European Union
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Operačný program VÝSKUM a VÝVOJ

Ministry of Education, Science, Research and Sport of the Slovak Republic

AGROBIOTECH RESEARCH CENTRE NITRA

We support research activities in Slovak Republic
The project is co-financed by EU resources

AGROBIOTECH RESEARCH CENTRE

WE THINK OF THE FUTURE

www.agrobiotech.sk

IT IS ANOTHER AMBITIOUS PROJECT THAT WE SUPPORTED FROM MULTIPLE FUNDING SOURCES. I BELIEVE THAT THE PROJECTS WHICH WERE ALREADY SUPPORTED AND ALSO THOSE WHICH ARE CURRENTLY BEING PREPARED WILL BE APPRECIATED BY STUDENTS, UNIVERSITIES AND ENTREPRENEURS.

IT IS A WIDE PLATFORM FOR CREATING SUCCESSFUL PARTNERSHIPS.

Dušan Čaplovič

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RECTOR'S WELCOME

For 63 years of its existence, Slovak University of Agriculture in Nitra has become a modern and dynamic university ranked among the top educational and research institutions in Slovakia with an ambition to be widely recognised at international level as well.

In accordance with the University's long-term development strategy until 2020, our goal is to encourage, develop and ensure mainly applied research and to implement an effective transfer of knowledge, products and technologies based on mutually beneficial cooperation among universities, research institutions and businesses in market environment.

The project enabling the creation of the University Research Centre "AgroBioTech" places strong emphasis especially on the transfer of knowledge from academic environment to economic practice whether in terms of cooperation of businesses regarding research and development, transfer of innovative ideas to practice, or establishment of start-up and spin-off companies.

The establishment of the University Research Centre can be divided into four periods. In early December 2011, the Ministry of Education, Science, Research and Sport of the Slovak Republic published the announcement of the possibility to submit proposals to create university research parks and centres within the Operational Programme Research and Development. Together with the Constantine the Philosopher University in Nitra and the Institute of Plant Genetics and Biotechnology of the Slovak Academy of Sciences, SUA in Nitra submitted a joint

project proposal to create a research centre titled AgroBioTech.

In June 2012, Dušan Čaplovič, the then Minister of Education, announced that the project proposal had been approved and that the University had become eligible to submit the application for non-refundable financial contribution within the call for creating university research centres. In January 2013, the application was submitted to the Ministry of Education, Science, Research and Sport of the Slovak Republic and afterwards, in April 2013, a non-refundable financial contribution in the amount of EUR 24,993,512.29 was approved. Total eligible costs of the project were approved in the amount of EUR 26,308,960.30. The implementation stage finished on November 30, 2015, was the last stage of the project. During this stage, the reconstruction of two pavilions within the University campus with total area of 5,800 m2 was successfully completed. These pavilions form the material basis of the AgroBioTech Research Centre that includes 30 laboratories. Thanks to the investments into the laboratory equipment, the Central European region will obtain a number of unique scientific workplaces. We believe that this excellent research infrastructure will allow more and more intensive cooperation of our research teams with foreign teams.

The research centre focuses on 8 priority areas: agrobiology; biotechnologies; genetic technologies; food production; processing technologies for agricultural products; agroecology, bioenergy and bioeconomy. Together with already established centres of excellence focusing on the protection and use of biodiversity, white-green biotechnologies and integrated river basin management, these priority areas will become an integral part of research infrastructure of the University. Such themes are very topical in terms of the Research and Innovation Strategy for Smart Specialisation of the Slovak Republic (RIS 3) and also in terms of the priorities of agricultural science and research.

I wish the whole academic community of our University as well as our partners good health and creative success that will allow our institutions to progressively develop and our laboratories to push back the frontiers of knowledge and to bring high-quality results.

At the same time, let us wish that the Slovak society perceives the support provided to the science and research in the developed European society not as a possibility but as an obligation.

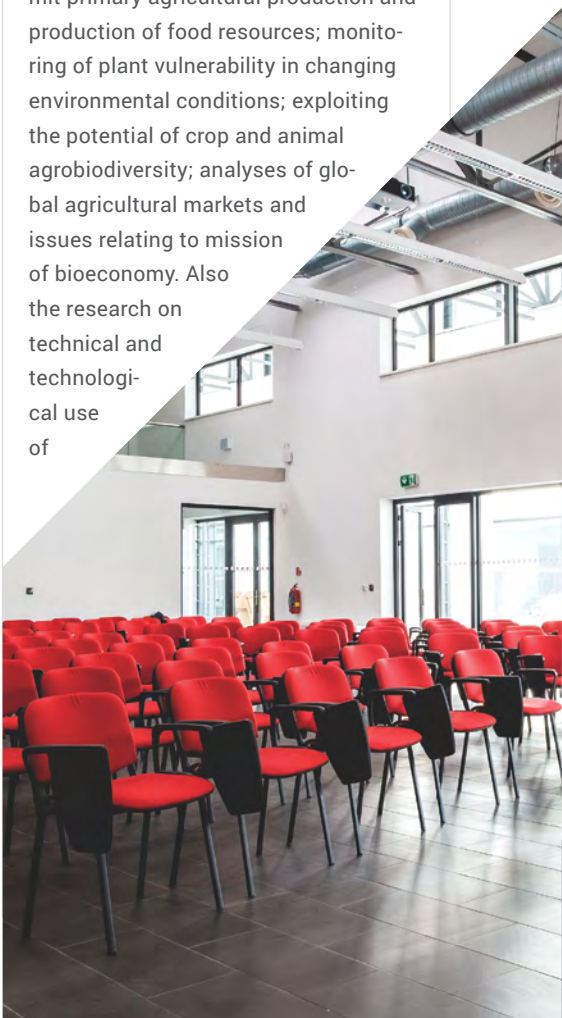
Dr.h.c. prof. Ing. Peter Bielik, PhD.
Rector of the Slovak University of Agriculture in Nitra

AGROBIOTECH RESEARCH CENTRE

AgroBioTech is a research centre, which is focused on applied research in the field of agrobiology; biotechnologies and technologies in agriculture, food production and bioenergy. This regional competence centre of applied research and development integrates top-quality applied research through a partnership of three institutions: **Slovak University of Agriculture in Nitra, Constantine the Philosopher University in Nitra and Institute of Plant Genetics and Biotechnology of the Slovak Academy of Sciences in Nitra.** Research centre is equipped with top research infrastructure, which allows carrying out a research at international level.

AgroBioTech: space for innovative research in different areas

AgroBioTech is regional research centre, which joints the efforts of people having the same goal and opens up opportunities for applied research. This new and unique research centre offers space for innovative research in the fields of agrobiology; biotechnologies; genetic technologies; food production; processing technologies for agricultural products; agroecology, bioenergy and bioeconomy. Breeding ground for the research centre is the orientation on the following issues: current issues that limit primary agricultural production and production of food resources; monitoring of plant vulnerability in changing environmental conditions; exploiting the potential of crop and animal agrobiodiversity; analyses of global agricultural markets and issues relating to mission of bioeconomy. Also the research on technical and technological use of



renewable energy sources and development of new production and processing technologies for industry and agriculture is of key importance.

AgroBioTech consists of three individual research centres located in the premises of all three partners of this unique project. Workplaces located in the premises of Slovak University of Agriculture in Nitra are focused on experimental food technologies and human nutrition; experimental biotechnologies; agrobiology and crop production and, last but not least, on bioenergy and economic studies. Constantine the Philosopher University in Nitra and Institute of Plant Genetics and Biotechnology of the Slovak Academy of Sciences in Nitra are aimed at the issues of molecular biology, embryotechnologies and plant biotechnologies.

Linking universities, research and practice

Along with the creation of the AgroBioTech Research Centre, also the specialised workplace titled Transfer Centre was established. It offers a space for creating closer linkages among universities, research and economic practice.

Main task of the Centre is to promote the transfer of knowledge, technologies and innovations from research and development area into commercial sector and to evaluate and actively use the results in practice. Transfer Centre is also aimed at cooperation with small and medium enterprises; popularisation of the results of science and research; protection of intellectual property; demand-driven research and expertises and, of course, international cooperation.

AgroBioTech Research Centre also created a platform for cooperation of foreign experts with Slovak scientists. This is the place where experts from both partner and cooperating institutions can implement their projects and researches.

Unique devices and equipment

AgroBioTech´s workplaces and laboratories are equipped with the most advanced equipment. From among a number of modern devices in the Centre can be mentioned the only transmission electron microscope in Slovakia or second-generation sequencer for genetic analyses. Within the laboratories of the AgroBioTech Research Centre, scientists investigate e.g. biomass conversion into second-generation biofuels or technologies to be used for processing of the foods of both plant and animal origin. The Centre includes also laboratories of human nutrition, which allow verifying the health implications of consumption of certain foods through clinical trials.

AGROBIOTECH´S WORKPLACES AND LABORATORIES ARE EQUIPPED WITH THE MOST ADVANCED EQUIPMENT.

PROJECT PARTNERS

Idea of establishment of the AgroBioTech Research Centre together with its entry into life was born at three important institutions.

The Slovak University of Agriculture in Nitra (SUA) operates since 1952. Right from the beginning the university was destined to be a centre of agricultural education, research and development in Slovakia in the priority area of human activity – sufficient production of safe and wholesome food in harmony with environmental protection, the conservation of biological diversity and sustainable development. Scientific and educational performance and historical traditions of the institution is recognised at home and abroad. Achieving comprehensive accreditation in 2009, SUA ranked among higher education institutions of university type.

In 2010, as the first university in Slovakia, SUA was awarded the prestigious ECTS Label by the European Commission for the provision and implementation of the European Credit Transfer and Accumulation System for student mobilities. International award "Diploma Supplement Label" awarded in 2013 proves that the supplement to the diploma issued by SUA meets the demanding European standards.

At its six faculties SUA offers a wide range of study possibilities not only in the field of agriculture, but also biology, economy and technical sciences. This paves the way for the graduates in various areas of the economy.

University consists of six faculties: Faculty of Agrobiology and Food Resources, Faculty of Biotechnology and Food Sciences, Faculty of Economics and Management, Faculty of European Studies and Regional Development, Faculty of Horticulture and Landscape Engineering and Faculty of Engineering.

Constantine the Philosopher University in Nitra (CPU) is ranked among the top educational, scientific and artistic institutions. It bears the name of an important figure in the history of Nitra and Slovakia – Constantine the Philosopher (also named as St. Cyril, 827-869). University follows the way of Cyril-Methodius Tradition and spread of education, humanism, democracy and tolerance. CPU is forming as a modern European university, in which dominates science, spiritual quality, high professionalism, pedagogical mastership and wide communicativeness. Its strength lies in the wide offer of flexible, innovative and diversified study programmes at bachelor, master and doctoral level. In addition to the traditional training of teachers for elementary and secondary schools, the university provides education for future social workers, experts in the field of culture, political scientists, catechists, journalists, archaeologists, historians, museum scientists, biologists, environmental scientists, mathematicians, physicists, IT experts, psychologists, gemology scientists and other experts. CPU is unique for its training provided in Hungarian language for future teachers in areas with large share of Hungarian minority. CPU´s scientific potential is concentrated into unique workplaces – research institutes and specialised laboratories, which are the guarantee of high-quality outcomes of scientific activities of scientific-pedagogical staff and PhD. students of the university and. This is also a basis for professional growth of the next generation of young researchers.

Nowadays, the university consists of five faculties: Faculty of Natural Sciences, Faculty of Social Sciences and Health Care, Faculty of Central European Studies, Faculty of Arts, and Faculty of Education

The Institute of Plant Genetics and Biotechnology of the Slovak Academy of Sciences (IPGB SAS) in Nitra was established in 1990 as the Institute of Plant Genetics, aimed to solve actual problems of genetics and breeding of selected crop plant species, forest and fruit trees. Since 1998 the scientific orientation of the Institute has been extended to plant biotechnology and gene engineering, while its name has been changed to Institute of Plant Genetics and Biotechnology. The IPGB is the only research body in Slovakia developing the field of plant embryogenesis, plant transformation and at present time also plant proteomics.

The genome modification of agronomic important crops, forest and fruit trees is focused on achievement of desirable traits or increased resistance against pathogens. Studies of transgene expression, factors influencing this expression as well as safety issues related to environment are in focus of our interests, too. Currently, the research spans over the studies of functional genomics, namely in process of plant embryo development (zygotic, somatic and gametic), as well as in plant stress responses. The cytological, morphological, biochemical and molecular aspects of these processes are also followed. Micropropagation and in vitro regeneration of selected crops and important plant species are integral part of our research activities.

In the field of population genetics, the Institute, as one of the few institutions in Europe, is dealing also with dendrobiology, carry out

AgroBioTech
Research Centre

is one of the research university projects funded from EU financial resources within Operational Programme Research and Development. Implementation of this research project was supported by the amount exceeding EUR 26 million. Financial resources allocated for establishment of the AgroBioTech Research Centre come from EU funds (EUR 22.4 million), state budget (EUR 2.6 million) and from the budget of the project implementer (EUR 1.3 million), respectively from the financial resources of the university.

DEPARTMENT OF AGROBIOLOGY

Laboratory of Production Physiology and Plant Ecophysiology

Laboratory of Plant Nutrition and Ionomics

Laboratory of Human Nutrition

Laboratory of Explant Cultures

Laboratory of Special Seed Production Techniques

Laboratory of Agrobiodiversity and Genetic Technologies

Laboratory of Experimental Botany

Department of Agrobiology consists of seven specialized laboratories. They are oriented on basic and applied research of plant food sources and were created to provide a complete equipment cascade allowing that type of research. Their infrastructure allows detailed botanical, physiological and genetic characteristics of plants in the relation to their production characteristics, as well as to the quality of the products for which they are planted. Specialized laboratory of human nutrition is an inevitable part of the department and is focused on the analysis of the interaction of the human body and the food. Other laboratories provide the physiological analysis, the analysis of mineral elements in the soil, plants, water and other environments and materials, genomic and transcriptomic analysis and research of population and reproduction of plants.

Findings from research in these areas can be applied in molecular genetics, evolution biology, in biotechnology applications, in agriculture and forestry, in pharmacology, for the nutrition policies, but also in medicine and public health applications (especially in the field of prevention and treatment non-infectious civilization diseases).

DEPARTMENT OF APPLIED ECOLOGY AND BIOENERGY

Laboratory of Applied Ecology

Laboratory of Biomass Gasification

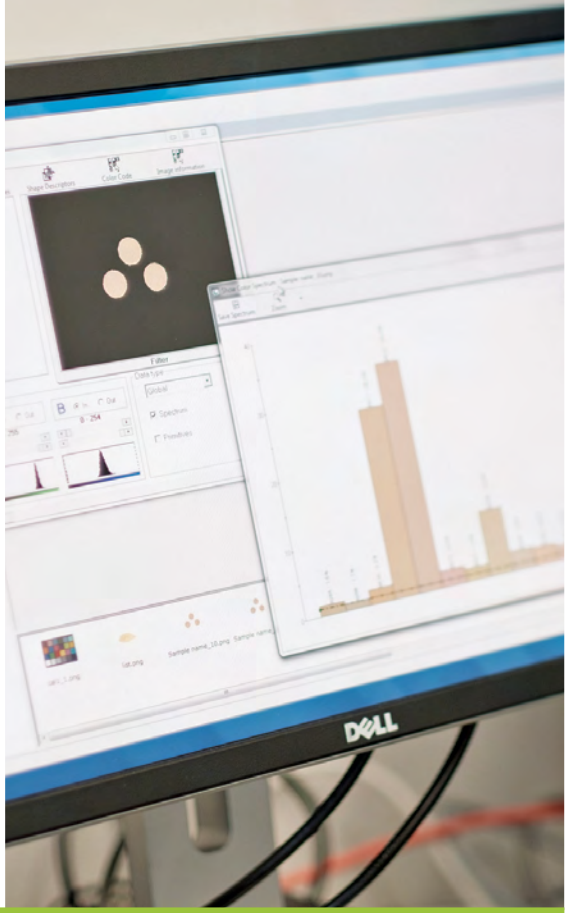
The competence and professional activities of the Department of Applied Ecology and Bioenergy include know-how in the field of technology of energy crops and herbs cultivation developed on the basis of ecophysiological characteristics and the ability to carry out production potential in specific soil and environmental growing conditions, integrating the results from different researches and the design of

This department offers space for the fulfilment of the main objectives of the National Action Plan for Renewable Energy and set priorities by the European Commission in the wider use of renewable energy sources.

Department of Applied Ecology and Bioenergy has been honoured to have been offered membership in several centres of excellence within the European Research Area.

models for the woodworking and energy industry, based on quantitative experimental data, a wide range of applied research in the field of biofuels research and energy use of biomass waste from agriculture and food production, as well as municipalities.

Areas where it is possible to apply the results achieved by research laboratories such as, for example, the use of renewable energy, wood processing and furniture industry, agriculture and food production, as well as its use in the municipal sector.



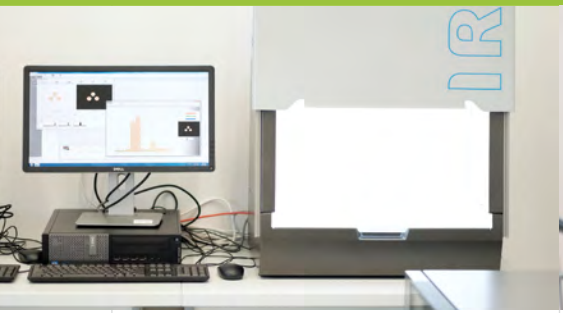
DEPARTMENT OF BIOECONOMY

Laboratory of Economic Studies

Laboratory of Neuroeconomy and Consumer Decision-Making

Professional activities of the Department of Bioeconomy and its specialized labs are as follows:

- **Analysis of prices, production, consumption and trade of energy crops;**
- **Analysis of agricultural and energy policies;**
- **Business plan and analysis (costs, revenues, return on investment, market position, market trends, competition, environmental impact and innovation);**
- **Popularization of energy issues and mapping of public opinion;**
- **Cost benefit analysis of bioenergy production in conjunction with environmental impact assessment;**
- **Analysis of return on investment in bioenergy production;**
- **Econometric modelling of agricultural markets and the effects of agricultural policies.**



Laboratory of Neuroeconomy and consumer decision-making provides an interdisciplinary research area supported by excellence and applied research in the field of bio-economy, market studies and consumer decision-making.

DEPARTMENT OF BIOSYSTEMS ENGINEERING

Laboratory of Analysis of Biomass for Bioenergy

Laboratory of Bioenergy Sources

Laboratory of Innovative Technologies for Crop Production

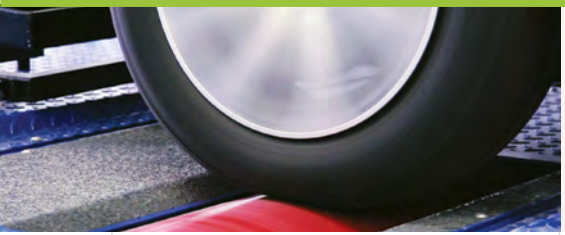
Laboratory of Raw Materials
and Foodstuffs Physical Properties

Department of Biosystems Engineering deals with wide spectrum of research areas. Among all, following research topics may be mentioned: possibilities to utilize crop biomass for pellets and briquettes production, assessment of quality parameters of input material used for solid bio fuels production, assessment of technological parameters of solid bio fuels which are based on biomass, assessment of physical and mechanical properties of obtained products, design of production lines for soil bio fuels production. Furthermore, assessment of environmental aspects of biomass for energy, bio fuels, bio oils and bioenergetics are in the centre of attention. Conducting experiments in the area of assessment of energetic and ecological properties of ecological energy carriers need to be mentioned as well.

Laboratory of innovative technologies in crop production is aimed at precision farming technologies. Here, obtaining, processing and analysing of geographically localized information is conducted. Moreover, attention is paid on building database of properties connected to selected geographical area in long term period.

Laboratory of physical properties of materials and food products is aimed at: measuring the effect of heat stress during the drying process on macro/micro damage of grain, research of material heat behaviour, effect of temperature on physical properties as well as research of rheological and strength properties of materials, measuring the grain cleanness, grain separation and effect of physical and mechanical properties on grain threshing process quality.

Results are applicable in agricultural production, research and development and agriculture machinery management.



DEPARTMENT OF BIOTECHNICS AND LANDSCAPE MODELLING

Laboratory of Modelling of Urban Environment and Landscape

Laboratory of Beverages “A”

Research activities of the Department of Biotechnics and Landscape Modelling correspond with concept of the Healthy landscape. The department has two laboratories, which are specialized in the following activities:

- **quantification of morphometric, biochemical and physiological parameters of woody plants and herbs, indicating lack of water in the urban environment;**
- **data screening under controlled conditions and in specific areas in settlements and country - creation of Landscape Model;**
- **structural and shape analysis of the landscape components, the quantification of the changes in relation to the timeline;**
- **modelling artefacts of cultural and natural heritage of the landscape;**
- **evaluation of the quality of nutritional composition and content of health-promoting substances in the horticultural crops and products;**
- **evaluation of the content and seasonal dynamics of nutrients in the cider and wine of new Slovak varieties of Vitis vinifera;**



- **optimization and control of technological process of making wine, fruit, vegetables, grape juice and cider with a notice to high nutritional and sensory quality of the final product.**

Areas where this research can be applied are such as adaptations of plants to the conditions of urban heat islands or production of non-traditional drinks with a high nutritional value.

DEPARTMENT OF FOOD TECHNOLOGY AND BIOTECHNOLOGY

Laboratory of Cereals Technologies

Sensory Laboratory

Laboratory of Fats and Oil

Experimental Brewery

Laboratory of Beverages

Laboratory of Animal Origin Food

Laboratory for Biologically Valuable Substances Analysis

Laboratory of Animal Biotechnology

Laboratory of Plant Biotechnology

Laboratory of Experimental Biology

Laboratory of Experimental Microbiology

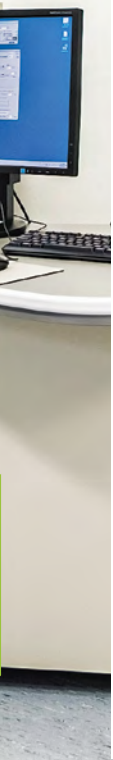
Department of food technology and biotechnology is divided into 10 laboratories in which the research activities are focused on current experimental food processing technologies with emphasis on their effectiveness, utilization of raw materials and ecological approach. The individual laboratories are specialized in analyses of primary metabolites (content of proteins, saccharides, lipids and fibre) and secondary metabolites (antioxidant activity, content of polyphenols and vitamins); analyses of less-known plant species; oil production using novel extraction technologies; evaluation of barley and malt quality to determine high quality malt cultivars; analyses of embryos and embryonic stem cells; identification, differentiation and characterization of cereals, pseudocereals and legumes using molecular and protein markers; analyses of hormone profile of blood and cells, hypophysis hormones, hormones of thyroid gland, steroid hormones etc.

INTEGRAL LABORATORIES

Laboratory of Spectroscopic Analysis

Laboratory of Genetic Analysis

Laboratory of Microscopic Analysis



The integral laboratories are dedicated to spectroscopic, genetic and microscopic approaches in biology, biomedicine, pharmacology, toxicology and food processing. In general, the research activities are focusing on the effects of various environmental factors on living organisms and their biochemical, eco-physiological and molecular-biological aspects.

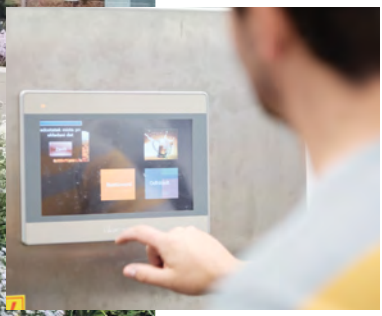
The main research activities of integral laboratories:

- **assessment of the impact of particular factors on cell processes;**
- **isolation and purification of DNA and RNA for the use in gene chip technology and sequencing;**
- **preparation of gene libraries for sequencing;**
- **manipulation with embryos and sperm of livestock (freezing – cryopreservation, genetic modifications, etc.);**

- **identification of point mutations associated with functional characteristics of plants and animals;**
- **genotyping of different microorganism species;**
- **study of cell processes causing increased production of antioxidants against oxidative stress;**
- **embryotechnologies focusing on assessment of embryos and sperm quality;**
- **isolation and utilization of embryonic and somatic stem cells in agricultural and biomedicine, one of the most perspective area in animal biotechnologies.**

TRANSFER CENTRE

The Transfer Centre is focused on evaluation, promotion, support, utilization, and transfer of knowledge and innovation potential from academia to the commercial sphere.



Functions of Transfer Centre:

- cooperation with agrifood sector
- popularization and commercialization of the science and research results
- intellectual property protection
- support of start-up and spin-off establishing
- international cooperation

Main activities:

- monitoring of needs of agrifood sector
- support of university – business cooperation
- establishing of food incubator
- demand driven research and expertise
- legal support and consultancy regarding intellectual property protection (patenting and licencing)

AGROBIOTECH RESEARCH CENTRE AT CPU IN NITRA

Laboratory of Molecular Biology

Laboratory of Embryotechnology

Laboratory of Physiology and Anathomy

Biochemical Laboratory

Laboratory of Biological Stress

The primary goal of the Laboratory of Molecular Biology is to understand biological processes in the bone tissues and its diseases, with the ultimate aim on estimation of genetic variability of specific human and animal traits. The Laboratory of Embryotechnology explores new options in nucleologenesis and in vitro production and evaluation of embryos used in biomedical research. The equipment in the Laboratory of Physiology and Anatomy allows for biomonitoring of phthalates from samples to tackle specific problems associated with human health and animal nutrition as well as proteomic analyses of epigenetic markers associated with early embryonic development in farmed animals. Biochemical Laboratory employs advanced techniques for determination of the concentration of heavy metals in water, plants and food, with particular aim on assessment of the intake and accumulation of toxic elements in living organisms. The laboratory performs also analyses of antioxidative and prooxidative characteristics of natural substances such as chlorophylls, carotenoids and polyphenols their content in cells. The Laboratory of Biological Stress is suited to perform complex analyses of plant physiology during stress conditions.

THE INSTITUTE OF PLANT GENETICS AND BIOTECHNOLOGY, SLOVAK ACADEMY OF SCIENCES

Laboratory of reproduction and developmental biology

Laboratory of plant molecular breeding

The Institute of Plant Genetics and Biotechnology of the Slovak Academy of Sciences (IPGB SAS) in Nitra was established in 1990 as the Institute of Plant Genetics, aimed to solve actual problems of genetics and breeding of selected crop plant species, forest and fruit trees. Since 1998 the scientific orientation of the Institute has been extended to plant biotechnology and gene engineering, while its name has been changed to Institute of Plant Genetics and Biotechnology. The IPGB is the only research body in Slovakia developing the field of plant embryogenesis, plant transformation and at present time also plant proteomics.

The genome modification of agronomic important crops, forest and fruit trees is focused on achievement of desirable traits or increased resistance against pathogens. At present, the IPGB SAS is very well equipped with all necessary laboratory equipments and gadgets and managed by experienced scientific staff.

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European Union

Ministry of Education, Science, Research and Sport of the Slovak Republic

We support research activities in Slovak Republic
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Priority axis 2 - Research and development support

NAME OF THE PROJECT:
Creation of the Research Centre "AgroBioTech"

IMPLEMENTATION:
4/2013 – 11/2015