benefited leading to the best depth resolution (1 nm) to date. at the peak. Ion beam analytical techniques are also having a long tradition. Special forms of ellipsometry is also a stronghold. In bulk materials analysis, a proprietary magnetic sensor, combined with Eddy current measurements, also finds broad applications.
- *Theoretical studies and interdisciplinary applications of computing* aims at models in game theories, in surface migration of

atoms, in modeling of ion impact into solids, etc.; interdisciplinary fields are also aimed at, e.g., information content of animal "languages", characteristics of melody memory in sustaining of folk songs, etc. Studies in the field of telemedicine and special applications of image processing are of priority. MFA participates in projects aiming parallel operation of large computers.

List of major projects: European Commission, 5th Framework

- Part of Condensed Matter Res. Centre, a *Centre of Excellence on Campus (Human Potential)*
- "*Large scale synthesis and characterization of carbon nanotubes and their composite materials*" (NANOCOMP, Human Potential)
- "*Sensor Array for Fast Explosion-Proof Gas Monitoring*" (SAFEGAS, Growth)
- "*Deuterium Lamp Standard*" (Growth)
- "*European Sources for Nitride Materials*" (EURONIM, Growth)
- "*New nanocomposite-based wear resistant and self-lubricating PVD coatings for future applications in tools and components*" (NANOCOMP, Growth)
- "*Advanced Dry Processes For Low Cost, Thin Multicrystalline Silicon Solar Cell Technology-target Action I.*", (ADVOCATE, Energy)
- "*Front-End Models for Silicon Future Technology - EAST*" (FRIENDTECH, Info. Soc.)
- "*Non-destructive Characterisation of Ferroelectric CVD-Layers for Memory Application*" (FECLAM, Access)

- *"New Fullerene-like materials"*
(Human Potential)

NATO Science for Peace

- *"Opto-electronic devices based on the protein bacteriorhodopsin"* (Inst. of Biophys., Szeged)
- *"Surface Acoustic Wave Devices on Ceramics"* (CERSAW)
- *"Integrable Lithium Thin Film Batterie"*

Ministry of Education, Szechenyi Project, with industrial participation

- *"Nanotechnology"* (Growth), the consortium is headed by MFA
- *"Innovation Centre for Solar Energy Technologies"* (Kraft Inc., Growth)
- *"Discharge Lamps for vehicles"* (GE, Growth)
- *"Environmentally Friendly Discharge Lamps"* (GE, Growth)
- *"Composite materials for brakes"* (Univ. of Miskolc, Knorr-Bremse, Growth)

- *"Sensing computers and telepresence"*
(Res. Inst. for Automatization, SzTAKI, Info. Soc.)

- *"Telemedicine care of Hypertoni"*
(Tensiomed, Info. Soc.)
- *"Economic Health Control"* (Univ. of Veszprem, Info. Soc.)
- *"Long life Joint Prostheses"* (Centre for Chem. Res., Protetim, Inc., Health)

Other projects sponsored nationally, with partners

- *"Recognition of stationary and moving object"*
- *"Coupling of heterogeneous computing systems, DemoGrid"*
- *"Tailored on-line content filtering"*
- *"Digital imaging spectroellipsometry"*
- *"New efficient Hydrogen-based Energy Storage"* (with Accusealed, inc.)
- *"Integrated Gas Sensors to Monitoring Communal Trash"* (with Weszta-T, Inc.)

Extreme low-energy ion gun for artifact-free surface layer removal



RESEARCH INSTITUTE FOR SOLID STATE PHYSICS AND OPTICS

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The building of the institute

The Institute hosts the KFKI Condensed Matter Research Centre (KFKI-CMRC), an organisation founded by four academic research institutes to coordinate the research activity in the field of condensed matter physics and application at the KFKI campus. In 2000, the KFKI-CMRC has been awarded by the title "Centre of Excellence" by the European Commission within the 5th Framework program.

Scope of activities

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 crystals, non-linear 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 postgraduate *education*.

Research aims and topics

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.
- *Theoretical study of complex systems*: Phase transitions and scaling. Numeric research of systems with stochastic dynamics. Quantum-many body systems. Non-linear 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. Superconductivity in mesoscopic systems.

Experimental solid state research

- *Investigations of non-equilibrium alloys*: Study of the macroscopic magnetic properties and the

characteristics of the local atomic environments in order to clarify their relation in melt quenched bulk spin-glasses and granular structures. Study of formation of the nanophases with special magnetic properties; formation of nanocrystals from the amorphous state in different processes. Besides the magnetic studies, the samples will also be investigated by calorimetry, Mössbauer spectroscopy, and other methods.

- *X-ray diffraction*: Synthesis and structural studies on high charge state C₆₀-alkali polymers. Structural studies of alkaline-earth-metal C₆₀ compounds, especially concentrating on the superconducting compositions. Experimental study of the atomic structure and chemical bonding by the combined use of x-ray diffraction and infrared spectroscopy. Field theoretic study of first order phase transformations. Experimental and theoretical study of atomic resolution X-ray holography. Theoretical study of atomic level imaging of small non-periodic systems.
- *Electron crystals*: Study of the ground state collective excitations and the origin of the non-Fermi-liquid behaviour of the metallic phases in organic conductors by measuring superconductive properties and NMR parameters.
- *Liquid crystal research*: Study of pattern forming instabilities in nematic and smectic liquid crystals induced by different applied fields (electric, magnetic, temperature, concentration and velocity gradient). Synthesis of deuterated liquid crystals and polymers and their study by ²H NMR spectroscopy. Synthesis and study of ferroelectric liquid crystals formed by bent shaped molecules.

Light induced reorientation and alignment of dye-doped liquid crystals. Rheological investigations of liquid crystals.

- *Metal physics*: Investigation of metal-hydrogen and carbon-hydrogen systems (in-situ measurement of H content, study of the electronic structure of hydrogen, the H-H distance and hydrogen mobility). Research in the field of spin electronics on electrodeposited nanostructures: study of giant magnetoresistance (GMR) in nanoscale magnetic/non magnetic multilayers tunnelling magnetoresistance (TMR) in ferromagnet/insulator/ferromagnet nanostructures. Study of hydrogen diffusion behaviour in steels by electrochemical permeation technique. Research on soft magnetic nanocomposites prepared by rapid quenching and ball milling for understanding magnetic coupling phenomena and the application of such materials in electronic devices.
- *Neutron spectroscopy*: Neutron diffraction and inelastic scattering investigations of short and medium range ordering, nanoscale structure and atomic/molecular interactions in metals, alloys and composites, as well as in soft and liquid materials (solvents, suspensions gels, ferro-liquids, micelles etc). Strain distribution, texture and surface properties in model and real materials and objects with industrial relevance, medium and short range structure of amorphous semiconductors. Study of atomic resolution neutron holography and neutron optical phenomena (e.g. standing waves). The development of novel neutron physical devices and technologies, installation of new experimental stations

- *Neutron diffraction*: neutron powder diffraction studies of crystalline systems of technological importance (laser crystals, zirconium based alloys, nanocrystalline magnetic materials). Refinement of the crystalline structure by Rietveld analysis. High resolution neutron diffraction investigations of residual stresses and texture. Structural studies of liquids and amorphous materials by neutron diffraction. Development and extended application of inverse methods, mainly of the Reverse Monte Carlo method, for modelling structural disorder. Basic and applied research in the field of neutron radiography. Development of instruments for neutron diffraction and neutron radiography.

Theoretical optical research

- *Non-linear and quantum optics*: Quantum state engineering and reconstruction. Non classical light, non-linear optical processes. Cavity quantum electrodynamics and atom optics. Quantum informatics. Oscillator systems, molecules, atom traps.

Experimental optical research

- *Interactions of intense laser fields with matter*: Experimental revealing and theoretical interpretation of the fundamental photon-electron interaction processes induced by superintense, ultrashort laser pulses. The measurement of quantised spectra for both high energy photoelectrons and high harmonic light beams. Development of attosec light pulses from the latter beams.

Setup for generation of ultrashort laser pulses

– *Laser physics:* Modelling of basic processes of gas discharges and gas lasers by means of Monte Carlo simulation. Development of high power UV gas lasers using cathode sputtering in segmented hollow cathode discharges. Development of gas discharges with new geometry; Research on optimum output coupling of microdisc lasers. Investigations of the electrolyte cathode atmospheric glow discharge; plasma light emission mechanisms and plasma-electrolyte interface processes. Investigations of the optical parameters of noble metal and dielectric thin layers by means of attenuated total reflection (ATR) method. Development of the optical STM.

– *Laser applications:* Development of diode laser pumped solid state lasers by using new active materials with broad absorption band. Development of optical measuring devices for the determination of size distribution, concentration and electrical charge of particles of submicron and micron size. Application of these instruments in environment monitoring and medicine. Development of experimental equipment for the generation of entangled photon states. Determination of quantum efficiency of photodetectors using entangled photon pair, without standards. Preparation of various hydrogenated and hydrogen-less carbon nanostructures and films by plasma enhanced chemical vapour deposition (PE-CVD) and pulsed laser ablation (LA) methods. Investigation of the structure and various properties of these materials by Raman scattering, optical absorption in both visible and

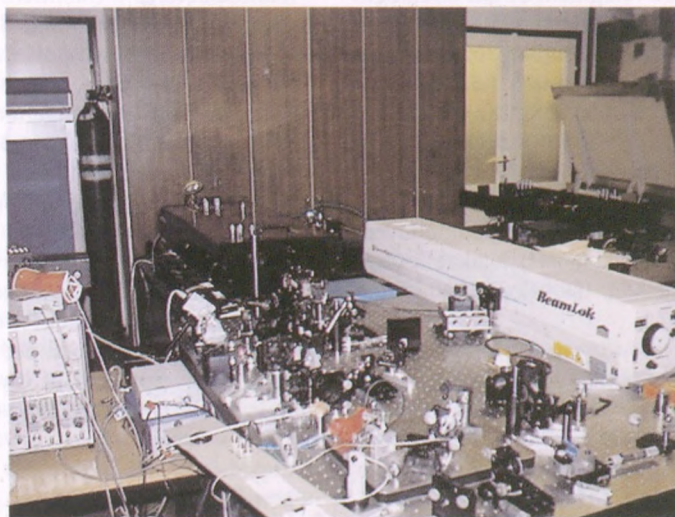
infrared regions, photo-luminescence and electric conductivity. The application of a femtosecond pump-probe measuring system for time resolved spectroscopy of semiconductor nanostructures as well as biological and chemical samples. Linear and non-linear optical studies of photonic crystal structures and nanostructures. Submicron material processing of diamond like carbon films with femtosec pulses.

- *Optical thin films:* Theoretical and experimental investigations on the performance of chirped dielectric 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 metal vapour lasers.
- *Crystal technology:* Growth of pure, doped and nano-periodic structured non-linear optical (NLO) crystals by melt and high temperature solution techniques. Characterisation of the crystals by chemical analytical, microscopic, etching, optical and absorption spectroscopic methods. Study of physical properties important in the NLO applications as a function of material parameters (stoichiometry, dopants): nonlinear optical processes, photorefractive and photochromic phenomena, and photoemission.
- *Crystal physics:* Investigation of the real structure and physical properties of crystals. In particular, studies of the effect of dopants, growth and irradiation induced real structure on the photorefractive, photochromic, dielectric and spectroscopical properties, including also magnetic resonance.

Graduate and postgraduate education

The scientists of the Institute take part in the graduate and postgraduate education at the following universities in Hungary:

- Budapest University of Technology and Economics, Eötvös University of Sciences, University of Pécs, University of Szeged, University of Debrecen. Research activity of about 30 – 35 PhD students is supervised regularly by scientists from the Institute.



Setup for the generation of ultrashort laser pulses

ALFRÉD RÉNYI INSTITUTE OF MATHEMATICS

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Scope of activities

The principal function of the institute is to perform systematic basic research in various topics in mathematics and its applications, concentrating on theoretical studies inspired partly by the internal development of mathematics, partly by the applications of mathematics in other sciences. Other important functions of the institute are to provide active support for the teaching of mathematics and education of mathematicians of various levels, to participate in the postgraduate training of mathematicians working in other institutes, and to contribute to the general progress of mathematical culture. To accomplish these goals, the Institute organizes postgraduate courses, publishes textbooks, participates in postgraduate education and offers visiting research positions. In cooperation with the Central European University, the Institute offers Ph.D. programs in various fields of mathematics. Besides accomplishing these basic research programs, the Institute participates in concrete practical applications by cooperating with industrial enterprises.

Research topics

- Algebra
- Algebraic geometry
- Algebraic logic
- Approximation theory



The building of the institute

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

COMPUTER AND AUTOMATION RESEARCH INSTITUTE

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Fields and activity at the Institute

The Institute is a base of informatics, in the broad sense, a national research centre of information technology, computer science and their related fields. Primarily, the technico-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.

Research aims and themes

Mathematics and computer science

In *combinatorial computer science* research is focused on the constructive integration of combinatorics, computer science and further branches of science. The aim is to achieve novel scientific results, applicable in practice as well, in the fields of graphs and hypergraphs, communication networks, theoretical computer science, algebra and algebraic logic. The same is true in connection with research in *stochastic systems*



The main building of the institute

where financial mathematics and research related to the statistical examination of hidden Markov-chains are emphasised.

As to the field of *operations research*, we intend to proceed with the study of the theory of equilibrium systems, and smooth optimisation, as well as with the examination of optimisation algorithms of large systems and the investigation

of differential algebraic equations. From among the problems of decision systems, the mathematical foundation of models applicable in multi-attribute group decision support, furthermore, solving problems of environment protection are highlighted.

In *symbolic computation* research on the algorithmic exploration of the structures of group-representations and modulus is to be continued. In the field of the *mathematics of internet*, its algorithmic relations, data-mining tools are investigated for the analysis of network traffic. Research and application of *cryptographic algorithms* is also regarded an important area.

Research is carried out in *bio-computing*, primarily in *molecular computer science*. The aim is to develop non-traditional computation algorithms for the model of which molecular biology and other biological phenomena serve as base.

Informatics

Analogic CNN (Cellular Neural/nonlinear Network) is meant as one of our most important R&D fields, also in the future. Basic research activities are continued on the complexity of analogic spatio-temporal computers, the physical implementation of analogic cellular computers, the theory of analogic cellular algorithms, and on integrated multi-modal sensing-computing-perceiving and analysing systems. From among the potential application areas, here, telepresence added, ultrasound-based heart diagnostics (see the figure), and modular, multi-sensor perception,

surveillance and identification are emphasised.

In *distributed systems* research goes on in the further development of digital library architectures and user interfaces, as well as in the algorithms and architectures of training systems that can be applied in space science and teleoperation.

In *Grid systems* research is done in the following themes: scaling of information systems, flexibility of checkpoint mechanisms, monitoring of Grid systems and graphical program-development.

Research, design and monitoring activities in *computer networks* are considered crucial tasks also in the future.

Automated control systems

Systems and control theory serves as basic science in automated control systems. Accordingly, we deal with the state-space theory of linear multi-variable systems, their relation-theory, as well as the formal optimal synthesis of robust control. Our algorithms to be elaborated in connection with the theoretical problems of model-based fault-detection, control, and system reconfiguration are applied in designing control systems for road vehicles (as illustrated) and aircrafts. New methods are elaborated for the fault detection of *distributed real-time control systems* and the validation of their operation, which can be applied in the new security system at the Nuclear Power Plant, Paks.

In the field of *analysis and control of nonlinear process systems*, the starting point of our research is the thermo-

dynamic-based, mechanics-analogue Hamiltonian description of process-systems. We intend to deal with the hierarchical decomposition-based modelling and control of compound, complex non-linear process-systems.

Research is continued in *geometric modelling and reverse engineering*, in the segmentation of scanned multiple point regions, fitting of surfaces and surface-groups and the application of geometric constraints in the interest of improving reversed objects. These processes are expected to be employed, first of all, in the motor industry and medical applications.

In *computer integrated manufacturing* our efforts are concentrated, on the one hand, on introducing the latest results in informatics in order that all the essential data related to production should be available and manageable, in a controlled, user-dependent way. On the other hand, in *engineering and management intelligence*, techniques are investigated which are appropriate for running complex technical and economic systems operating in varying environment burdened with uncertainties. Special emphasis is laid on *artificial intelligence* and *machine learning* (intelligent manufacturing and business processes and process chains, hybrid artificial intelligence methods, constraint satisfaction, agent-based approaches, techniques based on reinforcement-like learning).

Inland and foreign contacts

First in the line is the distinguished title of *Centre of Excellence* granted by the EU, the significance of which is manifested primarily in the increased prestige diffused by the title, and

consequently, in its influence. From among the over-seas research grant organisations Office of Naval Research, USA; National Science Foundation, USA; US Army Research Office (ARO) are highlighted.

Making our Institute prepared for *EU VI Framework projects* of incomparably greater importance and complexity than those ones up to our days, is regarded as the most imperative task.

Our results achieved in the first announced *National Research and Development Programs* in 2001 are encouraging: from among the 14 projects supported in the IT category, the Institute acts as a co-ordinator of 5 five projects and is a participant in two projects:

- Commercial vehicle fleet management system.
- Sensing computers and telepresence.
- Knowledge-intensive information technology for the safe and optimal operation of complex industrial systems.
- Digital techniques for the restoration of movie-films.
- Digital enterprises, production networks.
- Information security technology and data insurance.
- Demand-driven information tools and systems of information society.

The above enumeration suggests that the interdisciplinary research and development of informatics and other branches of science (material-, life- and social sciences, mathematics, artificial intelligence, system and control science, automation, operations

research) are concentrated on, which may strengthen the Institute's fame for a long period ahead. Our co-operation with outstanding large companies, such as GE, MATAV, MOL, Nuclear Power Plant, Paks is broadened also through the above projects, and similarly, the participation of some small enterprises ensures that our results should get publicity in the widest possible circle.

Educational activity

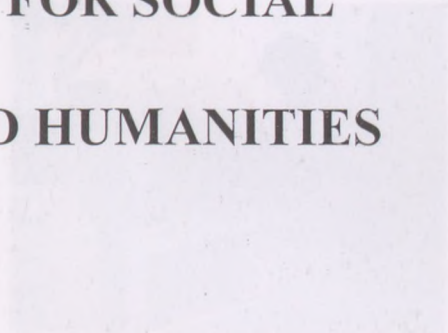
Gradual and post-gradual *university education* has always been regarded as an important task associated with research, and pursued as an essential condition for future-shaping. We continue our educational activity with the following national universities

(using their Hungarian abbreviations): BME, ELTE, BKÁE, VE, PTE, ME, PPKE. Generally, about 30 Ph.D. students do research at the Institute, under the scientific leadership of our colleagues. In the Doctoral Schools brought about not long ago, our colleagues act as external foundation members in 25 cases and as internal foundation members in 5 cases. Above the co-operation schemes up till now (part-time employment of our researchers, associated department, and co-operation in establishing faculties in informatics), we intend to devise new forms of co-operation (common chairs, possibly common doctoral schools), though our educational activity is approaching the limits of our capacity.

ARCHAEOLOGICAL INSTITUTE

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INSTITUTES FOR SOCIAL SCIENCES AND HUMANITIES



Scientific objectives and priorities of the Institute
In the context of the Institute's mission
The Institute supports the research in
fields of the social sciences and the
humanities. It is a part of
the national infrastructure which
is essential for the advancement of
the sciences and the humanities.
The Institute's work is supported by
various official bodies and other
institutions.

ARCHAEOLOGICAL INSTITUTE

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The scope of the Institute

The activity of the Institute targets the archaeology of the Carpathian Basin and the historically related areas, and that of 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 Hungarian Conquest period). The study of the Roman Period is logically extended to the entire territory of the Roman Empire. Our colleagues also take part in research into the history of prehistoric religions and the Roman period as well as with Roman and medieval numismatics. The Institute helps the publication of the results by editing the *Annales* of the Institute called *Antaeus*, a monograph series: the *Varia Archaeologica Hungarica*, and other books and monographs. The researchers of the Institute frequently publish papers in reputed scientific periodicals of other countries and some monographs were also edited abroad. The financial background of the research programs is provided by numerous OTKA and three Széchenyi grants.



Laboratory for Conservation

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. It is a work of national importance, which is scientifically justified and necessary for the protection of archaeological sites. Ten volumes have already been edited, and three are being prepared on the sites of Békés, Fejér and Pest counties. The topographical work is indispensable for certain official tasks that other institutions do not undertake.

Archaeological research into prehistoric societies and settlements

The researchers of prehistory take part in international programs first of all

with the intensive multiaspectual study of smaller territories. Since 1995, a project aiming at the recognition of the settlement history of seven thousand years has been pursued in the Kerka valley in flourishing co-operation with scientists from the neighbouring Austria and Slovenia. This work offers the possibility to sketch the history of the territory between the western basin of the Balaton and the Mura region. The excavations of a seven thousand five hundred years old settlement at Szentgyörgyvölgy – Pityerdomb uncovered the archaeological traces of an until unknown archaeological formation. An international prehistoric project has been launched in the region of Kalocsa as well. The late Copper Age cemetery of Budakalász is being analysed in co-operation with the Archaeological Institute of the ELTE and the Hungarian National Museum, monographs are being compiled on the Neolithic transformation and the dispersion of Neolithic religious concepts, the social structure of the late Neolithic based on cemetery analyses, and on cultural processes in the early and late Bronze Age. Each monograph of finds serves the better understanding of the Iron Age, that is the culture of the Scythians and the local Celtic tribes.

The Roman Empire and its borderline territories

Beside the geographically divaricate territories, a similarly diverse research field characterises the work of the scientists who are engaged in this period. Beside the study of the settlements and the ceramics of the autochthonous population of the province, an internationally acknowledged research is pursued in the field of ornamental pottery, and

Roman coins. The investigations at Almásfüzitő provide new information about the interrelation between the Celtic population and the Roman conquerors, while the settlements of Zalalövő and Zalabaksa open a view into the world of Roman villas and roadside settlements. A colleague studies the life of the Roman period barbarians in Eastern Hungary. 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.



Photo laboratory

Avars, Hungarians and their neighbours

The colleagues studying this topic work in a close partnership: several research fellows study the settlement history of the Carpathian Basin and the neighbouring territories in the 7th – 10th centuries, analyse the social processes of the area and their interrelations. In the near future, summary publications can be expected in the field of the



Anthropological collection

eastern and south-eastern contacts of the Avarian tribes, the ceramics in the Avarian period and the Árpáadian Era, the analysis of the Avarian cemetery of Budakalász, the 9th century remains in the centre of Zalavár Mosaburg and in its environment in Transdanubia, the find corpus of the Gepid, Avarian and Conquest periods and the cadastre of the grave finds from the 10th - 11th centuries. The monograph to be edited about the Nagyszentmiklós treasure and the genetic studies in respect of Hungarian ethnogenesis, carried out within the frames of the NKFP project, are significant accomplishments.

Medieval studies

For a long time, this period could be studied only within the frames of the topographic work due to lack of other possibilities. Nevertheless, 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 use of boundaries, the medieval towns of Székesfehérvár, Vác and the one at Decs, the bronze metallurgy in Transylvania and the find material from the time of the Turkish occupation of

Hungary. A large-scale NKFP project won in 2001 provides a new impetus and a financial background to the monographic publication of the yet unprocessed find material of formerly unearthed castles and royal centres. This project will provide tasks for the researchers of the Middle Ages in the Institute and the partner institutions, museums in Budapest and in the for several years.

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. Beside the fact that modern archaeological work cannot be imagined without information about the history of the environment, these natural scientific studies also appear as independent achievements in the international scientific life. The other NKFP project of the Institute see above.

Conservation

No research is possible without conservators' work. The metal and ceramic conservator 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 conservation of archaeological finds from excavations preceding the construction of motorways in Hungary. The specialists also restore of some exquisite find units on special requests.

RESEARCH INSTITUTE FOR ART HISTORY

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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 with the scope of the collections of Hungarian museums and the objects under the protection of Hungarian building conservation, partly exceed those 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 national heritage, the Institute co-operates closely with 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.



The library of the institute

Research into the history of 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. They are active in post-graduate training and university education, and they support young scholars in their early careers. The Institute organises 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 prepares and completes 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 can be found in the entries of new, professional encyclopaedias (*Saur Allgemeines Künstlerlexikon*, *Enciclopedia dell'Arte medievale*, etc.). Besides compiling the national art historiographical bibliography, 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 one being the volume on Hungarian art from the beginnings to 1800) eminent subjects are: the art and architecture of the Árpád age, research into the insignia, iconographical research (Saint Ladislav, Saint Martin), codicological research and the art of the illuminated book, within the framework of international Cupertino the art of Sigismund's age and the Jagiellonian age, research into artistic representation.

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 Cupertino: 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.

For computer-based communications the electronic recording of the Institute's publications and collections, and the creation of a data-base, ensuring accessibility, are under way.



A view of the institute's library

INSTITUTE OF ECONOMICS

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The Institute of Economics of Hungarian Academy of Sciences 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. Findings of the research programs of the Institute are made available for and are regularly used by policy making bodies and universities.

The IE/HAS puts emphasis on promoting academic cooperation with other 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 IE/HAS research programme Includes

Macroeconomics and economic policy: Macroeconomic performance and its micro foundations in developed and emerging market economies; growth and disinflation policies, tools and efficacy of monetary and fiscal policy.

International economics: The competitiveness of the Hungarian economy and its integration to the European Union.

Public economics: The role of central and local governments in market economies, intergovernmental fiscal relations, competition and regulatory policies, structural changes in public utilities.

Human resources: Demand and supply on the Hungarian labour market, the economic and institutional aspects of labour market flexibility, the means of employment and wage policies; changes in consumption and income patterns with special attention to age-group related problems.

Agricultural Economics: Agricultural policy modelling, international agricultural trade, EU enlargement issues in agriculture, rural development policy, vertical co-ordination in agriculture, transformation of agriculture in CEE countries.

Dissemination of Research Output

Regular Seminars: Economic Theory and Policy Seminar Series; Budapest Economic Seminar Series (jointly organised with the Central European University)

Regular Publications: Discussion Papers New Series; Budapest Working Papers on the Labour Market (published in cooperation with the Human Resources Department of the Budapest University of Economics and Public Administration; Labour Research Studies (one volume per year); Labour Market Yearbook (one volume per year). Publications can be downloaded from <http://www.econ.core.hu>.

ETHNIC AND NATIONAL MINORITY STUDIES INSTITUTE

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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: the Centre of Jewish Studies and the Migration Research Centre.

The Institute focuses its interdisciplinary research activities on four areas: the minorities living in Hungary, the Hungarian minorities living outside Hungary, the Roma population in the region, and the immigrant and migrant population in the region.

Our institute works in close co-operation with the Janos Arany Public Fund which supports 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 investigate the issues of language rights, bilingualism and use of the mother tongue in education.

The institute has a similar function regarding the Domus Hungarica grant system which also aims at supporting Hungarian students and scholars living in the neighbouring countries. In addition, our institute runs the Cooperation 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 the Gömör region
- 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
- Identity transformation in German, Croatian 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 ETHNOLOGY

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Scope of activities

1. Research into the popular culture (folklore, cultural and social systems) of European (especially Hungarian) societies
2. Non-European ethnological researches
3. Contemporary problems of the rural population, religious and national minorities
4. Coordination of ethnographical synopses (ethnological atlas, encyclopaedia, handbook)
5. Participation in international projects
6. Contribution to university, graduate and postgraduate education

Research aims and topics

Hungarian Ethnography, an eight-volume handbook

Systems of folk-beliefs and customs

- Influences, conflicts and changes in popular mentality in modern times
- System of Hungarian witchcraft in parallel with European connections
- Database of mythological motives and Hungarian folk-beliefs



Mongolian Shaman

- Catalogue of the folk-beliefs and customs of the peoples in the Carpathian Basin
- Beliefs and customs of the life cycle

Archaic folklore genres

- Creating the image of the 'national hero'
- Narratives and medieval allegories in the fine arts
- Catalogue of Hungarian folk-tales
- Catalogue of Hungarian folk-legends

The role of literature in folklore

- Role of writing and reading culture in early modern Hungarian villages and country-towns
- Texts of codices, sermons and proverbs in the fine arts
- Popular knowledge of history in the 19th and 20th centuries

Social anthropology

- Comparative researches into the ways of living in different regions and local communities
- Social change in Hungarian society and traditional culture in the 19th-20th centuries
- Culture of work in the changing villages
- Connections among the social norms, tradition and individual attitudes
- Jews in Hungary between the two World Wars

Traditions, identity and national symbols

- Identity problems of Hungarians outside Hungary
- Creation of national identities in Middle East Europe in the 19th century
- Culture and identity of the religious and national minorities in Hungary

Historical ethnography

- Historical periods of Hungarian popular culture
- Comparative analysis of the élite, popular and peasant cultures
- Different regions of Hungarian peasant culture on the basis of the Atlas of Hungarian Folk Culture
- Ethnographical lessons of the 'canonica visitation'
- The status of vineyards in the law of winegrowing communities
- Food and material culture in European food history
- Unpublished artisan price-lists from the 17th to the 19th centuries

Non-European researches

- Hungarian ethno-genesis
- History and ethnography of Finno-Ugrian peoples
- Social system, folklore, linguistic problems and revival of ethnic identity among the Voguls and Ostyaks
- Encyclopaedia of Uralic Mythology
- Contemporary ethnic problems of the peoples of the Caucasian Mountain
- Economic anthropological questions about the coffee production of the Kikuju people (Africa)
- The belief-system and social organization of the Bru tribe (Middle Vietnam)



Wedding in Hungary

INSTITUTE OF HISTORY

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About the Institute

Founded in 1949 the Institute of History is an independent member of a network of research institutions that belong under the jurisdiction of the Hungarian Academy of Sciences. Our mission is research and the writing of scholarly books and papers. Employment at the Institute does not carry teaching obligations although most of the researchers do teach at institutions of higher education on an individual basis.

The Institute is the nation's central workshop of historical scholarship which produces handbooks, collections of historical sources, studies and monographs on Hungarian and European history from the early Middle Ages to contemporary history. It is our major mission to produce works of large scope, such as handbooks, source publications and large syntheses all of which require collective effort by a community of scholars, while at the same time we allow our researchers to pursue their individual scholarly interests.

Main Directions of Research

Generally speaking our Institute concentrates on historical themes that are of basic importance from the perspective



The main building of the institute

of national identity and historical consciousness. At the same time researchers are encouraged to pursue topics that tie into the major trends of international historical scholarship. Hence the focal points of research are the following:

The Hungarian State in the Middle Ages

This ongoing research is part and parcel of a larger international effort that deals with the states that came into existence on the periphery of Western European Christian culture. Central to this project is to reveal the role of the mediaeval Hungarian State in European history, as well as its place in the regional economy. More specifically we prepared the genealogical corpus of the country's leading families and a collection of medieval Hungarian place names. Work related to medieval lay archontology, royal itineraries, the historical geography of the Árpád period is in progress, just like the preparation of a lexicon on late medieval Hungarian history.

The History of Hungarian-Turkish Cohabitation

Our history under the Ottoman conquest has always been one of the main interests of Hungarian historiography. As part of this long standing tradition our efforts are directed at examining the forms of Turkish-Hungarian political, interethnic and religious cohabitation, the economic and institutional framework of coexistence. In terms of specifics a yearbook of Ottoman studies, source publications (e.g. defters), a collection of castle names and a monograph on the Ottoman military in Hungary are currently (2002) under preparation.

Hungary in the Habsburg Monarchy

Hungary's place in the Habsburg Monarchy has been in the centre of historical debates in Hungary for a

century and a half. We are focusing on publishing the sources of the 17th century and of the Dualist (1867-1918) state structure and prepare monographs devoted to institutional and social history.

Nationalities and Churches

East-Central Europe has been an ethnically and religiously highly heterogeneous region, which in turn was the source of acute and chronic political strife. Our efforts are now directed at an issue that suffered long neglect: the history of the Hungarians that were forced into a minority status by the treaty of Trianon in 1920. We are compiling a comprehensive chronology on the history of the Hungarian minorities between 1918 and 1990 alongside with a series of works on the national minorities in Hungary prior to 1918. We took an active role in the foundation of the Institute of Ethnic Minorities of the Hungarian Academy of Sciences, an institution of interdisciplinary research on national and ethnic minorities. We co-operate with a number of other institutions in the field of religious and church history.

In the Soviet Zone

Now, after the transition following the collapse of the Soviet Bloc and the opening of domestic and foreign archives Hungary's place in the Soviet zone is an issue of especially great interest for the Hungarian society. This institute is involved in publishing handbooks - chronologies, collections of documents - essential for the in depth study of the period. Initial steps have been taken along the road of making Budapest the regional centre for the

comparative study of the Soviet zone. Our researchers are also involved in writing interpretative histories within the larger framework of the Cold War.

Modern Society and Culture

Social history has been one of the main directions of scholarly investigation since 1986. In order to produce a large synthesis of Hungarian social history a substantial amount of basic research has to be done, including the preparation of source publications, data bases and manuals. In 1989 we started the book series entitled Social and Cultural Studies which has so far published more than two dozen volumes.

Historiography and Handbooks

The history of historical scholarship has traditionally enjoyed an outstanding place among our projects. We are preparing a lexicon of Hungarian historical scholarship and recently we came out with a unique volume on the history of historical scholarship in Eastern Europe. Handbooks, collections of documents are among our priorities as well. These include a multi-volume analytical bibliography of Hungarian historical scholarship edited by Domokos Kosáry. Chronologies, collections of data and figures have been published by our *História Könyvtár* series since 1991. These are meant for educational and research purposes, but the media are also among our target audience for the purpose of assisting an objective, scholarly

approach to history in mass communication. Our chronologies include two volumes on Hungarian ecclesiastical history, and one devoted to world history since 1945. A four volume chronology of Hungarian history is now under preparation together with its abridged English version and a multi-volume historical atlas.

Source Publications

Since the very beginning we have published documentary collections on various historical periods. Current projects include the publication of the diplomas of the queens of the Árpád dynasty, documents relating to the history of national minorities, the nationality question in Hungary and a series devoted to French policy in the Carpathian Basin since 1918. Some of these will appear on CD-ROM.

Central Role in Scholarly Activities

In 1989 we launched a series entitled "Lectures from the Workshop of Historical Scholarship" which occasions an annual five to eight presentations on important issues. The talks and the ensuing debates take place with the active participation of the best experts of the field. The deliberations are published subsequently. In co-operation with the Europa Institut Budapest and the Hungarian Historical Society we also organise up to 16 domestic and international conferences a year.

INSTITUTE FOR LEGAL STUDIES

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A view of the institute.

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 including administrative law, civil law, comparative law, constitutional law, European 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 Academy of Sciences.

The main concern of the Institute is to promote the legal scholarship in Hungary; in addition it assists in various form legislative drafting, 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

- Rule of law and the Hungarian legal order
- The European system of protection of fundamental and human rights
- General questions of the theory of the legal system

1) European law and the Hungarian legal system. This research stream focuses on the harmonization of Hungarian law with European law which is relevant to Hungary's accession to the European Union. This research field affects different branches of law. Special attention is given, beyond the harmonization of Hungarian private law, in particular business law, to the legal aspects of international cooperation in criminal matters and the struggle against organized crime as well as to research on public law issues relating to the accession of Hungary into the Union, such as transfer of sovereignty, regionalism, Union citizenship, and the law of parliamentary elections to the European Parliament.

2) 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 liability /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.

3) 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.

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

5) 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. Priority is given to the research on 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 lags considerably behind the law making.

6) 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, lacunae in law, contradictions within legal systems, retroactive legislation, constitutional aspects of the legal system, and problems of constitutional review. One aspect of this research project is the study of the concept and foundations of the legal culture in general and the characteristics of Hungarian legal culture.

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, they advise different governmental and non-governmental agencies as independent experts. Projects of collaboration are undertaken with Hungarian and foreign universities and research institutes in various countries.



The library of the institute

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The main building of the institute

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 linguistic data banks, development of linguistic 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

I. Grammar and Theory

Description of present-day Hungarian, investigations into the theory of grammar

Study of the structure of the lexicon as a component of the grammar of Hungarian, characterization of the

phonological, morphological, syntactic and semantic properties of lexical items. Development of the phonological, syntactic and semantic components of a new model of grammar on the basis of large bodies of data from present-day Hungarian. Implementation of the lexical component of grammar using current procedures of computational linguistics.

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

On the basis of investigations in structural grammar and in theoretical linguistics, continuous 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.

II. 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 written on the basis of a corpus of 3,000,000 characters. By the end of the present phase of the project, 15 chapters of a historical grammar will be finished.

Studies in Uralic

Computerized morphological analysis of Uralic languages: the morphologies of nine minor Uralic languages (the Ob-Ugrian languages, Permian languages, Volgaic languages, two of the Samoyedic languages (Nenets and Nganasan), as well as Northern Lapp. Completion of a phonological and phonotactic description of Proto-Ugric and Proto-Ob-Ugrian; a lexicological/semantic investigation of common lexical innovations of the Ob-Ugrian languages. Historical linguistic analysis of Permian languages as a continuation of the reconstruction of Proto-Permian. Processing the linguistic material collected from two dialects of Ostyak and its publication on an electronic data carrier.

III. Interdisciplinary

Neurolinguistics

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 in 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.

Acoustic-phonetic and perceptual investigation of spontaneous speech

Systematic description of speech production (spontaneous speech,

individual speech properties) and its comparison with types of communication not requiring linguistic planning (laboratory speech recording, reading aloud, etc.). The analyses specifically target coarticulation and the issue of segmentation, as well as intonation, stress, and temporal factors of speech (also as a function of ageing). Series of experiments are carried out both in the area of segmental and suprasegmental structure using up-to-date analytical software, in order to gain information concerning 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, the Ukraine, Romania, Yugoslavia (Serbia), Slovenia, and Austria.

Studies in normative linguistics

Description of linguistic norms of verbal derivation, preverbs, arguments of verbs, and conjugation, especially in the language of the media. The results are put to use in the public information service of the institute providing members of the general public with expert advice in matters of usage.

Oriental Studies and Turkology

Exploring the social background of Islamic fundamentalism, research in the history of that religion. The study of

Arabic and Persian literature. The phonology and morphology of Pali. The history of Buddhism in Tibet and Mongolia, on the basis of sources written in Tibetan. 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*).

IV. 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 is 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 million 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 last volume of the New Hungarian Dialect Dictionary (vol. 5, Sz-Zs) is now being completed and expected to be published in 2005.

Hungarian National Corpus of Texts

The text corpus is electronically recorded. After its linguistic analysis, the next task is the elaboration of an increasingly more accurate method of accessing. The existing morphological analysis of the corpus is now being complemented by a syntactic analysis.

Computerized lexical data base of the Hungarian core vocabulary

Constructing a lexical data base that contains a syntactic and semantic analysis of unprecedented accuracy of a core vocabulary selected on the basis of

the frequency data of the Hungarian National Corpus of Texts. The dictionary will be a central component of a syntactic parsing system to be developed.

Development of an automatic translation system

In the framework of a research cooperation with Systran, both directions of an English-Hungarian and a French-Hungarian machine translation system are being developed. Application of the general system to the special terminology of business.

Information retrieval from short business news

Constructing a lexical data base and a surface syntactic parser for the projected system, in cooperation with Internet content providers.



Data base and processing

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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, Literatura, Magyar Könyvszemle, Neohelicon.

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



The building of the Eötvös College

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.

INSTITUTE FOR MUSICOLOGY

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The courtyard of the institute

Scope of activities

- to maintain and enlarge the primary collections hosted by the institute: the Hungarian Folk Music and Folk Dance Archives, the Bartók Archives, the Dohnányi Archives, and the Museum of Music History, all of which are internationally of outstanding importance, and unique to Hungary in their field,
- to conduct research in all areas of Hungarian music history, and in various fields of general music history,
- to carry out research in the domain of ethnomusicology and ethnochoreology (Hungarian and European folk music and folk dance),
- to participate in graduate and postgraduate education in musicology in cooperation with the Ferenc Liszt Music Academy).

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 cca 1820.
- Preparation and publication of the comprehensive series *Music History of Hungary*.
- 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 Musical Works, and of Bartók's Hungarian Folk Song Collection.
- Researches into organology and musical iconography. Development of a computer-aid catalogue system for

the iconographical collection of the Museum of Music History.

Researches in Ethnomusicology and Ethnochoreology

- Edition of the series *Collection of Hungarian Folk Music (Corpus Musicae Hungaricae Popularis)*, which, prospectively, will present the main corpus of the Hungarian folk music material.
- Systematization of the melodies 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 of the past more than 100 years.
- Collection and recording of Hungarian folk music and folk dances from the ever smaller areas still conserving their folkloristic tradition.
- Computerized (digital) analysis of recorded folk music



The library of the institute

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, networked, 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.



The library of the institute

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The research building

Objectives and goals of the Institute

The Institute of Political Science of the HAS conducts theoretical, empirical and comparative research primarily in the field of political science, and to a considerable extent in the field of related social sciences as well. Its activity is characterised by a marked inter- and multidisciplinary approach. It is its task to continuously study Hungarian political life, to describe and interpret the decisive trends and to enrich the academic means requisite for that work.

The research activities of the Institute cover a broad area of topics. The assessment of the various aspects and consequences of systemic change was in the forefront of analysis in the 1990's. Though it has not lost its importance, it has been enriched since by major international comparative studies. The emphasis is gradually shifting to the study of the process of European integration. In the teams of the Institute several research projects are in progress that address problems related to the future membership of

Hungary in the European Union. Our analyses of the accession process are done not only from the specific angle of political science, but also from that of philosophy, social theory, sociology and anthropology.

The Institute has built up a broad national research network and it serves as a centre and background institution for political science research conducted in several places in Hungary.

Our colleagues are involved in higher education both at graduate and postgraduate levels. They helped to introduce political science into the curricula of universities and colleges all over the country. Some of them hold the office of chair professors and lead Ph.D. courses.

Academic co-operation with other Hungarian research organisations has also gained significance. The Institute participates in a number of international projects jointly with other national institutions. The number of presentations given at various academic conferences is impressive. Most of them fall under academic co-operation arrangements and our researchers give account of their achievements and carry on activities for the dissemination of knowledge at various ad hoc events, too.

The broad activities of the Institute take advantage of the resources available under research grants. Since its establishment the Institute has participated in national academic competitive applications with considerable success. The progress of Hungary towards the European Union has already made available several

foreign resources supporting research, and our research fellows have been successful in tapping them. Naturally, a significant part of joint international research projects deals with the European integration process and with its Hungarian aspects and therefore they have been carried out jointly with European partners. At the same time the scope of co-operation with colleagues from outside Europe is not negligible either.

In addition to the large number of foreign publications, numerous presentations are given abroad and teaching activities outside Hungary also contribute to the success of applications for research grants. Our colleagues give presentations in several parts of the world, mostly in EU member states and also in the United States as well as in Turkey and in Norway, at IPSA Congresses etc. The research staff actively participates in the operation of the Hungarian Association for Political Science, in the professional jury of the National Basic Programmes for Academic Research, and in other academic organisations. Relying on its extensive national and international contacts, the Institute organises conferences, publishes monographs, collections of papers and conference proceedings and working papers, too.

The Political Science Review, the only Hungarian professional periodical of the discipline, is also edited in and published by the Institute. In addition, the Central European Political Science Review, the English-language political science periodical of the region is also edited and published here.

The research institute has built up an advanced computer network system which provides adequate infrastructure for the research. The favourable composition of the research staff by age and its high standard of qualification offer encouraging perspectives for the continuity of the research work in the long run.

Research tasks and topics of the Institute

Theoretical and methodological questions

Basic research in political science, theory and methodology belong traditionally to the profile of our Institute. Topics such as the principles and foundations of political science and the theoretical perspectives of politics in general all come under the above definition. Summaries of studies on the Hungarian political life and reviews on the state of art and various tendencies within the discipline are also included in this category.

Research related to the system of political institutions

Research related to elections, to the various state institutions and the parties can be listed under this heading. The researchers investigate not only the institutional changes caused by the systemic transformation, but also the effects of the European integration on the Hungarian political system.

Researches into political sociology

The empirical and theoretical study of the reshuffled social and economic

structure after the system change is an important task of the Institute because of its relevance to national and local politics.

Research related to European integration

While practically all of our research projects pay special attention to some aspects of the European integration of Hungary, special analyses are being done directly on the topic of the European Union. The research group for international and European politics studies the changing rules of integration and accession policy of the EU and their implications for the Hungarian adaptation policy, and analyses the new challenges for the political, economic and legal culture of the country.

Researches in the area of the sociology of values

The project studies the changes occurred in the social consciousness, in the set of values and behavioural culture of Hungarian society in the context of accelerating globalisation and European integration. The study of the emergence of an European civil society is also in progress, similarly to the work on the influence of the eastern enlargement of the European Union on the institutions, culture and identity/identities. The study of the border regions in the European Union as laboratories for transnational co-operation and the investigation of similar transborder activities between Hungary and its neighbours is a promising new research topic of the group.

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

Cerebral lateral dominance patterns in information processing

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



Psychophysiological stimulus generating and data processing system for the study of mechanisms of cerebral bioelectric signal formation

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 responses by multichannel intracortical multi-electrode analysis of primary-tonotopic and secondary areas of the acoustic cortex in behavioral task situations

Psychophysiological correlates of cognitive operations (acoustic and phonological conditions of speech understanding, processing features of linguistic functions, lexical, morphological and semantic processing, probability perception)

Neuropsychological and psycholinguistic study of different levels of speech understanding and speech formation in aphasic patients

- Investigation of factors modifying access to word meaning and possible points of interaction among these factors.

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.



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 elderly age
- 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



Laboratory of the Social Development Group

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

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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Great Plain Research Institute

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Central and North Hungarian Research Institute

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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

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 development of the Alpine-Adriatic region

Central and North Hungarian Research Institute

- Study of 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
- 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

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

Training of regional science

- 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 Scienc of University of Pécs;
- Faculty of Economics, Miskolc;
- Faculty of Natural Sciences of József Attila University, Szeged;
- Berzsenyi Dániel Teacher Training College, Szombathely; Körös College, Békéscsaba-Szarvas; College of Trade and Economics, Szolnok.

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The Institute of Sociology was founded in 1963. Since then it has become a major research centre of social sciences in Hungary

Profile of the Institute

The Hungarian Academy of Sciences Institute of Sociology was founded in 1963 and became an important center of the Hungarian social scientific researches. Besides domestic researches the Institute is involved in several EU-, OECD- and NATO-projects and it maintains strong scientific co-operation with more than 30 research institutes.

Main fields of activity

Modernisation of the economic and technological systems;

Empirical research on social transformation;
Social development trends;
Role of human resources;
Elderly and ageing society;
Sociology of values;
Innovation processes;
Institutional changes;
East and Central European comparative research;
Communication and Media;
Environmental issues;
Social and cultural anthropology, social history;
Cultural research;

Systems of management;
Social policy.

Research aims

The basic aim of the Institute is twofold. First, to conduct 'classical' sociological researches, that is, basic researches on sociological theoretical and methodological 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 researches on the one hand, while it also pursues policy-oriented researches on the other. It applies both analytical and normative research methods. Involvement of international co-operation is a priority of the researches.

Dynamics in Transformation of Hungarian Society

- Emergence of a new bourgeois society in Hungary;
- The new service class;
- Old and new poverty in Hungary;
- Modernisation processes;
- The Roma/Gypsy population in Hungary;
- Changing rural societies;
- Changing family structures;
- Changing role of women, transformation of gender roles;
- Changing world of work;
- Political trends in Hungary;
- Changes in the conception of justice;
- Mortality;
- Civil society.
- Social (environmental, women's and trade union) movements.

Globalisation Impacts on Hungarian Society

- Transformation of institutional system;
- Regional conflicts;

- Adaptation processes related to joining the European Union;
- Communication systems of economic organisations;
- New production methods;
- Institutionalisation process of technology and innovation;
- Systems of knowledge creation and distribution;
- Transformation of health-care system;
- Local government policies;
- Co-operation between public and private institutions in social policy.

Risk Society

- Distribution and re-distribution of risks;
- Management of risks at macrolevel;
- New deprivation related to knowledge distribution.

Social Consciousness, Values, Culture and Identity

- Minority/majority policies;
- Activity structure of Hungarian society;
- Value changes in Hungarian society;
- Attitudes and values of the economic elite;
- Cultural aspirations of the new elite;
- The state of culture and its changes in Hungary.

European Studies:

- East and Central European comparative studies (models of development, situation of minorities, comparison of elites);
- Nationalism and democratisation in an all-European context
- Centre-periphery relations in Europe;
- Winners and losers of European integration;
- Regional co-operation in Europe.

Theoretical, Methodological and Historical Aspects of Social Sciences

RESEARCH CENTRE FOR SOCIAL STUDIES

Address: H-1014 Budapest, Országház u. 30.

Postal address: H-1014 Budapest, Országház u. 30.

Telephone: (36-1) 224-6791

Telefax: (36-1) 224-6792

President of the Scientific Council: Ferenc GLATZ, OM

E-mail: magdolna@tti.hu

Acting director: Margit BALOGH, C.Sc.

E-mail: bal8686@helka.iif.hu

One of the main purposes of the Research Centre 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 centre is to organize conferences and joint scientific projects of nine academic institutes 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.

This way the „scientific manager” activity covers the whole Academy. What’s more, some projects even include researchers and institutes from other scientific areas like natural science.

The organizational base of the centre 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 centre there are three research teams, namely:

Demographic Research Team

The Hungarian Academy of sciences established a demographic research team to study demographic issues and policies. Its main task is to take part in the production of the demographic atlas showing Hungary’s population at the beginning of the 20th century.

Science bank

Activities of the Science bank working within the frames of the Research Centre for Social Sciences:

- To establish and replenish databases of academic history
- To establish a database of scientific history
- To establish connection with every research institutions where researches of scientific history are in progress. The starting point is the register of research institutions.

European History Research Group

This unit is created to establish a Hungarian workshop of European history, publishing essays also in foreign languages and to start a series of monographies with the planned title *Hungarians in Europe*.

INSTITUTE FOR WORLD ECONOMICS

Address: H-1014 Budapest, Országház u. 30.

Postal address: H-1535 Budapest, P.O.Box 936

Telephone: (36-1) 224-6760

Telefax: (36-1) 224-6765

Director: András INOTAI, D.Sc.

E-mail: vki@vki.hu

Home page: www.vki.hu



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 independent of political influences. Its purpose is to draw conclusions and make recommendations for Hungarian policy-makers, based on its research findings. These concern eco-

nomics 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 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, the transformation of Central and Eastern Europe, and the return of the region to the international mainstream. Since its foundation, the IWE has possessed a dynamic, internationally active staff of researchers. They have reacted successfully to the professional challenges posed by the decisive political and economic processes in recent years.

Fields of research

Main fields of research at IWE are the following:

- Comprehensive assessment of the processes occurring in the world economy.
- Forecasting the changes and trends in the world economy that can be expected in the medium and long term.
- Examining the enlarging and deepening processes in the EU, especially in relation to Hungary's accession.
- Comparative study of economic transformation in the Central and Eastern European countries since the change of system.
- Monitoring international trends, industries, countries and groups of countries decisive to the Hungarian economy.
- Analysis of the trends and the global and regional determinants and factors in international competitiveness.
- Examining the international competitiveness of the Hungarian economy, exploring ways of increasing it through global, regional and bilateral cooperation, and devising economic-policy measures to enhance it.

The institute bases its activity on a global network of cooperation. It has comprehensive and 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 decentralized research centres organized on regional and/or functional bases. *Ad hoc* groups from more than one research centre may assemble within the institute to perform specific research tasks and projects. These sometimes include researchers from other organizations. The institute also undertakes outside assignments. Some of its income derives from funding obtained by competitive applications.

The research centres and main research fields

Development Research Centre

The centre prepares development studies and makes research into the developing world. Topics are: world agriculture and the World Trade Organization (WTO); agricultural transformation in the CEE countries; Hungarian agriculture and food economy; CEFTA cooperation; EU agriculture and Hungary's agricultural accession; the potential labour-market effects of accession; the labour market and employment policy in the EU countries; globalization and the labour market in the world economy, with special attention to Eastern Europe; the labour market for young people in Eastern Europe; world economic trends and their influence on Hungary; globalization and the financial bubble.

East-Central European Research Centre

The centre carries out research into Russia and the CIS, Poland and the Baltic states, the Czech Republic and Slovakia, and Southeast Europe. It also focuses on Hungary's relations with the CEE countries, as well as regional cooperation and European integration. The centre attaches great importance to comparative analysis of the CEE region in relation to transformation as a whole and to its various aspects.

European Integration Research Centre

The centre deals with economic integration within the EU, the economic situation and integration interests of its members-states, and aspects of Eastern enlargement, such as financial considerations. It also covers Hungary's preparations for EU accession, and the role and effects of foreign direct investment (FDI) on Hungary.

Japan and Southeast Asia Research Centre

The centre deals with the position of the Asian-Pacific region in the world and its socio-political and economic questions. Subjects include 'Asian values', modernization, concepts of democracy, management methods, the transformation process in the Japanese economy and society, the People's Republic of China and the so-called Greater Chinese Community, as well as the cooperation formations (APEC, ASEAN, *etc.*), the Asia-Europe dialogue (ASEM), and the macroeconomic and corporate relations between the Far East region and Hungary.

Modernization and Services Research Centre

Within the field of infrastructure and services, emphasis is placed on the following issues: Hungarian strategy in negotiations with the EU and the conditions for Hungarian entry into the EU; international comparison of economic-development levels; modernization models in various centuries and countries; corporate reorganization and competitiveness in Hungary; FDI projects and modernization of Hungarian manufacturing industry; aspects of environmental protection; environmentally sensitive transport policy; territorial (regional) dimensions of these.

Library

Since January 2000, the Scientific Information Service has been part of the Joint Library of Social Sciences, along with the libraries of the research institutes for minority studies, political studies and sociology.

The scope of the library has been shaped by the research directions being pursued at the institute. Many of the acquisitions are obtained through the institute's extensive network of international cooperation and exchanges. This means that a decisive proportion of the stock consists of items commercially not available or found elsewhere. Excellent relations with international institutions ensure that the library receives sizeable collections of publications, statistics and handbooks from the EU, the World Bank, the IMF, the OECD, specialized UN agencies, and other bodies.

A comprehensive library information service is accessible for readers by tele-

phone: (36-1) 224 6759. The computerized catalogue can be reached via www.etk.mtapti.hu.

Publications

The institute's research findings appear in its own publications. Prominent institute publications include the internationally well-known *Working Papers* series, running for more than ten years now. The series in Hungarian are entitled

Kihívások (Challenges) and *Műhelytanulmányok* (Working Studies). Actual reflections on international economic and political issues of the day in *Vélemények, Kommentárok, Információk* (Opinions, Comments, Information). Occasional volumes of studies in English or Hungarian also appear. The institute's publications form the basis for the extensive international programme of exchanges mentioned in the previous section.



OFFICE FOR ACADEMY RESEARCH GROUPS ATTACHED TO UNIVERSITIES AND OTHER INSTITUTIONS

Address: H-1051. Budapest, Nádor u. 7.

Telephone: (36-1) 413-3220

Telefax: (36-1) 413-7890

E-mail: igazgato@tki.office.mta.hu

Director: Huba PAÁL

Council of the Research Group's Representatives

President: Béla HALÁSZ, O.M.

Vice President: Kálmán MEDZIHRADESKY, O.M.
György HUNYADY, C.M.

Berzsenyi Dániel Teacher's College

Research Group for Regional Development and Microintegration

Head: *Ádám TÖRÖK, C.M.*

Research topic: The development of the region of western Hungary in the context of globalisation and european integration, microintegration cross-border cooperation

Budapest University of Economics Sciences and Public Administration

Research Group for Together for Europe

Head: *Attila ÁGH, D.Sc. (Political Sciences)*

Research topic: The Europeanization of the Hungarian policy

Research Group for Complex Futures Studies

Head: *Erzsébet NOVÁKY, D.Sc. (Economics)*

Research topic: Evolutionary development and forecasting of complex economic systems; future judgement of entrepreneurs

Research Group for European Integration

Head: *Tibor PALÁNKAI, C.M.*

Research topic: European integration

Budapest University of Technology and Economics

Research Group for Physical Geodesy and Geodynamics

Head: *József ADÁM, C.M.*

Research topic: Physical geodesy and geodynamics, and some further subjects within geodetic science

Research Group for Stochastics

Head: Imre CSISZÁR, O.M.

Research topic: Randomness, information, dynamical system

Research Group for Geoinformation

Head: Ákos DETREKŐI, O.M.

Research topic: Geoinformation, remote sensing and image processing research

Research Group for Geotechnics

Head: József FARKAS, D.Sc. (Engineering)

Research topic: Interaction between the soil and structure

Research Group for History and Philosophy of Science

Head: Márta FEHÉR, D.Sc. (Philosophy)

Research topic: History and philosophy of the sciences

Research Group for Technical Chemistry

Head: Zsolt FONYÓ, C.M.

Research topic: Environmental oriented academic research for technical chemistry with theoretical and experimental tools

Research Group for Numerical Structural Mechanics

Head: Zsolt GÁSPÁR, O.M.

Research topic: Numerical structural mechanics

Research Group for Materials Science

Head: János GINSZTLER, C.M.

Research topic: materials science and technology

Research Group for Informatics and Electronics

Head: László GYÖRFI, O.M.

Research topic: Statistic, information theory, telecommunication

Research Group for Structural Engineering

Head: István HEGEDŰS, D.Sc. (Engineering)

Research topic:

Research Group for Solids in Magnetic Field

Head: András JÁNOSSY, O.M.

Research topic: Study in high magnetic fields, of solids with unusual electric and magnetic properties

Research Group for Control Engineering

Head: László KEVICZKY, O.M.

Research topic: Modeling and control of linear, nonlinear systems, robots and mechatronic systems

Research Group for Alkaloid Chemistry

Head: Lajos NOVÁK, D.Sc. (Chemistry)

Research topic: Preparation and biological evaluation of natural product

Research Group for Embedded Information Technology

Head: Gábor PECELI, D.Sc. (Engineering)

Research topic: Theory of distributed, heterogeneous systems, embedded information systems

Research Group for Neuropsychology and psycholinguistics

Head: Csaba PLÉH, C.M.

Research topic: Neuropsychological disorders in childhood, Williams syndrome and SLI; child language; mechanisms of sentence processing

Research Group for Dynamics of Machines and Vehicles

Head: Gábor STÉPÁN, C.M.

Research topic: Dynamics of machines and vehicles

Research Group for Technical Analytical Chemistry

Head: Klára TOTH, O.M.

Research topic: Research and development of chemical sensors and instrumental methods of analysis

Research Group for Theory of Condensed Material Physics

Head: Alfréd ZAWADOWSKI, O.M.

Research topic: Theory of strongly correlated electron systems, many-body physics, computational physics

Research Group for Soft Matters

Head: Miklós ZRINYI, D.Sc. (Chemistry)

Research topic: Soft materials (complex fluids, composite elastomers polymer gels)

Research Group for Molecular Network Dynamics

Head: Béla NOVÁK, D.Sc.

Research topic: Mathematical modelling at cellular, regulatory networks with the tools of reaction-kinetics

Research Group for Organic Chemical Technology

Head: László TÓKE, O.M.

Research topic: Selective reactions in organic chemistry

University of Debrecen

Research Group for Ethnography

Head: Elek BARTHA, D.Sc.

Research topic: The meeting and connections of culture in the regions of the North-Eastern part of the Carpathian basin

Research Group for Textological Studies on the Age of Enlightenment

Head: István BITSKEY, D.Sc. (Literature)

Research topic: Textological studies on the age of enlightenment

Research Group for Cell Biophysics

Head: Sándor DAMJANOVICH, O.M.

Research topic: Structural and functional role of cell surface receptor patterns

Research Group for Cell Signaling and Apoptosis

Head: László FESŰS, C.M.

Research topic: Molecular mechanism and cell signaling pathways contributing to determine cell fate

Research Group for Tumourvirus

Head: Lajos GERGELY, D.Sc. (Medicine)

Research topic: Ethiological role of human papilloma- and retroviruses

Research Group for Number Theory

Head: Kálmán GYŐRY, O.M.

Research topic: Effective, quantitative and computational investigation in Diophantine number theory

Research Group for Homogeneous Catalysis

Head: Ferenc JOÓ, C.M.

Research topic: Aqueous organometallic chemistry catalytic modification of biological membranes

Research Group for Theoretical Linguistics

Head: András KERTÉSZ, C.M.

Research topic: Empirical foundations of cognitive semantic theories

Research Group for Cell Physiology

Head: László KOVÁCS, C.M.

Research topic: Molecular mechanism of intracellular signal transduction under physiological and pathological conditions

Research Group for Carbohydrates

Head: András LIPTÁK, O.M.

Research topic: Synthesis of biologically active carbohydrate derivatives

Research Group for Tissue and Neuroscience

Head: László MÓDIS, D.Sc. (Medicine)

Research topic: Cell-cell and cell-matrix interactions in the organization of connective and nervous tissues

Research Group for Thrombosis and Haemostasis

Head: László MUSZBEK, O.M.

Research topic: Factor XIII of blood coagulation: structural and functional aspects, involvement in various diseases

Research Group for Land use and Regional Development

Head: János NAGY, D.Sc. (Agriculture)

Research topic: Scientific foundation of the agriculture and soil protection and the agroecological, biological and cultivation technological effects with computer programs

Research Group for Microbial Developmental Genetics

Head: Mátyás SIPICZKI, D.Sc. (Biology)

Research topic: Genetic regulation of the differentiation and multiplication of microscopic fungi and streptomyces: genetic and genomic analysis

Research Group for Autoimmune Diseases

Head: Gyula SZEGEDI, O.M.

Research topic: Polysystemic autoimmune and cardiovascular diseases

Research Group for Antibiotics

Head: Ferenc SZTARICSKAI, D.Sc. (Chemistry)

Research topic: Isolation, structure elucidation, semi-synthetic transformation, and synthesis of new antibiotics

Research Group for PET study

Head: Lajos TRÓN, D.Sc. (Biology)

Research topic: Functional investigations by positron emission tomography

Research Group for Vulgo

Head: Mihály VAJDA, C.M.

Research topic: Encyclopedia of ethics

Eszterházy Károly Teacher's College

Research Group for Bryology

Head: Tamás PÓCS, O.M.

Research topic: Complex research of the taxonomy, phytogeography and ecology of bryophytes

Eötvös Loránd University, Budapest

Research Group for Comparative Ethology

Head: Vilmos CSÁNYI, O.M.

Research topic: Studies on behaviour evolution by comparative ethological methods

Research Group for Immunology

Head: Anna ERDEI, D.Sc. (Biology)

Research topic: The role of immune complex binding receptors in the induction and regulation of immune reactions; study of the function of B lymphocytes, dendritic cells and mastocytes

Research Group for Geoinformatics and Space Sciences

Head: Csaba FERENCZ, D.Sc. (Engineering)

Research topic: Investigation of the Earth surface and upper atmosphere by electromagnetic wave-analytical methods using satellite data

Research Group for Combinatorial Optimization

Head: András FRANK, D.Sc. (Mathematics)

Research topic: Combinatorial optimization: structures and algorithms

Research Group for Biotechnology

Head: László GRÁF, O.M.

Research topic: Proteomics of serine proteases of the human brain

Research Group for Geology

Head: János HAAS, D.Sc. (Earth sciences)

Research topic: Geological study of Hungary and the surrounding region

Research Group for Structural Chemistry

Head: István HARGITAI, O.M.

Research topic: Determination and modeling of intramolecular and intermolecular information in molecular structure

Research Group for Theoretical Physics

Head: Zsolt HORVÁTH, C.M.

Research topic: Particle physics and high energy nuclear physics, quantum field theory; Statistical physics: chaotic behaviour, nonequilibrium dynamical system, pattern formation, environmental fluid flows

Research Group for Peptide Chemistry

Head: Ferenc HUDECZ, D.Sc. (Chemistry)

Research topic: Synthesis, structure-function studies of bioactive peptides and peptide conjugates

Research Group for Communication Studies

Head: György HUNYADY, C.M.

Research topic: Communication research

Research Group for Legal History

Head: Lajos IZSÁK, D.Sc. (History)

Research topic: The ways of development of the Hungarian legal history in the XIX.-XX. Century

Research Group for Neurobiology

Head: Gábor JUHÁSZ, D.Sc. (Biology)

Research topic: Neurobiology of neurodegenerativ disorders and state dependent changes in brain protean

Research Group for Academic Dictionary of Hungarian Language

Head: Miklósné KAÁN, D.Sc.

Research topic: Compilation of the Academic Dictionary of Hungarian Language

Research Group for Altaic Studies

Head: György KARA, C.M.

Research topic: Altaic studies

Research Group for Appiled Number Theory.

Head: Imre KÁTAI, O.M.

Research topic: Appiled and algorithmic number theory

Research Group for Philosophy of Language

Head: János KELEMEN, D.Sc. (Philosophy)

Research topic: Philosophy of language

Research Group for the Investigation of the Collection of Prints of the ELTE University Library

Head: Éva KNAPP, D.Sc.

Research topic: Investigation and Systematisation of the collection of prints of the ELTE University library (Historical and allegoric representation in 18 th century)

Research Group for Literary Theory

Head: Ernő KULCSÁR SZABÓ, C.M.

Research topic: Highlightings of the Medial character of language in Hungarian literature and art theory in the first half of the 20th century

Research Grop for Systematic Zoology

Head: Sándor MAHUNKA, C.M.

Research topic: Taxonomical researches to explore the biodiversity of soils

Research Group for Classical Studies

Head: Miklós MARÓTH, C.M.

Research topic: Hungarian medieval latin dictionary classical esthetics

Research Group for Geophysics and Enviromental Studies

Head: Attila MESKÓ, O.M.

Research topic: Global and regional studies in geophysics, appiled and enviromental geophysics, enviromental and sustainability science studies

Research Group for Protein Modelling

Head: Gábor NÁRAY-SZABÓ, O.M.

Research topic: Investigation of protein structure-activity relationships with X-ray crystallography, nuclear magnetic resonance and computer modelling

Research Group for Regional Science

Head: József NEMES NAGY, D.Sc.

Research topic: Regional studies, regional modelling, spetial inequalities, theory of social space

Research Group for European Art History

Head: Krisztina PASSUTH, D.Sc.

Research topic: European art history

Research Group for Statistical Physics

Head: András PATKÓS, C.M.

Research topic: Statistical physics of mesoscopic systems

Research Group for High Culture

Head: Sándor RADNÓTI, D.Sc. (Philosophy)

Research topic: The genesis and functioning of modern high culture

Research Group for Theoretical Biology and Ecology

Head: Eörs SZATHMÁRY, D.Sc. (Biology)

Research topic: Theoretical biology, evolutionary biology, ecological modelling

Research Group for NATO Information

Head: László VALKI, D.Sc. (Law)

Research topic: NATO's Role in recent international relations war on terrorism

Research Group for Biological Physics

Head: Tamás VICSEK, O.M.

Research topic: Collective behaviour in biology

Research Group for Evolutionary and Molecular Genetics

Head: Gábor VIDA, O.M.

Research topic: Evolution of Filicidae taxa, genetic regulation, developmental genetics, mesoderm development

Research Group for Environmental Chemistry

Head: Gyula ZÁRAY, D.Sc. (Chemistry)

Research topic: Accumulation of heavy metals in plant and humanbiological materials: investigation of biofilms and urban aerosols

Research Group for Nyugat

Head: Zoltán KENYERES, D.Sc. (Literature)

Research topic: Studies of the periodical Nyugat: Endre Ady, Mihály Babits, Dezső Kosztolányi

Research Group for Structural Chemistry and Spectroscopy

Head: Pál SOHAR, C.M.

Research topic: Synthesis and complex spectroscopic study of metallorganic and heterocyclic compounds

Research Group for interdisciplinary studies in archaeology

Head: Miklós SZABÓ, O.M.

Research topic: Interdisciplinary research in archaeology

Research Group for Nuclear Techniques in Structural Chemistry

Head: Attila VÉRTES, O.M.

Research topic: Chemical applications of the Mössbauer spectroscopy and the positron annihilation techniques

Research Group for Folklor Text Analysis

Head: Vilmos VOIGT, D.Sc.

Research topic: Collecting, systematizing of hungarian folklore texts, with forming adat-base archive, preparing scholarly editions

University of Kaposvár

Research Group for Animal Science and Hygiene

Head: Péter HORN, O.M.

Research topic: Food safety and human health concerns of toxic substances in the food chain

Research Institute of Demography of the Central Statistical Central Office

Research Group for Demographic Methods

Head: Tamás FARAGÓ, D.Sc. (Sociology)

Research topic: Long time population development in Hungary

Liszt Ferenc University of Music

Research Group for History and Theory of Church Music

Head: László DOBSZAY, D.Sc.

Research topic: History and theory of church music

University of Miskolc

Research Group for Geotechnology

Head: Ferenc KOVÁCS, O.M.

Research topic: Complex evaluation of effects of geotechnical activity

Research Group for Numerical Mechanics

Head: István PÁCZELT, O.M.

Research topic: Numerical investigation of non-linear mechanical problems

Research Group for Materials Science

Head: András ROÓSZ, D.Sc. (Engineering)

Research topic: Examination and simulation of transformation in metals and alloys

Research Group for Mechanical Technologies

Head: Miklós TISZA, D.Sc. (Engineering)

Research topic: Application of the methods of computer aided engineering in materials science and materials processing technologies

Research Group for Production Information Engineering

Head: Tibor TÓTH, D.Sc. (Engineering)

Research topic: Application of New Information Engineering Tools for Supporting Computer Integrated Production

National Archives of Hungary, Budapest

Research Group for Archives of Sigismund's Age

Head: László SOLYMOSI, D.Sc. (History)

Research topic: Research and publication of the archives of Sigismund's age

Hungarian Natural History Museum, Budapest

Research group for Animal Ecology

Head: László PAPP, O.M.

Research topic: Structure and diversity of animal communities, population interactions

Research Group for Paleontology

Head: Attila VÖRÖS, D.Sc. (earth sciences)

Research topic: Critical events and evolution of the biosphere in the past 250 million years

University of West-Hungary, Sopron

Research Group for Process Engineering of Agricultural Products

Head: Miklós NEMÉNYI, D.Sc. (Agriculture)

Research topic: Modelling of the conserving, storing and process engineering methods of the agricultural products

National Széchenyi Library, Budapest

Research Group for History of the Hungarian Revolution of 1956

Head: Gábor GYÁNI, D.Sc.

Research topic: History of Hungary between 1944-1989, especially the Sixties, and the history of the Hungarian Revolution of 1956

Research Group for Mediaeval Manuscripts and Early Hungarian Printed Books

Head: Edit MADAS, D.Sc.

Research topic: Identification, description and cataloging of codices preserved in Hungarian Libraries and of codex-fragments from the binding of early printed books

University of Pécs

Research Group for Neurohumoral Regulations

Head: Valér CSERNUS, D.Sc.

Research topic: Investigation of neuronal systems elaborating hypophysiotropic neurohormones and study of hypophysiotropic hormone analogs

Research Group for Clinical Neuroscience

Head: Tamás DÓCZI, D.Sc. (Medicine)

Research topic: Investigation of basic problems in clinical neuroscience by means of molecular methodology

Research Group for Hungary and Europe

Head: Ferenc FISCHER, Ph.D.

Research topic: History of Hungary and Europe in the 19th -20th Century

Research Group for Clinical Genetics

Head: György KOSZTOLÁNYI, C.M.

Research topic: Genotypical and phenotypical analysis of genetic instability

Research Group for Neurophysiology

Head: László LENÁRD, C.M.

Research topic: Mechanisms of motivation, learning and reinforcement

Research Group for Chemical Sensors

Head: Géza NAGY, D.Sc. (Chemistry)

Research topic: Development of selective chemical sensors, investigation of molecules and interaction mechanisms providing sensor function. Working out measuring methods employing sensors

Research Group for Fluorescence Spectroscopy

Head: Béla SOMOGYI, D.Sc. (Biology)

Research topic: Studies on functional dynamics of cytoskeletal and motorproteins by the use of fluorescence spectroscopy: from individual molecules to cellular systems

Research Group for Reproductive- and tumor Immunology

Head: Júlia SZEKERES, D.Sc. (Medicine)

Research topic: The immunomodulatory molecule- PIBF affects tumor growth and the development of autoimmunity

Research Group for Neuropharmacology

Head: János SZOLCSÁNYI, O.M.

Research topic: Pharmacology of primary afferent neurons

Semmelweis University, Budapest

Research Group for Neurochemistry

Head: Veronika ÁDÁM, C.M.

Research topic: Oxidative stress in the central nervous system. Transports in the blood-brain barrier

Research Group for Molecular Genetics

Head: Rudolf de CHATEL, D.Sc. (Medicine)

Research topic: Molecular genetics of cardiovascular and metabolic diseases

Research Group for Molecular Immunology

Head: András FALUS, C.M.

Research topic: Allergy and leukemia, immunology and genomics

Research Group for Neuropsychopharmacology

Head: Zsuzsanna FÜRST, D.Sc. (Medicine)

Research topic: Brain reward and stimulatory mechanisms: neurobiological and pharmacotherapeutic aspects

Research Group for Neuroendocrinology

Head: Ida GERENDAI, D.Sc. (Medicine)

Research topic: Neurochemical and functional analysis of the hypothalamic glutamatergic innervation and of the control of gonadal function and prolactin secretion

Research Group for Peptide Biochemistry

Head: György KÉRI, D.Sc. (Biology)

Research topic: Synthesis and characterisation of anti-tumour peptides and other signal-transduction inhibiting molecules

Research Group for Neurobiology

Head: Elemér LÁBOS, D.Sc. (Biology)

Research topic: Functional morphology of neural plasticity

Research Group for Neurochemical

Head: Kálmán MAGYAR, O.M.

Research topic: Studies of neurodegenerative and neuroprotective mechanisms

Research Group for Endoplasmic Reticulum

Head: József MANDL, D.Sc. (Medicine)

Research topic: Transport processes and transporters in endoplasmic reticulum

Research Group for Brain Physiology

Head: Csaba NYAKAS, D.Sc. (Medicine)

Research topic: Action of exercise and dieting on normal and pathological brain ageing

Research Group for Neuromorphology

Head: Miklós PALKOVITS, O.M.

Research topic: Neuroanatomical and neurochemical identification of the pathways of central nervous system

Research Group for Metabolism and Atherosclerosis

Head: László ROMICS, O.M.

Research topic: Complex study on the pathomechanism of atherosclerosis by genetical immunological and cellbiological approaches

Research Group for Biophysics

Head: Györgyi RONTÓ, D.Sc. (Biology)

Research topic: Application and extension the DNA-based molecular and global UV dosimetry to the VUV, UVA, VIS radiation bacterial and mammalian cells, proteins

Research Group for Nephrology

Head: László ROSIVALL, D.Sc. (Medicine)

Research topic: Pathomechanism of progressive renal fibrosis

Research Group for Membrane Biology and Immunopathology

Head: Balázs SARKADI, D.Sc. (Biology)

Research topic: Structure and function of biological membranes

Research Group for Genes and Environment

Head: Péter SÓTONYI, C.M.

Research topic: "Affected family" investigation of pathological cell division with cyto- and moleculargenetical methods.

Research Groups for Cellular and Molecular Physiology

Head: András SPÁT, O.M.

Research topic: biological signal transduction

Research Group of Molecular Pathology

Head: Béla SZENDE, D.Sc. (Medicine)

Research topic: Regulation of growth and propagation of tumors

Research Group for Pediatrics and Nephrology

Head: Tivadar TULASSAY, C.M.

Research topic: Prevention of adulthood chronic diseases in childhood. Identification and investigation of risk factors

Research Group for Gastroenterology and Endocrinology

Head: Zsolt TULASSAY, D.Sc. (Medicine)

Research topic: Molecular biologic aspects of gastroenterological and endocrinological disorders

Research Group for Molecular Oral Biology

Head: Gábor VARGA, D.Sc.

Research topic: Research in the field of oral biology, physiology and pathophysiology particularly on regulation of epithelial transport process and cell proliferation

Szent István University, Gödöllő

Research Group for Applied Animal Genetics and Biotechnology

Head: András DINNYÉS, D.Sc.

Research topic: Research on genetics and biotechnology in animal breeding

Research Group for Molecular Plant Breeding

Head: László HESZKY, C.M.

Research topic: Development and application of molecular breeding methods in agricultural and horticultural crop plants

Research Group for Agricultural Mycology

Head: László HORNOK, C.M.

Research topic: Development and use of nuclein acid based diagnostic technique for identification of plant pathogen fungi

Research Group for Plant Ecology

Head: Zoltán TUBA, D.Sc. (Biology)

Research topic: Plant ecological processes in temperate and tropical areas under changing climate

University of Szeged

Research Group for History of Ideas in Early Modern Period

Head: Mihály BALÁZS, D.Sc.

Research topic: History of ideas, church history

Research Group for Laser Physics

Head: Zsolt BOR, O.M.

Research topic: Femtosecond lasers; application of lasers in materials science, biology and medicine

Research Group for Ability Development

Head: Benő CSAPO, D.Sc.

Research topic: System organization and development of knowledge and skills

Research Group for Artificial Intelligence

Head: János CSIRIK, D.Sc. (Mathematics)

Research topic: Machine learning, speech recognition, natural language processing

Research Group for Nanostructured Materials

Head: Imre DÉKÁNY, C.M.

Research topic: Preparation and characterization of nanoparticles, nanocomposites and ultrathin layers

Research Group for Dermatological

Head: Attila DOBOZY, C.M.

Research topic: Functional genomic studies and new therapeutic possibilities of inflammatory and hyperproliferative skin diseases

Research Group for Medieval Hungarian History

Head: Gyula KRISTÓ, C.M.

Research topic: Charters of the Angevin era, Medieval Hungarian History

Research Group for Microbiology

Head: Erzsébet NAGY, D.Sc. (Medicine)

Research topic: Production and molecular genetic characterization of transgenic fungi

Research Group for Cardiovascular Pharmacology

Head: Gyula PAPP, O.M.

Research topic: New potential drugs to treat heart failure and cardiac arrhythmias: analysis of efficacy and mechanisms of action

Research Group for Protein Chemistry

Head: Botond PENKE, C.M.

Research topic: Characterization and investigation of proteins playing key role in the pathomechanism of neurodegenerative diseases

Research Group for Natural Effect and Embryology

Head: János SZABAD, D.Sc. (Biology)

Research topic: What factors are required for the commencement of embryogenesis?

Research Group for Neurohumoral Studies

Head: Gyula TELEGDY/Gyula SZABÓ, O.M.

Research topic: Neural and humoral regulation of adaptive processes

Research Group for Analysis

Head: Vilmos TOTIK, O.M.

Research topic: Approximation theory and dynamical systems

Research Group for Neurology

Head: László VÉCSEI, C.M.

Research topic: Pathomechanism of neurological disorders: therapeutic perspectives

Research Group Organic Catalysis

Head: Mihály BARTÓK, O.M.

Research topic: Enantioselective catalytical syntheses

Research Group for Heterocyclic Chemistry

Head: Gábor BERNÁTH, D.Sc. (Chemistry)

Research topic: Synthesis and stereochemical study of fused-skeleton saturated heterocycles and 1,2-disubstituted alicyclic compounds

Research Group for in Turkology

Head: Árpád BERTA, D.Sc. (Linguistic)

Research topic: History of turkic languages

Research Group for Reaction Kinetics

Head: János KISS, D.Sc. (Chemistry)

Research topic: Surface science and heterogeneous catalysis

Research Group for Bioinorganic Chemistry

Head: Tamás KISS, D.Sc. (Chemistry)

Research topic: Biospeciation of essential and toxic metalions and complexes; structural and functional modelling of metalloproteins

University of Veszprém

Research Group for Plant Virology

Head: József HORVÁTH, O.M.

Research topic: Biology and ecology of plant viruses and virus resistance

Research Group for Air Chemistry

Head: Ernő MÉSZÁROS / A. GELENCSÉR, O.M.

Research topic: Study on the physical and chemical properties of atmospheric aerosol and its environmental effects

Research Group for Analytical Chemistry

Head: János MINK, D.Sc. (Chemistry)

Research topic: Applying of FTIR, Raman- and atomic spectroscopy in material environmental sciences

Research Group for Petrochemistry

Head: Ferenc UNGVÁRY, D.Sc. (Chemistry)

Research topic: Synthetic application of metal compounds in organic chemistry

