Your research gate to Horizon 2020

Find the best partner for your project

Your project partners from the Region of Western Pomerania
POLAND

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Dear Readers,

To achieve success in science today it is not enough to confine yourself to your laboratory and work hard. On the contrary, it is necessary to open up your laboratory and invite other people to participate in and contribute to the work. In other words, it is necessary to get in touch, or to form networks with similarly minded people who share – or complement – our interests, potential, and resources. This publication is intended to facilitate such networking. You will find information on research pursued by leading research centres of Western Pomerania, a region in the north-western part of Poland. You will also find information on expertise offered and co-operations sought by research groups which have opened up their laboratories to you. This is particularly important in the advent of Horizon 2020. The research groups described in this publication welcome opportunities of joint application for research projects that Horizon 2020 will entail. An opportunity to combine efforts and jointly use state-of-the-art laboratories and knowledge base available in Europe, including the laboratories highlighted in this publication, cannot be overestimated – and should not be missed! Undertaking joint efforts in overcoming barriers for innovation and in advancing the frontiers of science and technology for the benefit of the society in Europe 2020 is, in our opinion, an appropriate motivation for collaboration and for taking advantage of cooperation opportunities, including those presented in this publication.

We do hope that this publication will help you in locating and finding a partner or partners for your new research initiative. Please feel free to contact us or get directly in touch with scientists from among those listed in this publication who are relevant to your research needs and with whom you will establish a fruitful research cooperation.

We invite you to read. We invite you to network!
Your Team of the Regional Contact Point for EU Framework Programmes in RCIiTT, ZUT.

REGIONAL CENTRE FOR INNOVATION and TECHNOLOGY TRANSFER

The Regional Centre for Innovation and Technology Transfer (RCIiTT) was founded in 1999, in response to the need for international co-ordination of research programmes carried out at the University of Technology in Szczecin. Currently, RCIiTT provides advice and training for researchers, graduates and companies in research funding, partner search, and commercialization of knowledge. The RCIiTT mission is to create a culture of innovation and entrepreneurship, to initiate and support co-operation between businesses and academic environments. In addition, RCIiTT fosters networking between academia and interested businesses and animates development of industrial clusters to generate and increase opportunities for translating scientific achievements into commercial practice, which involves initiating and rationalizing technology transfer from the Research & Development sector to the economy. Every year, RCIiTT provides more than 600 consultations and organizes more than 60 training courses. The Centre is a member of the Enterprise Europe Network, the world's biggest network supporting small-medium enterprises (SMEs).

RCIiTT offers:

- expert advice regarding national and international technology transfer;
- assistance in commercialisation of research results;
- promotion of innovation;
- support for and organisation of foreign trade missions;
- advice in preparation of international trade agreements;
- assistance in cluster initiatives.

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The Regional Contact Point (RCP) for UE Framework Programmes operates as a part of the Regional Centre of Innovation and Technology Transfer (RCIiTT) and is a link in a network of Western Pomeranian Contact Points at the top five universities in the region. In addition to promoting research teams, RCP provides a variety of customer support programmes, including consultations, training sessions and workshops concerning EU funds for research & development, new technologies, innovative implementations in industrial sectors and transnational research fellowships. RCP primarily aims at increasing scientists' awareness of the range of research opportunities offered by the European framework programmes and thereby encourages participation in those programmes. As a regional public body operating in the international context, RCP has both the knowledge of the Region's research and economic potential and experience in international cooperation. Owing to long practice in the framework programmes and other R&D international initiatives, RCP assists its customers (researchers, entrepreneurs) in preparation and submission of proposals and in actual conducting the projects. The RCP efforts bring fruit in successful projects and in co-operative endeavours which results in numerous internationally funded projects. RCP assists the Region's successful scientists in their negotiations with the European Commission, in preparing the consortium agreement, and in project management. RCP's work contributes to the effective and efficient running of international cooperation and scientific research.

RCP offers:

- individual meetings with potential beneficiaries of European funds;
- supporting potential beneficiaries by organising information and awareness campaigns, training courses, information days and workshops;
- preparation of technical guides to assists researchers and entrepreneurs in efficient applying for funding and in implementing their innovative ideas;
- maintaining a regional database of scientists, organisations and enterprises interested in taking innovative research actions;
- providing consultations, seminars and mailing services aimed at supplying its addressees with the most current and relevant information concerning RTD.

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Food & Biotechnology

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The Centre of Bioimmobilization and Innovative Packaging Materials (CBIMO) is an interdisciplinary group of specialists working on:

- innovative packaging materials (bioplastics, modified polymer films/foils, improvement of barrier properties);
- modification of cellulose materials (innovative formulations for coating applications);
- active and intelligent packaging systems (active substances and antimicrobial properties, nanomaterials and nanotechnologies in paper industry applications);
- bioimmobilization of substances for different applications (food additives, paper industry additives, biotechnology, microbiology);
- formation and characterization of biodegradable materials and microencapsulation of bioactive substances for different industrial applications.

CBIMO is involved in many international and national projects, contributing its experience in the development of innovative, environmentally friendly solutions with a potential for industrial applications. CBIMO cooperates with businesses from different sectors – including biotechnology, packaging (paper and cardboard, bioplastics, and plastics), food additives, active substances, etc.
The CBIMO research infrastructure includes well-outfitted laboratories with SEM, microscopy (stereoscopic, fluoroscent), and facilities for OTR and WVTR determination, contact angle, ultrasonic homogenization, DMTA, climatic chambers, bio-reactors, FTIR, particle size distribution, rheology, spray-drying, antimicrobial properties determination, micro and nano-encapsulation, simulation of biodegradation.

The expertise offered includes:

- morphological, mechanical, antimicrobial and barrier characterization of cellulose and bioplastics packaging materials;
- application of bioimmobilization for various technological and industrial processes;
- "packaging" of active substances at micro and nanoscale, design of active materials, and biotechnological processes;
- knowledge base in biopolymers (characterization, properties, modification); bioplastics (PLA, PHAs, treatment and processing); packaging materials (cellulose materials such as paper, paperboard, biocomposites, films, foils, plastics: characterization of properties, modification/improvement of barrier properties, design of active packaging systems, functionalization such as: antimicrobial properties), bioactive substances (antioxidants, antimicrobials, natural preservatives), bioimmobilization (active substances, living cells, bacteria), bio-reactions (bacteria, continuous production), nanocarriers and nanomaterials.

We have experience in Framework Programmes as a coordinator and a partner.

Keywords describing the expertise offered:
bioimmobilization, nanomaterials, active packaging materials, bioplastics, biopolymers, films, foils, paper, paperboard

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The group works primarily on various aspects of:

- food safety and quality control, including new emerging pathogens, toxigenic potential of pathogenic bacteria under diverse/atypical conditions encountered in food and food processing environment; survival and adaptative abilities of pathogenic bacteria to hostile environments; preventive measures to be undertaken to eliminate and/or stop the activity of harmful/spoilage/spore-forming bacteria, including new technologies (e.g. cold plasma);
- enzymatic activity of selected microorganisms of marine/freshwater and soil origin, mostly bacteria, particularly Actinomycetes, isolated worldwide, and their potential application in fish culture, horticulture, etc.;
- potential use of selected lactic acid bacteria strains as pro-/prebiotics;
- bacteria as wholesome food/feed additives;
- fast and reliable molecular techniques in identification as well as inter- and intra-species differentiation of pathogenic bacteria from diverse environments - food and water, in particular; and in tracing the source of contamination with pathogens;
- PCR techniques in detecting food adulteration;
- microorganisms and their role in water microcosms, including: structural and functional diversity of microbes in water environments; tracing the source of water contamination with pathogenic bacteria; microbial communities as the trophic web base; microorganisms as immunity stimulators for aquatic biota; molecular ecology.

The research infrastructure used includes Vitek Systems ATP Expressions, equipment for PCR and real-time PCR, Gel Doc System, chambers with laminar air flow, INFORS AGCH bioreactor, fluorescent microscopy.

The expertise offered includes primarily:

- assessment of food quality and safety based on fast methods of microbiological hazard identification, including toxigenic potential of strains and new pathogens and detecting food adulteration;
- selection of microbes with a potential to be used as pro-/prebiotics or source of desired enzymes, etc.;
- identification of specificity and role of individual microbes in diverse ecosystems.

Keywords describing the expertise offered:

new pathogens, strains toxigenicity, detecting food adulteration, pro-/prebiotic bacteria

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The Department of Plant Biotechnology (DPB) conducts comprehensive research on green biotechnology with a special emphasis on: somatic embryogenesis (SE), including:

- the role of gibberelins and abscisic acid in Medicago spp. SE;
- regulation of gene expression during SE by the hormones mentioned;
- role of jasmonates, salicylates and β-aminobutyric acid in fungal pathogen development;
- induction of systemic resistance (ISR) against phytopathogens – physiological, biochemical and molecular basis;
- plant growth promotion by rhizobacteria (PGPR) – physiological, biochemical and molecular basis.

DPB is involved in national research projects and aims at developing innovative, environmentally friendly biofertilizers, biostimulants, bioprotectants and natural elicitors of induced systemic resistance.

The infrastructure used includes laboratories equipped in climatic chambers with LED illumination, class I and II laminar flow hoods, incubated orbital shakers, lean benches, freezers and ultra-deep freezers, UV-VIS double-beam spectrophotometer, plate reader, HPLC chromatograph, thermocyclers (standard, gradient and real-time), and Advanced Gel Documentation System.

The expertise offered includes:

- assessing growth of bacteria, fungi and plants under in vivo and in vitro conditions;
- determining antimicrobial properties;
- microscopic analysis of plant material (including that affected by microbial pathogenesis);
- spectrophotometric assays of enzymatic activities, including stress markers (catalase, peroxidase, phenylalanine ammonia lyase);
- chromatographic quantification of carbohydrates and phenolic compounds;
- application of molecular techniques, including gene expression analysis.

Keywords describing the expertise offered:

somatic embryogenesis, micropropagation, hormonal regulation of somatic embryogenesis and plant defence, induced systemic resistance (ISR), plant growth promoting microorganisms (PGPM), stress markers, high pressure liquid chromatography (HPLC), gene expression

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The Meat Science Department is an interdisciplinary group of specialists working primarily on:

- effects of biological (including nutrition) and genetic factors on structural and mechanical properties of meat;
- suitability of game and exotic animals meat as well as game birds and ostriches for culinary and meat products;
- production of healthy dry-cured and cooked foods;
- modification of meat ripening process via chemical, physical and enzymatic treatment;
- utility and susceptibility of meat to massaging with traditional and innovative methods of tenderising;
- utility of local raw material resources for production of food with improved health-benefits as a developmental chances for the Province of Western Pomerania.

The research infrastructure used includes light microscopes (with computer image analysis systems), cryostats (including cryogenic LN2 containers), Instron for texture and rheology analyses; miniaturised production lines for fermented, dry-cured and heat treated sausages/hams: climatic chambers, tumblers, cutters, stuffers, smoking boxes etc.

The expertise offered includes:

- histochemical characterization of muscle fibres type and muscle structure;
- assessing meat texture properties;
- determining raw materials and final meat products rheology;
- modifying/improving texture and sensory properties of meat products with mechanical, chemical and enzymatic treatments;
- design and manufacture of products with improved health-enhancing qualitieis;
- assessing meat product quality and safety.

Keywords describing the expertise offered:

microscopy (histochemistry), rheology, texture, meat properties, meat technology

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The Division of Biological Agriculture Foundations, in cooperation with sibling units (the Division of Food Industry Processes and Devices; the Division of Biochemistry and Biotechnology; the Unit of Automatics) is an interdisciplinary group of specialists in food technology and human nutrition as well as in agricultural and forest technologies.

The main research interests of the group concern:

- modern no-tillage systems; developing innovative technologies for raw materials cultivation;
- processing using traditional knowledge to create food products with health-enhancing properties;
- increasing the variety of products based on traditional knowledge via developing innovative processing technologies and techniques;
- developing systems of intelligent plant-human communication;
- biomass production and conversion for energy;
- production of second-generation fluids; enzymatic cellulose hydrolysis.

Individual research units collaborating as the "Biocentrum" have a join capacity to monitor all the operations involved in cultivation, harvesting, storage and processing up to delivery of a product to the food market. The "Biocentrum" is also involved in sensory testing of raw materials, half-products and final products. The key area of interest is the analysis of ingredients of raw materials and resultant products.

The expertise offered includes:

- determining effects of no-tillage systems on changes in soil environment and plant yield;
- testing plant responses to stress-causing factors;
- determining sensory qualities of niche agricultural raw materials and products;
- developing technologies of health-enhancing product manufacture with the use of traditional methods to create innovative foods;
- conducting studies on identification of conditions optimal for raw materials storage and on selecting packaging appropriate for finished products and for extending their shelf life;

The group is interested in cooperating in:

- creation of product image and development of promotion systems for individual health-enhancing products;
- testing the utility of biomass manufacture of second-generation bio-ethanol.

Keywords describing the expertise offered:
no-tillage system, soil and crops assessment, innovative technologies, new product development, food quality analysis and assessment, biomass, bio-ethanol, enzymatic hydrolysis

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Department of Toxicology groups scientists solving problems associated with food toxicology and hygiene as well as ecotoxicology, with a particular reference to aquatic ecosystems. The research pursued is primarily focused on:

- the occurrence of chemical contaminants (metals, organochlorine pesticides, PCBs, PAHs, and other) in food, drinks and drinking water, in relation to contaminant origin (environment, processing, packaging, transportation, storage);
- a potential of technological processing and culinary treatments to reduce chemical contamination in final food products;
- cycling of xenobiotics in aquatic and terrestrial ecosystems (soil–plant–animal and water–sediments–organisms systems), including monitoring of hydrobiota and abiotic compartments of aquatic ecosystems for pollution with metals, pesticides, PCBs, PAHs, etc.;
- dynamics of bioaccumulation, elimination and detoxication of xenobiotics in aquatic organisms, and effects of fish intoxication with metals, PCBs, and other toxic or dangerous substances;
- prediction of changes in pollution levels in hydrobiota, based on analysis of long data series.

The group has been involved in national and international research projects, including the Programme for the Odra River 2006, the International Odra Project, and the Baltic Monitoring Programme.

The research infrastructure consists of well equipped laboratories making it possible to carry out analyses of a wide range of chemicals, including toxic metals (e.g., Pb, Cd, Hg, As), micro and macroelements (e.g., Zn, Cu, Na, K, Cr, Fe, Mn, Ni, V), and residues of organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), etc. in various complex matrices such as food, plant and animal tissues, soil, sediments, water. Speciation of metals in sediments and soils is examined as well. Advanced analytical techniques are used for accurate detection and precise quantification of elements and compounds. The laboratory equipment includes chromatographs (GC/MS and HPLC), atomic absorption spectrometers (GF-AAS and CV-AAS), atomic emission spectrometer (ICP-AES), microwave digestion system, lyophilizer, incubators, homogenizers, centrifuges, vacuum rotary evaporators, etc.

The expertise offered includes:

- conducting assays and analyses of a wide range of chemicals, including toxic metals (e.g., Pb, Cd, Hg, As), micro and macroelements (e.g., Zn, Cu, Na, K, Cr, Fe, Mn, Ni, V), and residues of organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), etc. in various complex matrices such as food, plant and animal tissues, soil, sediments, water;
- examining speciation of metals in sediments and soils.

Keywords describing the expertise offered:

ecotoxicology, food toxicology and hygiene, separation science, liquid chromatography, gas chromatography, atomic absorption spectrometry, atomic emission spectrometry, quantitative analysis, chemical speciation, trace elements, heavy metals, organochlorine pesticides, PCBs, polycyclic aromatic hydrocarbons, persistent organic pollutants

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The Department of Food Science and Technology (DFST) groups interdisciplinary specialists whose work is primarily focused on:

- fish and seafood processing technologies (especially marinading, salting, canning and surimi);
- properties, purification and application of selected proteolytic enzymes and transglutaminase;
- analysis of proteins and products of their hydrolysis;
- analysis of lipids and fatty acids;
- changes in fish during cold storage and freezing;
- low-value fish, fish fragments and filleting remains as a material for snack food and fish technology;
- heat and cold extrusion.

DFST pursued also research on modern and green technologies in fish processing and the use of by-products in manufacturing innovative food products.

DFST has been involved in numerous research projects, including development of innovative, environmentally friendly solutions with a potential for industrial applications. DFST cooperates with industrial partners from different sectors, including biotechnology, packaging, food additives, active substances, etc.

The DFST research infrastructure included an ultrasonic homogenizer, a texture analyzer, an ultra-centrifuge, a FPLC, GC+MS, CE+LIF, HPLC, and 2D SDS-PAGE equipment, a fluorimeter, a Hunter Lab, an ultra-freezer, a lyophiliser, and an extruder. The research facilities include also specialised production lines for fish smoking, canning (closing and sterilization), fish burgers and fish flesh deboning.

The expertise offered includes:

- analysis of composition (protein, fat, water, etc.) and properties (texture, colour, sensory assessment) of foods;
- characterisation of protein hydrolysis products (poly- and oligo-peptides, amino acids) and essential fatty acids;
- research on proteolytic enzymes and application of transglutaminase;
- assaying total volatile nitrogen bases and biogenic amines;
- determination of bioactive peptide properties.

Keywords describing the expertise offered:
innovative fish technology, by-products, enzymes, protein, bio-peptides

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The Control Engineering Group (CEG), a part of the Department of Mechanical Engineering, conducts research on:

- novel techniques and methods in monitoring and control of processes in the food and chemical industries and in precision farming;
- novel measurement techniques, mathematical modelling;
- model identification;
- dynamic optimisation;
- simulation, signal and image processing.

CEG has worked with:

- embedded systems;
- wireless autonomous sensor;
- algorithms for soft sensors to monitor environmental conditions, food quality and plant stress factors;
- application of artificial intelligence algorithms (fuzzy sets, neural networks) to control, monitor and fuse data;
- application of image processing techniques for food quality assessment.

The CEG research infrastructure includes a climatic chamber for research on food storage processes; a chamber for research on monitoring plant grow stress factors; sensors for monitoring environmental conditions; devices for the design and programming embedded systems; devices for measurement and analysis of electrical properties of food materials.

CEG offers expertise and seeks cooperation on:

- application of control algorithms in food processing, precision farming and chemical industry;
- real time sensing methods in precision farming;
- optimal (energy efficient) control strategies;
- methods of active ventilation and microclimate control;
- methods of microclimate control in storage chambers;
- methods of material quality monitoring based on digital image processing (computer visualisation);
- methods of water content and water activity measurement during material drying or storage.

Keywords describing the expertise offered:

wireless sensor, microclimate control, storage, biochemical processes modelling, model identification, water activity measurement, image processing, sensor and data fusion, signal processing

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Nanotechnology, Materials & New Production Technologies

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The Institute of Materials Science and Engineering (IMSE) and Institute of Mechanical Technology (IMT) group specialists working primarily on:

- innovative nanocomposite multifunctional materials (powders, coatings and volume materials, Metal Matrix Composites);
- manufacturing nanostructural carbides, borides and nitrides via sol-gel technique (TiC, TiN, TiB2, Mo2C, TiC-SiC-Si3N4, TiC-TiB2, microcapsules TiC-Mo2C);
- manufacturing nanostructural Metal Matrix Composites (MMC) using Rapid Prototyping and Selective laser Sintering and Melting Technologies (nc-TiC/Steel, nc-TiC/Ti, nc-TiC-TiB2/steel and others);
- modelling of nanocomposites using Final Element Method to determine stress distribution in heterogeneous or continuous structures;
- designing shape geometry and choosing the set of mechanical properties of material to ensure good interaction in the implant/tools/hydraulic parts-environment systems.

The group has:

- internationally recognized expertise in Materials Science/Chemistry/Engineering;
- developed a methodology for designing and modelling nanocomposite materials;
- developed their own original approach to a special subclass of composites – hetero-modulus ceramics, and has developed an original sol-gel method of synthesis of nanomaterials, nanocomposites in the form of powder and coatings in the Ti-Si-V- B-C-N-O system;
- has developed its own original approach to kinetic analysis of synthesis, oxidation, carbonization, and design of manufacturing technology for these nanocomposite materials;
- expertise in morphological, structural, mechanical, bio-tribo-corrosional characterisation of metallic, ceramic, polymeric and composite materials.

IMSE is involved in many international and national projects, and cooperates with different sectors of industry. The IMSCE research infrastructure consists of well equipped modern adapted to developing novel nanostructural composite materials using various coating techniques, morphological, mechanical and gas barrier characterization of metallic, ceramic, polymeric and composite materials.

The expertise offered includes:

- research on manufacturing nanostructural carbides, borides and nitrides via sol-gel technique in powders form (TiC, TiN, TiB2, Mo2C, TiC-SiC-Si3N4, TiC-TiB2, microcapsules TiC-Mo2C);
- manufacturing nanostructural Metal Matrix Composites (MMC) using Rapid Prototyping and Selective laser Sintering and Melting Technologies (nc-TiC/Steel, nc-TiC/Ti, nc-TiC-TiB2/steel and others);
- structural and morphological mechanical, bio-tribo-corrosional characterization of metallic, ceramic, polymeric and composite materials;
- modelling of the nanocomposites using Final Element Method to determine stress distribution in heterogeneous or continuous structures;
- designing shape geometry and selection of mechanical properties of materials to ensure good interaction in the implants/tools/hydraulic parts - environment systems;
- kinetic analysis of synthesis, oxidation, carbonization and other processes.

We have experience in Framework Programmes as a partner.

Keywords describing the expertise offered:

nanomaterials, Metal Matrix Composites, bio-tribo-corrosion resistance, Final Element Method, SLS/M, Rapid Prototyping

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The Division of Biomaterials and Microbiological Technologies (DBMT) groups scientists strongly strongly focused on developing new polymers (elastomers, thermoplastics, hydrogels) and composite and nanocomposite materials, including new polymer matrices, mainly for biomedical applications. The DBMT research concerns a wide range of biomaterials and their applications to:

- polymeric implants – components of heart assisting devices, finger joints;
- biodegradable polymeric materials for tissue engineering;
- injectable biomaterials for soft tissue reconstruction;
- antimicrobial coatings for implants;
- drug delivery systems;
- graphene-based materials for diagnostic applications.

The DBMT strength is the synthesis of new materials including melt polycondensation of polyesters and random copolymers based on polyesters, polyurethanes and polycarbonates. These are biodegradable materials synthesized form nontoxic monomers (dicarboxylic acids, sugars, alcohols) for biomedical applications. The unique process of preparing nanocomposites with different nanoparticles in situ during polycondensation allows to obtain materials with enhanced mechanical properties at a very low nanofiller content (<0.5 wt.%).

The technology recently patented by DBMT concerns development of in situ-in vivo curable and adaptable materials for less invasive surgical techniques (laparoscopy, endoscopy) to be applied in surgery (soft and hard tissue), neurosurgery and orthopaedics. DBMT develops antibacterial coatings based on chitosan, fatty acids and amino acid derivatives. Such systems are also used to formulate nanoparticles for targeted drug delivery. DBMT works also on enzymatic synthesis of biodegradable condensation polyesters and polymer networks. The group has carried out many national and international research projects. and is currently involved in two 7the FP projects and many national ones. The DBMT infrastructure includes advanced testing systems as well as equipment for polymer and composites processing and characterization. The DBMT laboratories serve also for microbiological testing of new materials (some of them can be used as antibacterial coatings for implants).

The expertise offered includes:

- synthesis of different polymeric systems (from synthetic and natural monomers);
- preparation and characterization of polymers and (nano)composite systems with advanced methods (DSC, DMTA, TGA, ATR FT-IR, GPC, LSM, etc.);
- modification of nanofillers (graphene, silica, MTT, etc.) and polymer and (nano)composite processing (injection moulding, extrusion, RTM, etc.).

We have experience in Framework Programmes as a partner.

Keywords describing the expertise offered:

polymers, biomaterials, nanocomposites, tissue engineering, antimicrobial coatings, implants

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The Optoelectronics Group (OG) is a team of physicists interested in advanced spectroscopy applied to solid state physics based on known and new materials for optoelectronics. The OG research is primarily focused on:

- new crystal materials for laser matrices, phosphors and scintillators obtained by the Czochralski growth method (e.g. molybdates, tungstates, molybdato-tungstates);
- new nanopowders for optoelectronics (double tungstates, phosphates);
- characterization and monitoring of dielectrical, optical, magnetical properties of known and new materials and nanomaterials.

The OG research infrastructure consists of laboratories with facilities for crystal growth using Czochralski normal and high pressure methods (platinum and iridium crucibles), structural (XRD, TG-DTA), optical (UV-NIR), dielectric (EPR – X-band) characterisation of crystals, powders and nanopowders, also in terms of their magnetic susceptibility (SQUID). The equipment includes Czochralski pullers working at normal and high pressures, a Brucker EPR spectrometer, a spectrophotometer, a spectrofluorimeter, a Sawyer-Tower circuit, SQUID, X-ray diffractometer.

The expertise offered includes:

- application of crystal growth methods to grow new materials for laser matrices, phosphors and scintillators under conditions suitable for obtaining clear, transparent, defectless single cristals with properties promising for numerous applications;
- characterization of physical (optical, dielectric and magnetic) and chemical properties of crystals, powders and nanopowders.

Keywords specifying the offered expertise:

crystal growth, Czochralski method, high pressure, laser matrices, phosphors, scintillators, structure, XRD, optical spectroscopy, dielectric, magnetic

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Researcchers at the Institute of Manufacturing Engineering (IME) specialise in the construction and analysis of machines tools, machining technology and organization and scheduling of industrial operations. The major research areas include:

- Dynamics of machine tools and cutting process;
- Control algorithms for machine tool drives;
- Modelling static and dynamic properties of machine tools;
- Vision methods for evaluation of the machined surface quality and positioning applications;
- Micromilling process;
- Industrial operations scheduling;
- Diagnostics and monitoring of the cutting process;
- Modal analysis uncertainty;
- Active vibration control methods.

The IME researchers have experience in modelling of the mass-spring-damping system of machine tools, experimental methods applied to machine tool performance evaluation, construction of machine tools, and active vibration control. The IME infrastructure includes LMS modal analysis system (software and hardware), Polytec laser vibrometer, vibration sensors, Kistler dynamometers, machine tools (e.g. 5-axis CNC milling center, CNC lathes), micromilling machine, CCD cameras, dSpace control card, FEM software, Labview system.

The expertise offered includes:

- Modelling machine tool structure;
- Vibration testing;
- Design of machine tools;
- Active vibration control;
- Development of scheduling algorithms;
- Development of machine vision systems;
- Micromilling.

Keywords describing the expertise offered:

Machine tool dynamics, control systems, machine vision, micromilling, modal analysis, industrial operation scheduling

Nanotechnology, Materials & New Production Technologies

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The Centre of Food Packaging, Polymer Processing and Recycling Technology is an interdisciplinary group of specialists working within the Department of Food Industry Processes and Machinery. The research concerns primarily:

- vacuum and modified atmosphere packaging, with a particular application to food products (fresh vegetables, bread etc.);
- packaging materials and technology;
- active substances and indicators for and food product intelligent packaging systems;
- food-packaging interactions;
- polymer processing and recycling, with a particular emphasis on extrusion.

The Centre's infrastructure includes a Differential Scanning Calorimeter (DSC), microscopes, Melt Flow Rate analyser (MFR), Charpy Impact Tester (for Charpy and pendulum impact test), packaging machines (VAC, MAP), extruders, injection machine and other tools. As a group of experts who develop innovative, environmentally friendly solutions for industrial applications, the Centre collaborates with local industry and large companies to solve problems relating to packaging technology and materials.

The expertise offered includes:

- developing packaging systems for fresh vegetables, mushrooms, meat, poultry, bread and other foods;
- developing packaging technology for specific products, as requested by industry;
- developing technologies for processing and recycling of polyolefins;
- processing wood-polymer composites (WPC);
- identification, testing and processing of polymer materials;
- testing packaging materials;
- testing gas mixtures for food packaging applications;
- design of packaging systems (VAC, MAP);
- developing methods for recycling of polymer materials and wood polymer composites (WPC).

Keywords describing the expertise offered:
vacuum packaging, modified atmosphere packaging, active and intelligent packaging, packaging materials testing, effects of gas mixture composition on stored food quality, polymer extrusion, injection and recycling

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The Department of Polymer Material Technology (DPMT) carries out research on various aspects of polymer materials preparation/development and characterization. The materials are based on thermoplastic polymers (mainly vinyl and acrylic) as well as reactive resins or polymers (epoxy, polyurethane, unsaturated polyesters, polysaccharides) and include:

- polymer composites and nanocomposites (infusion and prepreg technology, RTM technique of processing) with powdered and fibrous reinforcement;
- coating compositions and coats (anticorrosive, protective, special systems, e.g. for fire protection);
- adhesives based on synthetic resins and biorenewable polymers;
- polymer recycling and polymeric materials based on recycling products;
- starch-based polymeric materials (thickeners, surfactants, capsules and films, hydrogels, thermoplastic starch, biocomposites);
- nanofillers (montmorillonite/bentonite, carbon nanotubes, graphenes, nanophosphates) and their functionalization for usage in polymeric materials.

DPMT holds numerous Polish patents and collaborates with many SMEs.

The expertise offered coincides with fields in which cooperation is sought with research institutions and industry, that is in:

- polymer composites and coats based on thermoplastics and reactive resins including those modified with nanofillers (aluminosilicates, nanophosphates, carbon nanotubes and graphenes) and/or fibrous reinforcement (glass, carbon, basalt, natural fibres);
- processing of reactive resins (epoxy, unsaturated polyesters, polyurethanes), including composites with fibrous reinforcement;
- IPN (Interpenetrating Polymer Networks) reactive systems;
- processing of thermoplastics via extrusion and/or injection moulding (compounding, etc.);
- starch chemical and physical modification (thermoplastic starch-based composites/ nanocomposites, green plasticizers, carboxymethylstarch and their usage in various areas);
- nanofillers as polymers modifying agents (functionalisation of montmorillonite/bentonite, carbon nanotubes, graphenes); their dispergation in polymeric systems;
- rheological evaluation of polymeric systems in liquid state (solutions, liquid resins, dispersions of fillers/nanofillers) as well as in solid (meltable) state;
- scaling-up of the developed polymer process/technology;
- application and characterization of organic coating compositions and coats for metallic, polymeric and wooden substrates;
- FTIR and scanning microscopic analyses;
- thermal analysis of polymer materials (thermoset curing processes, thermoplastics behaviour, transitions, stability);
- mechanical testing of polymeric materials.

We have experience in Framework Programmes as a coordinator and a partner.

Keywords describing the expertise offered:

reactive resins, thermal and mechanical measurements, polymer processing, (nano)composites, nanofillers, starch-based functional polymers and biocomposites, varnishes and paints formulation, coat characterization

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Health

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The Centre for Methodology in Medical and Biological Research (CMBiB), including Biostatistics is an interdisciplinary group of doctors, scientists and statisticians cooperating between several universities, with the aim of increasing communication between these disciplines, especially in regard to the assessment of proposed research project designs (i.e. before a project starts).

CMBiB intends to overcome some systemic problems found in medical science by:

- increasing contact between doctors and scientists who have had extensive training and a thorough understanding of modern scientific principles, especially statistics;
- increasing support for studies with sufficient numbers of study subjects (rather than the historically-based reliance on anecdotal evidence);
- providing an interactive web questionnaire allowing effective traverse through the complex set of research design choices dictated by ethical considerations;
- providing contact with expert statisticians, with access to the explosion of statistical techniques available, before a project starts.

As more communication is needed between doctors, scientists and statisticians, especially with regard to assessment of research projects before their implementation commences, CMBiB is to function as a network of experts with links between several departments in other universities, specifically with the aim of developing protocols for assessment of proposed project designs.
The CMBiB infrastructure includes access to computer facilities with a high-speed Linux 4 processor.

The expertise offered includes:

- extensive experience in medical and biological sciences, including many years' experience with many types of medical project designs and statistical analyses of data from clinical, genetic, physiological, pathological and epidemiological studies as well as biobanking;
- video-conferencing and inter-university infrastructure for secure network communication;
- interactive web-site development;
- coordination.

Keywords specifying the offered expertise:
network of doctors, scientists and statisticians, communication, biobanking, secure networking

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Department of Medical Analysis (DMA) and Laboratory of Stem Cell Physiology and Biochemistry (LSCPB) group specialists working with bioactive lipids whose research focuses primarily on:

- metabolism of arachidonic acid and other PUFAs (eicosanoids, endocannabinoids, HETEs, EETs, enzymes, receptors);
- sphingolipid metabolism (sphingosine-1-phosphate, sphingosine, ceramide-1-phosphate, ceramides, enzymes, receptors);
- dynamics of changes in platelets and plasma bioactive lipids (AA derivatives and sphingolipids), including levels in patients suffering from CRF stage 4 or 5 (as classified according to the Kidney Disease Outcomes Quality Initiative, K/DOQI, scale) and levels in healthy individuals (controls);
- plasma bioactive lipids (sphingolipids) in psychiatric disorders;
- oxidative stress analysis (isoprostanes, antioxidative enzymes);
- laboratory diagnostics (clinical biochemistry, hemostasis, hematology, immunochemistry).

DMA and LSCPB are involved in international and national projects.

The research infrastructure of DMA and LSCPB includes modern laboratory facilities for conducting assays bioactive lipid (AA derivatives and sphingolipids) levels in plasma and other biological materials; antioxidative enzymes in plasma, platelets, erythrocytes, and to perform a wide range of medical analyses with equipment such as HPLC MS, FPLC, Raman microscopy, microscopy, spectrophotometers, plate aggregation analyser (Multiplate), hematology analyser, and Multilabel Plate Reader (EnVision).

The expertise offered includes:

- analysing metabolism of arachidonic acid and other PUFAs (eicosanoids, endocannabinoids, HETEs, EETs, enzymes, receptors) and sphingolipids (sphingosine-1-phosphate, sphingosine, ceramide-1-phosphate, ceramides, enzymes, receptors);
- analysis of oxidative stress (isoprostanes, antioxidative enzymes;
- laboratory diagnostics (biochemistry, hemostasis, hematology, immunochemistry).

Keywords specifying the offered expertise:

bioactive lipids, oxidative stress, clinical biochemistry, hemostasis, hematology, immunochemistry

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The Department of Physiology, Cytobiology and Proteomics (DPCP) groups scientists with extensive experience in research on comparative proteomics utilising two-dimensional electrophoresis (2-DE) and MALDI-TOF mass spectrometry. DCPC conducts research on:

- effects of pharmaceuticals (e.g. immunosuppressive drugs) on proteomic changes in selected tissues;
- effects of carbon nanoparticles (diamond and graphite) on proteomic changes in tumour tissues in the *in ovo* model;
- effects of physiological factors (i.a. pregnancy) on proteome changes in biological fluids and in immunocompetent cells;
- effects of dietary changes (including functional foods) on proteome changes in biological fluids and tissues;
- analysis of renal function in physiological aspects of neonatal period (including changes in water channel expression).

The DPCP research infrastructure consists of laboratories featuring equipment for analysing protein changes in complex biological systems (such as tissues) and physiological fluids (such as urine, plasma/serum, saliva). Bioinformatical analysis of protein profiles along with protein identification is carried out as well. DPCP has also a laboratory dedicated to Western blot analysis. Additional capacity involves determination of concentrations of various micro- and macroelements in tissues and biological fluids. The laboratory equipment includes a MALDI-TOF mass spectrometer, an apparatus for isoelectrofocusing (separation of proteins in the first dimension), an electrophoretic chamber for SDS-PAGE (separation of proteins in the second dimension), an electroblotter, bioinformatic tools for the assessment of protein expression changes on 1-D and 2-D gels and membranes, an atomic absorption spectrometer, a microplate spectrophotometer, and an osmometer.

The expertise offered includes:

- analysing protein changes in complex biological systems and physiological fluids;
- bioinformatical analysis of protein profiles along with protein identification;
- Western-blot analysis;
- determining concentrations of various micro- and macroelements in tissues and biological fluids;
- analysing proteome changes induced by physiological or pathological factors;
- assessing effects of dietary manipulations (e.g. addition of pre- or probiotics) or pharmaceutics on proteome changes in tissues or body fluids;
- organizing and conducting proteomics training and workshops.

Keywords describing the expertise offered:
physiology, proteomics, two-dimensional electrophoresis, MALDI-TOF MS, Western-blot

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Chair and Department of General Dentistry (CDGD) groups dentistry specialists whose research focuses on:

- dental caries and periodontal prophylaxis (fluoride, hydroxyapatites, nanohydroxyapatites, early caries diagnosis and treatment);
- diagnosis and treatment of craniofacial deformities (including clefts);
- interdisciplinary dental treatment (cooperation between orthodontist, general dentist, restorative dentist, dental surgeon and periodontologist);
- minimizing detrimental effect of bonding orthodontic attachments to the enamel.

The CDGD research infrastructure includes dental units and digital dental radiography.

The expertise offered includes:

- analysing mineral composition of saliva, enamel and dentin;
- assessing long-term effect of surgical procedures for the treatment of facial clefts;
- describing craniofacial morphology in facial clefts;
- investigating application of nanocomposites and other nanomaterials in dentistry;
- genetic background of gingival overgrowth associated with immunosuppression;
- clinical assessment of dental materials and treatment methods;
- radiological examination of materials and treatment results.

Keywords specifying the offered expertise:

dental instruments, dental equipment, dental materials, nanomaterials, grinding, caries prophylaxis, periodontal prophylaxis, periodontal regeneration

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The Chair and Department of Biology and Medical Parasitology (CDB&MP) is an interdisciplinary group of specialists working within the Faculty of Medicine, Biotechnology and Laboratory Medicine.

The CDB&MP's research activities are primarily focused on:

- ecotoxicology and toxicology (effects of trace elements, including heavy metals, on humans and animals);
- epidemiology of human parasites;
- physiological and biochemical aspects of the parasite-host system.

The CDB&MP research infrastructure includes chemical and parasitological laboratories: equipment for drying and wet mineralization of biological samples, microscopes (stereoscopic and fluorescent), an *in vitro* culture system, a microplate reader for evaluation and interpretation of immunological tests.

CDB&MP has been involved in numerous national projects. The group collaborates with Polish national parks as well as with universities in Poland and Europe.

The expertise offered includes:

- evaluating body burden of heavy metals (mercury, lead, cadmium, copper and fluoride) in warm-blooded native and alien wild animals (including animals occurring in Natura 2000 areas of NW Poland);
- investigating trace elements in human tissues, particularly bones;
- detecting and identifying parasites in patients, including low immunity ones;
- identifying pathogenic and opportunistic parasites in environmental samples;
- tracing effects of selected substances on ion transport in the digestive tract of laboratory animals experimentally infected with various parasites;
- identifying the role of arthropods as bloodsucking vectors of diseases, including the Lyme disease.

The group seeks cooperation in identifying chemical and biological environmental risk factors for humans, wild birds and mammals, in employing animal bioindicators in environmental pollution assessment and in investigating physiological and biochemical aspects of ion transport in parasite-host system.

Keywords describing the expertise offered:

ecotoxicology, toxicology, trace elements, human parasites, parasite-host system, ion transport

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The Department of Psychiatry (DP) is a scientific and clinical unit with a group of specialists in psychiatry, psychology, psychotherapy, genetics and biochemistry whose research focuses primarily on:

- stem cells, factors involved in their trafficking in acute psychiatric disorders and gene expression;
- pharmacogenetic evaluations of the use of old and new psychotropic medications, with assessment of their therapeutic efficacy, side effects (treatment safety) and costs;
- genetic and psychometric studies on alcohol-addicted patients and their families;
- genetic and psychometric studies on patients with personality disorders, depression, schizophrenia and anxiety disorders, and on healthy populations;
- pharmacotherapy rationalisation in endogenous depression and paranoid schizophrenia, based on genetic and pharmacokinetic conditions;
- new antidepressants, neuroleptics and medications against "alcohol craving" in clinical trials;
- dietary effects on psychosis, Alzheimer onset the disease development.

At present, the DP specialists work on:

- mobilisation of stem cells in patients with schizophrenia and ultra-high risk of schizophrenia, in anxiety disorders and in healthy volunteers;
- clinical evaluation of new psychotropic drugs;
- investigations on dopaminergic, serotonergic, gabaergic, glutaminergic, and cannabinergic neurotransmission in alcohol dependence, anxiety, personality, and eating disorders, and in schizophrenia;
- investigations on rehabilitation of cognitive functions in neurological diseases and psychoses;
- side effects of long-term neuroleptic therapy;
- neurocognitive and psychiatric effects of HCV infection and interferon therapy;
- sexual dysfunctions.

The techniques used in the research include:

- collection of standardized health histories of patients and their families;
- RehaCom;
- RT-PCR (Real-Time Polimerase Chain Reaction);
- psychological and psychiatric questionnaires and inventories, e.g. MMPI, Cattel, Wisconsin Card Sorting Test and other neuropsychological tests, TCI (Cloninger's Temperament and Character Inventory), MINI, SCID, MADRS, HAM-A, HAM-D;
- radioimmunological determination of hormone levels in blood serum;
- biochemical assays;
- flow cytometry.

The DP research infrastructure includes laboratories outfitted with, i.a. real time PCR, Rehacom, flow cytometer, HPLC and ELISA equipment.

The expertise offered includes:

- recruitment of patients with psychiatric disorders for stem cell mobilization studies;
- conducting genetic analysis in medicine;
- testing new methods of psycho- and pharmacotherapy;
- complex studies on stem cells and factors involved in their trafficking in psychiatric disorders;
- recruitment of patients and their families for epidemiological, genetic, neurocognitive, pharmacological and neurophysiological studies;
- detailed psychological, psychiatric and biochemical characterisation of patients.

Keywords specifying the offered expertise:

genetics, neurotransmission, stem cells, neurorehabilitation, pharmacotherapy, RT-PCR, clinical study, cytometry, ELISA, HPLC, schizophrenia, anxiety disorder, SUD, depression, bipolar disorder

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Department of Human Nutrition consists of a team of young researchers and experienced scientists involved in research on and selecting of nutrition systems aimed at developing optimal diets for healthy individuals and addressing particular needs of ill or nutrient-deficient individuals.

The group carries out research focused primarily on:

- assessing immunological responses resulting from consumption of different foods;
- examining effects of various foods on pathological processes to develop functional diets that address various individual needs (including dietary correction of biochemical imbalances);
- investigating vitamin deficiencies and developing deficit-balancing schemes in different social groups, with a particular emphasis on performance athletes to address specific individual and discipline needs;
- developing recommendations on dietary patterns for different social groups, with a particular reference to modification of nutrition recommendations associated with civilizational diseases.

The group collaborates closely with other university departments and universities (e.g. the Pomeranian Medical University) to determine levels of antioxidant enzymes, basic parameters as well as levels of carotenoids and free radicals in body fluids. Based on the assessment of a menu content and its nutritional value, the group redesigns diets for healthy and ill individuals as well as explores possibilities of extending remission periods through diet modification or to slow down the cachexia progress in the chronically ill. The group tests, using animal models (mice), immunomodulation effects caused by various chemicals, food products, and pro-biotic bacteria in nutritional allergies, using flow cytofluorometer (FACS) to determine immunological response. The group's research infrastructure includes laboratories outfitted with equipment necessary in assays of antigens, antibodies, cytokines, adhesion molecules, chemokines, dissolvable receptors (immunoenzyme method), high pressure high performance liquid chromatography (HPLC; to be used in, e.g. determining vitamin levels in human body).

The expertise offered includes:

- determining effects and deficiencies of 28 nutritional components (main nutrients, bio-elements, water and lipid dissolvable vitamins) based on menus and meal portion sizes;
- identifying effects of immunostimulation and immunosupression caused by nutrition components and probiotics;
- conducting studies on nutritional allergies.

The group seeks collaboration in assessing patients' physical condition and illness status, current state of nutrition, in developing treatment methods, and in determining individual energy requirements associated with individual sport disciplines.

Keywords describing the expertise offered:

human nutrition, diet, immunomodulation, vitamins, nutritional allergies

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Department of Genetics and Pathology (DGP) and International Hereditary Cancer Centre (IHCC) have attained a significant international position due to their achievements, primarily in diagnosis and prophylaxis of hereditary cancers, obtained in Poland in collaboration with scientists from other countries. IHCC groups a staff of 30, including 3 full and associate professors and 13 postgraduate researchers (Ph.D. and/or M.D.). Their research is primarily focused on cancer genetics, including prophylaxis, early diagnosis and treatment via:

- identification of molecular high, moderate and low cancer risk markers;
- diagnostic of familial cancer syndromes;
- diagnostic of cancer predisposition;
- targeted therapy of cancers;
- cancer surveillance programmes;
- genetic screening of Polish population to define cancer risks;

DGP and IHCC hold a number of patent rights, both in Poland (e.g. PL 185957, PL 192139, PL 202116, PL 209997, P212012, P.361597, P367319, P375857) and internationally, e.g. 7,319,007 B2 (USA), 011608 (Eurasia), 2006/02081 (RPA), US 7,851,162 B2 (USA), 93344 (Ukraine), No2470998 (Russia). Among the most important achievements of DGP and IHCC is publication of about 200 papers on hereditary cancers during the last 10 years, most of them published in SCI journals including JAMA (Impact Factor 23.33) and Journal of the National Cancer Institute (Impact Factor 15.171). DGP and IHCC have been involved, frequently with a leading role, in numerous international collaborative studies, e.g. Genomic deletions as markers for renal carcinoma diagnosis (U.S.-Poland Maria Skłodowska–Curie Joint Fund II; MZ/NIH-96-287); Identification of new cancer susceptibility genes by linkage analyses in Polish families with aggregation of breast or colorectal cancers (6th EU Framework Programme; MTKD-CT-2004-510114); DGP and IHCC have carried out population screening for familial cancers, whereby family doctors and nurses performed screening for family cancer history of all the Western Pomeranian region population (1.5 million) in Poland, the world's first such screening programme. In addition, the world's first register of family cancer syndromes has been established. DGP and IHCC were the first in the world to demonstrate, using the breast cancer model of the homogenous Polish population, the genetic contribution to all cancer forms. The research infrastructure includes Chemagen MSM I (12 and 96 rotheads), PE Janus/Victor, Sequenom, sequencing analyzers, MassARRAY system (Sequenom), Real Time PCR (LC 480, Roche), DHPLC (Wave, Transgenomic), Sequencer (3130 Genetic Anaylzer, Applied Biosystems), Pyrosequencer (Biotage), Gel-electrohporesis, Next Generation Sequencer (Junior, Roche), several low temperature freezers, refrigerators, laboratory centrifuges and other equipment.

The expertise offered includes:

- studies on molecular recognition of cancer therapy personalization;
- research on prognostic factors based on breakthrough molecular studies;
- development of uniform clinical, genetic, and molecular databases, combined with the collection of biological analytical material (including biobanking);
- application of genetic profile-based methods for determining reduced predisposition to cancer, involving a search for mutations BRCA1, BRCA2, MLH1, MSH2, MSH6, CHEK2, NOD2, NBS1, CYP1B1, CDKN2A (P16), and others;
- development of pharmacuetical and other cancer prevention methods;
- development of methods for early detection of reduced clinical response towards cytostatic neoadjuvant chemotherapy in breast cancer patients;
- implementation of case-control studies;
- analysis of relationships between molecular biomarkers, susceptibility biomarkers, clinical biomarkers and environmental and lifestyle factors;
- application of various analytical techniques (sequencing, sequenom, pyrosequencing, RealTime PCR RFLP, PCR ASO, DHPLC, biobanking).

We have experience in Framework Programmes as a coordinator and a partner.

Health

Keywords specifying the offered expertise:

hereditary cancer, cancer risk markers, genetic screening, population screening, familial cancer syndromes, targeted therapy

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The Centre for Research and Development of Innovative Therapies in Ophthalmology (CeRDITO) groups specialists working primarily on:

- prevention, diagnosis and innovative treatment of common neurodegenerative eye diseases associated with age and environmental factors [age-related macular degeneration (AMD), retinopathy of prematurity (ROP), diabetic and hypertensive retinopathy, ischemic ocular neuropathy;
- development of innovative therapeutics, including cellular and gene-based therapies for ophthalmic diseases (innovative cell-based formulations and packaging systems for controlled and site-specific delivery of pro-regenerative drugs for ophthalmic diseases);
- investigation of novel biomarkers for disease diagnostics and therapy monitoring (search for biologically active substances and gene-related products for diagnostic applications in ophthalmology);
- development of multi-centre pre-clinical and clinical studies of innovative therapies for different applications in ophthalmology (microencapsulation of therapeutic substances, ophthalmic delivery of controlled release drugs, biotechnology of therapeutic nanogels and dendrimers for ophthalmic diseases).

Additionally, the CeRDITO specialists pursue research on characterization of biodegradable nanomaterials and innovative nanotechnologies for different therapeutic and diagnostic applications in ophthalmology.

The CeRDITO research infrastructural capacity includes microscopy (fluorescence/confocal) facility, a multi-imager system for analysis of fixed and live biological samples (Pathway, BD), a Luminex-FlexMap3D bead array system, flow cytometry (LSRII, BD) and cell sorting facility (FacsAria-IIu, BD), a cell-culture facility for human primary cell cultures, real-time qPCR system and a microarray facility, a laboratory animal facility, a multimodal in vivo imaging system using bioluminescence/fluorescence/X-ray/ionizing radiation for preclinical studies (In-Vivo Xtreme), vision research facility including electroretinography (UTAS), a retinal vessel analyzer (Imedos), and retinal spectral-domain optical coherence tomography (Bioptigen).

The expertise offered includes:

- morphological and functional characterization of different retinal degeneration models;
- pre-clinical in vivo models for various ophthalmic diseases related to retina (retinal acute chemical injury, inherited slow retinal degeneration, retinal pigment epithelium (RPE) injury model);
- "packaging" of neuro-active substances on micro scale and characterization of their therapeutic effectiveness ("combined cell- and gene-based therapies");
- multiple-target biochemical or immunological diagnostic tests (ELISA, Luminex, Flow cytometry, protein arrays) for biomarker identification in clinical samples;
- search for differentially expressed genes and miRNAs as potential diagnostic or prognostic molecular biomarkers in personalised medicine of retinal degenerations;
- investigating pathophysiology of ophthalmic diseases through multimodal morphological, cytogenetic and molecular biology services;
- functional characterization of retinal degeneration in animal models, based on optical coherence tomography and biological responses to visual stimuli tested by electroretinography or retinal vessel responsiveness analysis;
- stem cell isolation for combined cell- and gene-based therapeutic strategies;
- animal models of different retinal degenerative diseases.

Keywords describing the expertise offered:

ophthalmology, retinal degenerative diseases, cell-based therapy, gene-based therapy, functional diagnostic tests of retina, biomarker identification, nanomaterials, nanotechnologies

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The Department of Systems, Signals and Electronics Engineering (KISSE) groups of scientists working on various specific applications (mainly biomedical) of systems science, control engineering, electronics, and (tele)informatics.

The KISSE research is focused on:

- innovative non-stationary filters and their various applications, e.g. in denoising bioelectrical signals like ECG, EEG, EMG, etc.;
- advanced methods (statistical, time-frequency, etc.) and techniques of signal and image processing and analysis, application in biosignal (including speech) and biomedical image enhancement; improving their diagnostic value (e.g. EEG, electrophysiology of vision, radiology – 3D/4D USG, Virtual Magnetic Resonance Imaging);
- bioelectrical Impedance Analysis and various applications of the technology in medical diagnostics, sports medicine, dietetics and aesthetic medicine;
- biosensing, particularly with respect to graphene-based materials, using different measurement methods and advanced electronics techniques;
- health telematics, using various technologies (RFID, Bluetooth, ZigBee, Z-Wave, LTE, Wi-Max, etc.) in health services, integration of different platforms;
- sound systems analysis and design, using innovative methods and techniques (e.g. advanced hearing aids, sound intensity measurements, advanced modelling acoustic fields).

KISSE has long-lasting experience in running theoretical and experimental studies and has participated in numerous research and development projects in Poland and internationally. KISSE collaborates closely with industry in effective design and prototyping of innovative devices and systems to achieve short time-to-market for a given technological solution.

The KISSE research infrastructure includes specialised equipment for signal and image processing and analysis – spectral analyzers, EEG, ECG & EMG equipment, advanced Electrochemical Impedance Scanning equipment (AutoLab), sound (including speech) recording and analysis systems, telematics modules & evaluation systems, microcontrollers and advanced programmable logic devices (CPLD, FPGA) – platforms and development environment.

The expertise offered includes:

- high level competences, knowledge and skills necessary at every stage of analysis, design, testing and manufacturing procedures within the fields listed above;
- design and prototyping of innovative devices and systems to achieve short time-to-market for a given technological solution.

Keywords describing the expertise offered:

biomedical engineering, (bio)signal & biomedical image processing & analysis, bioelectrical impedance analysis, health telematics, speech analysis, synthesis & recognition, sound engineering, electro-acoustics

Health

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The Department of Immunology (DI) is involved in research on:

- natural and acquired immunity (as determined using parameters of nonspecific and specific cell and humoral immunity) in infections, particularly those caused by viruses and Chlamydia; the parameters determined collectively create an immunological profile of mammalian subjects (animals, humans), pivotal for the assessment of their immunological status; the high quality equipment and a special animal culture facility make it possible for DI to conduct environmentally safe experiments; the research involves classical techniques used in immunology (flow cytometry) and virology (real-time PCR) as well as numerous other molecular techniques to assess, e.g. expression of genes encoding different immunological substances, i.a. cytokines, interleukins and chemokines; serological tests (ELISA) are carried out as well;
- diagnostics of influenza virus based on multiplex real-time PCR and molecular biology methods, bioinformatics, virusological and immunological methods, to develop a technology of anti-influenza vaccines production (in collaboration with National Institute of Public Health, National Influenza Centre in Warsaw);
- protein fractions constituting a part of DNA replication in bacteriophage lambda, and the role of SeqA protein in transcription regulation from bacteriophage's lambda promotors (in collaboration with Department of Molecular Biology, University of Gdańsk).

The expertise offered includes:

- conducting research on problems related to natural and acquired immunity (as determined with parameters of nonspecific and specific cell and humoral immunity) in viral infections.

Collaboration is sought to carry out joint projects focused on problems pertaining to natural and acquired immunity in viral infections.

Keywords describing the expertise offered:
immunology, natural and acquired immunity, viral infections, bacteriophages

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Department of Microbiology and Immunology (DMI) is a multidisciplinary centre active in clinical immunology, microbiology and transplantology. The DMI experience is based on effective collaboration of skilled laboratory specialists, clinically relevant immunologists and clinical transplantologists.

The DMI research is focused on:

- kidney allograft donor/recipient matching;
- bone marrow donor/recipient matching;
- monitoring of alloimmunisation level in kidney allograft recipients (anti HLA antibodies);
- molecular diagnostics of viral infections, BK and CMV in kidney allograft recipients;
- molecular investigations of nosocomial epidemics;
- immunological diagnostics of autoimmune and infectious diseases.

In collaboration with the Clinic of Nephrology, Transplantology and Internal Diseases (CNTID), DMI is currently starting a project on Immunological factors influencing long-term kidney allograft function aimed at identifying mechanisms involved in chronic allograft injury and allograft fibrosis despite immunosuppressive therapy.

The project concentrates on:

- the role of NK cells in the context of killing inhibitory receptor polymorphisms and locus C compatibility;
- the role of anti-HLA antibodies in chronic kidney allograft injury;
- the role of inflammatory reactions IL1, IL6 and IL 17 in the context of chronic kidney allograft injury and recurrent urinary tract infections;
- the role of IL 33 in kidney allograft fibrosis;
- all the above aspects in the context of BK and CMV infections.

DMI collaborates with the Department of Pathology (DP) on flow cytometry applications.

The expertise offered includes:

- molecular procedures related to HLA antigen examination (PCR-SSP);
- molecular parameters of BK and CMV infection monitoring (Real-Time PCR);
- Luminex technology and its application in alloimmunisation monitoring;
- different immunoassays: immunofluorescence and ELISA;
- bacterial strains genotyping methods (PFGE, RAPD);
- clinical background and translational approach resulting from collaboration with CNTID.

Keywords describing the expertise offered:

chronic kidney allograft injury, interleukins, alloimmunisation, CMV and BK viral infections, NK cells, fibrosis, HLA typing

Health

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Section of Toxicology and Bioanalytics (STB) conducts research in biomedical, environmental and pharmaceutical sciences. The group is particularly interested in developing new and non-expensive separation technologies that can be applied in quantification of endocrine disrupting compounds (EDCs), biomarkers, bioactive substances and related compounds in complex biological and environmental samples.
STB works with liquid chromatographic fractionation, separation and quantification (HPLC, HPTLC, CE) of low molecular mass compounds from complex samples. Extensive research is devoted to Spirulina-containing foods and to isolation and determination of fullerenes, steroids, and macrocyclic compounds such as cyclodextrins, calixarenes and macrocyclic antibiotics. Recently, STB has been working on new sensitive detection systems applied to planar separation techniques involving quantum dots fluorophores and quantification of biomarkers via paper based microfluidic devices. Substantial part of the recent STB research is related to antioxidant properties of foods. The STB research infrastructure includes a pre-treatment vacuum centrifuge, SPE vacuum manifolds, pH and oxygen-meters, analytical balances, an optical microscope with digital camera, HPLC chromatographs operating with DAD UV-Vis detector, and originally developed micro-thin-layer chromatographic chambers working under temperature controlled conditions (micro-TLC).

The expertise offered includes:

- application of temperature-dependent inclusion chromatography, temperature-controlled micro-planar chromatography and multivariate statistics for separation and quantification of steroids and related endocrine disrupting compounds in water samples;
- investigating thermochromic effect involving host-guest interactions between dyes and macrocyclic compounds and its potential use for quantitative detection of UV-transparent compounds in micro-TLC, HPLC and CE techniques as well as HPTLC based microfluidic devices;
- application of STB new analytical protocols for fast fingerprinting and quantification of a wide range of low-molecular mass compounds from complex samples, including Spirulina cells, pharmaceutical formulations, sewage water, fish bile, tissue extracts, blood or urine.

STB seeks cooperation in:

- analysis of steroids and related endocrine disrupting compounds in complex biological and environmental samples;
- pharmaceutical and biomedical analysis including drugs bioavailability and pharmacokinetics driven by multivariate data proceeding;
- theory and thermodynamics of separation processes;
- supramolecular chemistry, particularly thermochromic effects of inclusion complexes and LC separations involving host-guest complexation at different temperatures;
- miniaturisation of high-throughput separation and detection systems based on liquid mobile phases, including thin-layer chromatography, high-performance liquid chromatography, capillary electrophoresis and microchip electrophoresis;
- ecotoxicology focused on endocrine disrupting compounds;
- metabolomic study of biological and environmental systems involving new and high-throughput separation science protocols driven by multivariate statistics.

Keywords describing the expertise offered:
ecotoxicology, separation science, liquid chromatography, quantitative analysis, macrocyclic antibiotics, low-molecular mass compounds, supramolecular chemistry, pharmaceutical formulations, micro-thin-layer chromatography, temperature-dependent inclusion chromatography, antioxidants, steroids, cyclodextrins, fullerenes, quantum dots

Health

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Information & Communication Technologies

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The Department of Methods of Artificial Intelligence and Applied Mathematics (DMAIAM) is an interdisciplinary group of specialists working on:

- data analysis and application of classifiers and regression models based on data (technical, economic, medical) using standard methods and methods of artificial intelligence;
- solving optimization tasks – using classical methods and methods of artificial intelligence;
- development of mathematical models of dynamic plants and technical and economic processes;
- development and testing of a variety of control algorithms of technical objects, including classical and modern (fuzzy, neuro-fuzzy) algorithms;
- development of learning and control algorithms for a mobile robot or a group of robots.

The DMAIAM scientists are also involved in:

- application of reinforcement learning of a behaviour policy for mobile robots;
- decision making under uncertainty and risk, processing uncertain information;
- local regression models and their application for uncertain and incomplete data;
- machine learning and data mining (data analysis, classification and regression algorithms, theoretical background on machine learning techniques, application to medical and industrial problems);
- probabilistic Inference (probabilistic modelling) (Bayesian networks, HMMs) and probabilistic computation (statistical computation, distribution of statistics, propagation of uncertainty, system reliability, probabilistic arithmetic, etc.);
- artificial Intelligence (graph searching algorithms and related discrete optimization problems);
- rapid prototyping and testing of control algorithms using programmable controllers.

DMAIAM is involved in some international and national projects, has experience in software design and application, mainly for data analysis and control. DMAIAM cooperates with scientific institutions from different sectors, including medicine, control, maritime technology, and with businesses.
The DMAIAM research infrastructure consists of laboratories featuring programmable controllers (Bernecker&Reiner) X20s, Power Panels, Automation Panels (GE, Siemens, National Instruments); and software: Wonderware Industrial Software (ActiveFactory, Application Server Device Integration, Historian Client, Historian Server, InBatch etc.).

The expertise offered includes:

- software design and implementation for specific tasks;
- method assessment on a model and development of technical documentations and reports related to data analysis and application of classifiers and regression models;
- optimization methods;
- development of mathematical models;
- development and testing of control algorithms;
- application of advanced analytical techniques, including data analysis and application of classifiers and regression models based on data (technical, economic, medical);
- solving optimization tasks;
- development of mathematical models of dynamic plants and technical and economic processes.

Co-operation is sought in the development and testing of a variety of control algorithms of technical plants, including classical and modern (fuzzy, neuro-fuzzy) algorithms, based on rapid prototyping method and hardware in the loop method; development of tuning and supervisory algorithms dedicated to control algorithms and development of learning and control algorithms for a mobile robot or a group of robots.

Keywords describing the expertise offered:
data-mining, artificial intelligence, classification, regression, optimization, mathematical models of dynamic plants, learning and control algorithms

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The Division of Precision Mechanics (DPM) is an interdisciplinary group of specialists in human-machine interaction and applications of artificial intelligence in machine construction and operation. The group's research is primarily focused on:

- building intelligent interaction systems between technical devices and their human operators;
- developing intelligent methods for operator's biometric identification, command meaning analysis, command effect analysis, command safety assessment, and process supervision;
- developing intelligent methods for processing of commands and messages issued by human operator in a natural language;
- building cognitive interfaces for human operators of technical devices;
- building intelligent interactive systems for design of machine elements and assemblies based on features described in a natural language;
- developing means of control, supervision and optimisation of manufacturing processes;
- developing future intelligent interface devices for mobile technologies;
- analysing artificial creativity.

The DPM research infrastructure includes well equipped modern laboratories. The group is involved in international and national projects, and has experience in the development of intelligent interactive systems which can be used in industrial applications.

The expertise offered includes:

- building intelligent interfaces between technical devices and their human operators;
- developing artificial intelligence hybrid systems for production processes;
- exploring application of artificial intelligence methods and techniques (neural networks, evolutionary algorithms, fuzzy logic);
- developing methods for natural language and handwriting recognition;
- building intelligent interactive systems of technical devices and their operators, equipped with intelligent mechanisms for operator biometric identification, command meaning analysis, command effect analysis, command safety assessment, and process supervision. The systems are applied in supervision of automated production processes, with the use of mobile technologies and an intelligent assessment system of human operator's ability for efficient processing of information streams from multiple sources;
- developing cognitive interfaces for human operators of technical devices, intelligent interactive systems for design of machine elements and assemblies based on features described in a natural language;
- supervising and optimisation of manufacturing processes;
- developing future intelligent interface devices, artificial creativity, artificial intelligence hybrid systems, artificial intelligence methods and techniques (neural networks, evolutionary algorithms, fuzzy logic), methods for natural language and handwriting recognition.

Keywords describing the expertise offered:
intelligent interaction, speech interface, interaction by speech and natural language, artificial intelligence, hybrid systems, neural networks, manufacturing, production, machine building

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The Department of Signal Processing and Multimedia Engineering (DSPME) groups academic researchers working on signal and image processing, multimedia, and on selected aspects of applied computer science.

The DSPME research concerns primarily:

- acoustics and signal processing (digital surround systems, audio conversion, vibroacoustic analysis, real-time signal processing using DSP and GPGPU solutions, spectral analysis);
- computer vision, image processing and analysis (image and video quality assessment, image and video compression, 3D scanning, nonlinear filtration of images and signals, extraction of geometrical features from images, texture analysis, computer vision for automation and robotics, vision based control of mobile robots);
- video analysis and motion tracking (augmented reality, virtual studio technologies, motion capture, motion tracking, camera tracking);
- Web and multimedia technologies (computer network traffic analysis, Web and multimedia applications, mobile applications, audio and video streaming, integration of ICT systems, transmission of measurement data).

The DSPME research infrastructure (supported in part by the European Union's Integrated Operational Programme of Regional Development) includes:

- Laboratory of Audio Engineering and Ambiophonics with ICON Control 32 console;
- Accelerator of Multimedia Calculations (a computer cluster with 400 cores);
- Laboratory of Multimedia Engineering;
- Laboratory of Television Technologies (with motion capture system).

The expertise offered includes:

- various applications of applied computer science, especially related to computer vision and image/video analysis;
- potential application areas concern, e.g. vision based control of mobile robots, statistical video analysis and similarity based image analysis such as comparison of textures;
- application of automation and mechatronics systems with vision based monitoring or feedback;
- applications of audio and signal processing algorithms, with a particular reference to surround systems;
- applications of ICT, computer networks, parallel computing, and video analysis, particularly motion tracking.

Keywords describing the expertise offered:

multimedia, image analysis, computer vision, image processing, vibroacoustics, ambiophonics, surround systems, signal processing, computer networks, ICT, motion capture, video tracking, applied computer science

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The Department of Control Engineering and Robotics (DCER) groups specialists skilled in designing and implementing complex control systems, specifically in:

- modelling and simulation of processes;
- identifying process model parameters;
- synthesis of adaptive and predictive control algorithms in a single- and multivariable control systems in classical and resistant structures;
- control systems;
- application of the most recent methods and computational techniques to design of monitoring and automatic control, implemented through programmable automation devices and manipulators;
- classical and robotic (with DELMIA V5 Automation tools) control systems using distributed DCS/PLC/PAC latest generation automation systems.

The DCER staff's achievements won national recognition in the form of automation branch awards and those granted at the International Fair in Poznań (Poland), including five Gold Medals: for an open CNC machine control system (2009), for a prototype micromilling machine with integrated diagnostic system (2011), in 2012 for implementation of thermal correction in feed-drive module control in a ballscrew driven CNC machine (2012), and for automated visual positioning of workpieces and the prototype five-axis milling centre called X-5 (2013).

The DCER research infrastructure includes facilities for hardware-in-the-loop testing of complex systems, possibility of implementing real-time hardware modules for control and condition monitoring tasks, software for component-based acausal modelling and simulation.

The expertise offered and cooperation sought concern a variety of measurement technologies used in a machine (internal systems) or with it (external systems) that are able to proactively anticipate the emerging need for servicing or repair. Some machines are poorly designed, some are poorly assembled, and some are poorly utilized, 40-50% of machine failures being due to poor maintenance. Machines break down because operators do not realise the scale of the impact they might have on the state of the machines. Changes in machine operational procedures allow to reduce the damage rate by 40-50%. In the last thirty years, machinery operating has been undergoing an evolution of a kind, from reactive maintenance (RM) to preventive maintenance (PM) to modern predictive maintenance (PdM) systems. The essence of the predictive approach is an attempt to estimate the time of next maintenance activity based on monitoring of equipment condition. The monitoring can be based on available measurement signals in control circuits, or can require additional measurements (e.g. vibrations, force measurements). PdM differs from PM (with fixed maintenance dates), as it has varied length of service intervals.

The expertise offered includes:

- preparation of equipment and systems for industrial process automation, including performance reviews for innovative project proposals submitted to the European Union;
- research and services in design and construction of programmable control systems of technological processes (control algorithms, hardware selection, diagnostics and visualization processes, application of artificial intelligence in automation systems);
- training and courses in the design of distributed control systems of technological processes in PLC/PAC/FPGA programming, digital servo programming, diagnostics and visualization of processes, and robot and CNC machine tool programming.

We have experience in Framework Programmes as a partner.

Keywords specifying the offered expertise:
dynamic systems modelling, predictive maintenance, condition monitoring, component based acausal modelling, model-based control

Information & Communication Technologies

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The group consists of electronics and informatics specialists working on:

- population based optimisation algorithms (e.g. GA, EA, PSO);
- parallel architectures (dedicated processor arrays implemented into FPGA devices);
- parallel programming (e.g. TPL, CUDA, OpenCL);
- digital systems design dedicated to implementation into FPGA devices;
- rational fraction arithmetic (optimisation of arithmetic operation for FPGA implementation);
- custom accelerators design (FPGA);
- database systems.

The available infrastructure includes:

- programming software;
- software and hardware for the design and implementation of digital systems into FPGA devices;
- IP Core for arithmetic units using rational fraction arithmetic;
- GPU accelerators;
- access to supercomputers and compute clusters.

The expertise offered includes:

- strong programming skill (e.g. C,C++, C#, Java, ASP.NET, PHP);
- parallel architecture design;
- optimization algorithms design;
- HDL languages (VHDL, Verilog);
- databases design and optimisation;
- optimisation of algorithms for a variety of problems, in particular genetic and evolutionary algorithms for discrete optimisation;
- development of digital systems design and optimisation, particularly those dedicated to FPGA implementation;
- application of rational fraction arithmetic for FPGA based arithmetic unit optimization;
- parallel programming using several languages and technologies;
- processor array design, particularly those dedicated to linear algebra algorithms;
- strong experience in design and optimisation of databases to be implemented in a variety of management systems;
- parallel applications programming;
- www applications.

Keywords describing the expertise offered:

optimisation algorithms, parallel architecture, processor array, FPGA, rational fraction arithmetic, hardware accelerators, databases design and optimisation, parallel programming, GPU

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Environment

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The Department of Microbiology (DM) is involved in research on:

- the status of aquatic environment, with a particular reference to surface waters, by assessing their sanitary level and physiological groups of bacteria and bacteriophages, assaying their F-RNA and F-DNA as well as somatic parameters, i.e. components which control the levels of microbial contamination and are thus decisive for water quality classification;
- identification and presence of environmental Chlamydia, pathogenic for mammals (humans, animals) in aquatic environment and in biological materials of animal origin (i.a. blood);
- identification of enzymes with cold-adapted B-galactozydase isolated from the environment, with the production of cold-adapted glycoside hydrolases.

The expertise offered includes:

- using microbiological assays for assessment of the status of aquatic environment.

Collaboration is sought to carry out joint projects focused on applying physiological and somatic assays of bacteria to assess the status of aquatic environments.

Keywords describing the expertise offered:
water environment, bacteria, bacteriophages

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The Department of General Zoology groups specialists whose work is primarily focused on:

- restitution and protection of migratory fish, with a particular emphasis on rare species such as sea trout (Salmo trutta trutta), Atlantic salmon (Salmo salar), twait shad (Alosa fallax), sturgeon (Acipenser oxyrhynchus) and eel (Anguilla anguilla);
- behavioural biology of fish in relation to survival under natural conditions, growth, feeding and reproduction;
- adaptability of young fish (larvae and fry), particularly salmonids, to life in the wild;
- training of juvenile fish under hatchery conditions to increase their survival in streams, stocking natural waters with hatchery-reared fish is a popular way to restore salmonid populations and the group's research targets interactions between wild and hatchery-reared fish, their feeding habits, acquisition of predator avoidance behaviour, and effects of prey appearance;
- invertebrates of upstream river sections as a food base for juvenile fish; availability of food for stocked fish is a very important factor determining survival of young fish in the wild; thus, the group studies the food base (zooplankton and macrozoobenthos) of small streams stocked with salmonid larvae and fry; food selectivity is assessed by analysing fish stomach contents;
- histological analysis of fish tissue structure;
- characteristics of fish reproductive cycles;
- histological characterisation of fish and bivalve sexual cycles in the region as a contribution to the evaluation of species' expansion;
- biology and biotechnology of fish sperm (determination of basic sperm parameters; evaluation of sperm and spermatozoa quality using CASA – computer assisted sperm analysis; optimisation of fish sperm activation; sperm cryopreservation: development of cryopreservation procedures and gamete cryobanking; monitoring of development of the offspring obtained from fertilization of frozen gametes);
- fish parasites and health status (effect of environmental conditions on health status of salmonids, cyprinids and other freshwater and marine species; characteristics of micro and macroinvertebrates as intermediate hosts for fish parasites);
- migration of invasive bivalve species in the Odra catchment;
- complex analyses of hydrological and biological conditions (ichthyofauna, macroinvertebrates, plankton and macrophytes) in rivers and their catchments.

The research infrastructure includes a hatchery, sampling and diving equipment, underwater photocameras, liquid nitrogen tanks, microscopes (stereoscopic, fluorescent), a Computer Assisted Sperm Analysis (CASA) system.

The expertise offered includes:

- research on fish morphology and biology (growth, survival, feeding, reproduction, rearing and stocking);
- ecohydrological assessment of rivers and lakes via studies on zooplankton, macroinvertebrates, macrophytes, phytoplankton);
- evaluation of anthropogenic pressure on aquatic ecosystems by i.a. following temporal and spatial changes in riverine faunal communities;
- cryoprotection of fish sperm;
- identification of fish internal and external parasites.

Keywords describing the expertise offered:

fish restitution, fish biology, invertebrates, fish parasites, fish sperm cryoprotection

Environment

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The Department of Plant Physiology and Genetic Engineering (KFIGR) conducts research on seed biology, with a special attention paid to:

- Hormonal regulation of dormancy release and seed germination;
- Reactive oxygen species and nitric oxide functions during seed dormancy release;
- Breaking seed dormancy by smoke active compounds, karrikins;
- Factors inducing secondary dormancy in seeds and affecting seed longevity;
- Applicability of seed conditioning to improve seed performance.

Other areas of interest include:

- Characterisation of indirect somatic embryogenesis systems;
- Molecular basis of ethylene biosynthesis and perception;
- Identification of transgenes in plant material;
- external and internal factors contributing to the development and maintenance of viability and vigor of agriculturally and horticulturally important seeds.

The group investigates mechanism of seed dormancy release and seed germination as well as seed ageing/deterioration using biochemical and molecular approaches. Amarathus sp. and Avena fatua seeds and Medicago sativa somatic embryos are used as research models.
KFIGR is involved in several international and national research projects and aims at developing innovative, environmentally friendly solutions to be implemented in agriculture and biotechnology industry.
The research infrastructures includes climatic chambers equipped with a wireless temperature monitoring system, incubated orbital shakers, clean benches, freezers and ultra-deep freezers, centrifuges and vacuum concentrators, UV-VIS spectrophotometers (cuvette, 96-well plate, Biospec Nano), thermocyclers (standard, gradient and real-time), horizontal and vertical electrophoresis systems, flow-cytometer, GC FID and GC MS systems, automatic system of soil temperature monitoring, bead mill homogenizer.

The expertise offered includes:

- assessment of seed germineability and vigor;
- chromatographic quantification of phytohormones, including ethylene (GC) and abscisic acid (GC MS/MS);
- flow-cytometry;
- quantification of ROS in plant materials;
- determination of enzymatic activities (ACC synthase, ACC oxidase, dehydrogenase, ascorbate peroxidase) as well as application of molecular techniques including gene expression analysis and GUS analysis (histochemical and spectophotometric).

Keywords describing the expertise offered:

seed dormancy, seed germination, seed ageing, soil seed bank, seed conditioning, ethylene biosynthesis, reactive oxygen species, nitric oxide, smoke-water, karrikins, butenolid, transgene analysis, gas chromatography, flow-cytometry, gene expression

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The Department of Technical Analysis and Fundamentals of Technology (DTAFT) is a groups of specialists (chemists, engineers) working on inorganic chemical engineering, with a particular emphasis on:

- titanium dioxide modification;
- phosphorous compounds application;
- modification of orthophosphoric acid production;
- innovative solutions in mineral fertilizer production (slow and controlled release fertilizers with the use of biodegradable materials);
- life cycle assessment (of inorganic chemical products).

DTAFT is involved in many national projects to which it contributes its experience in the development of innovative, environmentally friendly solutions with a potential for industrial applications. DTAFT co-operates with businesses, mainly from the chemical sector.
The DTAFT research infrastructure consists of laboratories featuring SEM-EDX, an optical microscope, XRD, XRF, FTIR, spectrophotometers, climatic chambers, a fertilizer granulation assembly, continuous stirred-tank reactors (CSTR), plug-flow reactors (PFR).

The expertise offered includes:

- preparation of modified titanium dioxide, mineral fertilizers (including slow/controlled release fertilizers), orthophosphoric acid and other phosphorous compounds;
- chemical and physical characterization of titanium dioxide, mineral fertilizers and other phosphorous compounds;
- characterization, preparation and modification of inorganic chemicals.

Keywords describing the expertise offered:
titanium dioxide, fertilizers, phosphorous compounds

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The Department of Heat Engineering and Waste Management (DHEWM) groups specialists working on applications of magnetic fields in various areas of chemical engineering and biomedicine.

The DHEWM research is primarily focused on:

- analysis of transport processes in chemical engineering apparatus;
- mathematical modelling of transport processes in classical and non-classical mixers;
- application of methods and techniques of artificial intelligence to describe chemical engineering operations;
- theoretical and experimental analysis of magnetic field effects on selected unit operations and processes in chemical and biochemical engineering;
- optimisation of chemical engineering set-ups;
- magneto-biology systems;
- application of information theory to describing engineering systems.

During the last year, the DHEWM submitted more than 140 full-text research papers and filed over 30 patent applications.
The DHEWM research infrastructure includes laboratories dedicated to process dynamics, mixing processes, and fluid flow.

The expertise offered includes:

- design of process systems;
- experimental validation of modelling results and mathematical modelling;
- solving process engineering problems;
- analysis of dynamics behaviour in chemical set-ups;
- analysis of fluid flow.

DHEWM seeks cooperation with R&D institutions and chemical industry in pharmaceuticals, high-performance materials, biotechnology, electronic industry, paints and plastics, petroleum refining, synthetic fibers, transport processes in chemical engineering systems, fluid flow and hydrodynamics problems, application of artificial neural network in mixing and reactor modelling and in the development of new technologies employing novel materials.

Keywords describing the expertise offered:
chemical engineering and processing, patent, biochemical engineering, analysis, mathematical modelling, mixing, chemical engineering apparatus

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The Department of General and Ecological Chemistry (DGEC) carries research focusing primarily on:

- eutrophication in shallow reservoirs and marine environment;
  - nutrient limitation of primary production (nutrient supply ratios, quantitative determination of phosphorolytic enzyme activity);
  - nutrient sources (agricultural land non-point sources, availability of bio-assimilable forms of phosphorus in aquatic ecosystems);
- internal eutrophication (nutrient release from bottom sediments, fractionation of sediment-bound phosphate, sorption);
- chemical methods of lake restoration (phosphate inactivation in the presence of polyvalent metal compounds, formation and characterisation of intelligent and environmentally friendly biomaterials-based adsorbents);
- effects of agrochemical formulations on behaviour of active substances in the environment (degradation kinetics of agrochemicals (pesticides) in soil and water, determination of TD_{50}, determination of partition coefficients K_d, $K_{OC,}$ adsorption processes in the water/soil and water/sediment systems, mobility of agrochemicals in soil).

DGEC is involved in national projects and collaborates with other Departments of the West Pomeranian University of Technology in Szczecin, Poland contributing its experience in the development of innovative and environmentally friendly solutions.
The DGEC infrastructure includes well-equipped laboratories for the study and chemical analysis of water, soil and bottom sediments.

The expertise offered includes:

- unique knowledge on chemical analyses of water, soil, bottom sediments (analysis of nutrients, metals, agrochemical residues);
- research on phosphorolytic enzyme activity in aquatic environments (water and bottom sediments) and soil;
- speciation analysis of phosphorus in soil, water and bottom sediments;
- analysis of degradation kinetics of agrochemicals (pesticides) in water and soil;
- exploring mobility of chemical pollutants in soil and sediments;
- determination of partition coefficients and sorption processes (adsorption, desorption) of pesticides, metals and phosphorus compounds in water/soil and water/bottom sediment systems equilibrium and kinetics studies on phosphate sorption from aqueous solution by biomaterials-based adsorbents;
- physico-chemical modification of biomaterials.

Keywords describing the expertise offered:
eutrophication, shallow reservoirs, phosphorus, lake restoration, pesticides, nutrient limitation, metals, mobility, environment, biomaterials-based adsorbents

Environment

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The group consists of specialists in GIS and remote sensing whose research focuses on:

- innovative cartographical studies (image maps, hybrid databases);
- geoinformatics application in geodesy and cartography (GIS servers, INSPIRE implementation in geodesy and cartography);
- vector databases in GIS (building topographic and cartographic databases, spatial analysis);
- geodetic surveying (experience in modern methods of field measuring).

The research is carried out using infrastructure consisting of specialised laboratories (GIS and remote sensing), the Earth measuring equipment (GNSS, geodesic and photogrammetric surveying).
The project implemented, involving delivery of a variety of products (analyses and assessments, data bases, etc.) were commissioned by, i.a., the Polish Ministry of National Defence.

The expertise offered includes:

- hybrid maps (imagery data characterization, properties, applications of large scales in cartographical studies) including processing of both ortho- and non-ortho rectified imageries to create special maps;
- georeferenced databases (modelling, building, analysis of topographic and cartographic databases with GIS as a DBMS application) including GIS analysis and creating digital and printed maps;
- remote sensing applications and analysis (wide range of EM waves: optical, infrared, radio and sound), including analysis of hyperspectral (multispectral) imageries and unmanned aerial system data processing.

Keywords describing the expertise offered:
remote sensing, image map, GIS, georeferenced databases, spatial analysis

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Department of Biotechnology (DB) groups specialists whose research is primarily focused on:

- water and wastewater purification using membrane techniques (ultrafiltration, microfiltration, reverse osmosis and membrane distillation);
- investigation of antifungal and antibacterial properties of nanomaterials (mainly nanomaterials used in building industry);
- photocatalytic purification of water (removal of a variety of organic contaminants from water using photocatalytic oxidation);
- membrane bioreactors (fermentation of various substances, like: whey, glycerol, cellulose, using bioreactors).

DB is involved in national and international projects; it has developed innovative, environmentally friendly solutions with a potential of industrial applications.

The DB research infrastructure includes modern analytical equipment such as an ion chromatograph, a high performance liquid chromatograph, total organic carbon analyzers, a nanoparticle size analyzer, a UV/Vis spectrometer and a variety of other laboratory equipment. Experiments are conducted using many laboratory scale and pilot scale installations.

The expertise offered includes:

- providing solutions for water and wastewater purification using membrane techniques;
- developing solutions for separation of impurities and products of bioprocesses from water;
- investigation of antifungal and antibacterial properties of nanomaterials and photocatalytic purification of water.

DB seeks cooperation in the areas indicated above, with the use of its modern infrastructure (laboratories and equipment such as IC; HPLC; TOC; UV/Vis spectrometer; nanoparticle size analyzer; ultrasonic homogenization; bioreactors; antimicrobial properties determination; ultrafiltration, microfiltration, reverse osmosis and membrane distillation systems, photocatalytic reactors).

Keywords describing the expertise offered:
membrane processes, antimicrobial properties determination, bioprocesses, photocatalytic processes

Environment

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The Palaeoceanology Unit (PU) conducts research on:

- diatom taxonomy, ecology and biodiversity;
- application of diatoms and other siliceous and calcareous microfossils to palaeoenvironment reconstructions in aquatic systems;
- diatom culture and molecular characterisation;
- application of diatoms as indicators in environmental monitoring and water quality assessment;
- phytoplankton communities in various brackish and marine ecosystems;
- ecology and diversity of meiobenthos in various brackish and marine (including deep sea) areas;
- ecology and diversity of macrobenthos, including alien species, in various brackish and marine areas;
- application of fossil and subfossil molluscs in reconstruction of past environmental conditions;
- biological monitoring of anthropogenic disturbance effects in marine coastal ecosystems;
- fish parasites;
- climate change effects in coastal systems, including modelling of past and projection of future developments.

PU is involved in vigorous far-fetching international collaboration featuring joint research projects, support for international PhDs, and international training workshop and courses. PU scientists carry out a number of nationally funded projects and perform consultancy services for non-academic stakeholders. The PU research infrastructure includes a research boat (seaworthiness: up to 20 nautical miles offshore range) and field sampling equipment; laboratories equipped in state-of-the-art compound microscopes and stereomicroscopes with cameras and image processing capabilities; an algal culture facility; a molecular analysis laboratory; an extensive diatom collection; a comprehensive collection of diatom literature.

The expertise is offered and co-operation opportunities are sought in:

- comprehensive diatom research, including diatom culture and molecular analyses;
- innovative diatom applications (including oil extraction);
- multi-proxy approaches using diatoms, sediment-bound plant pigments, and calcareous microfossils in historical and palaeoceanological environmental reconstructions;
- phytoplankton-based tracing of water mass movement;
- meio- and macrobenthos-based biomonitoring;
- modelling of climate change effects in the coastal zone.

We have experience in Framework Programmes as a partner.

Keywords describing the expertise offered:

diatoms, algal cultures, molecular characterisation, multi-proxy, palaeoreconstructions, biological diversity, phytoplankton, meiobenthos, macrobenthos, monitoring, anthropogenic disturbance, climate change effects, coastal zone

Environment

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Energy

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The Department of Electrical and Computer Engineering (DECE) is among Polish R&D leaders in application of electromagnetic methods for non-destructive testing (NDT). The group has participated in numerous national and international research projects. DECE scientists are members of scientific organizations such as the World Federation of Nondestructive Evaluation Centers (WFNDEC) and have served on Scientific Programme Committees of 18th and 19th World Conferences on Non-Destructive Testing (WCNDT), International Symposium on Applied Electromagnetics and Mechanics (ISEM), International Workshop on Electromagnetic NonDestructive Evaluation (ENDE) and International Symposium on Theoretical Electrical Engineering (ISTET). In the last decade, the DECE research potential has been systematically expanded. Currently, the DECE research is focused primarily on:

- multi-frequency eddy current non-destructive testing;
- vector magnetic field measurements;
- magnetic flux leakage and Barkhausen noise method;
- high frequency (terahertz and microwave) NDT systems for testing of composites;
- digital and computer radiography;
- active thermography;
- numerical analysis of electromagnetic fields;
- artificial intelligence algorithms for NDT;
- data fusion algorithms;
- algorithms of automatic defects recognition.

The DECE infrastructure consists of laboratories equipped with the state-of-the-art equipment for computer and digital radiography, THz inspection, application of various electromagnetic evaluation methods (eddy currents, magnetic field flux leakage, Barkhausen noise) and thermography.

The expertise offered includes:

- developing and constructing new, innovative electromagnetic NDT systems;
- construction of electromagnetic transducers for NDT and materials testing with NDT methods, including radiographic, terahertz, thermography and eddy current techniques;
- developing methods and algorithms for automatic NDT testing, especially including algorithms for artificial intelligence and data fusion, and numerical electromagnetic field analysis by means of finite element method with special emphasis on computer simulations of eddy current NDT systems.

DECE seeks cooperation opportunities in inspection of composite materials, designing and developing software for NDT systems with advanced analysis of measurement data and in developing advanced methods for automatic analysis of radiographic images and automatic defect recognition.

We have experience in Framework Programmes as a partner.

Keywords describing the expertise offered:

NDT, eddy current, magnetic flux leakage, Barkhausen noise, data fusion, automatic defect recognition, digital radiography, artificial intelligence, thermography, THz, electromagnetic field analysis

Energy

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The Power Electronics Laboratory (PEL) focuses on modern industrial electronics, control systems and power electronic supply units.
The major areas of research include:

- high efficiency power supply units for non-thermal plasma systems;
- highly integrated control units based on modern microcontrollers and DSPs;
- custom power electronics and special topologies for microwave and UV generation;
- electrical machine control and supervisory systems;
- plasma system operation and measurements;
- contactless power supplies;
- power electronic system modelling and simulations.

The PEL scientists are skilled in modelling (Plecs, Simplorer, Simulink, Maxwell, Gecko Circuits), analysis, design and prototype construction of power electronic units (up to 50kW), control systems (Texas Instruments Code Composer) and measurement units.
The PEL research infrastructure includes modern digital oscilloscopes (LeCroy, Tektronix), measurement probes for current (Norma, Pearson, Hall-effect, Rogowski coil), voltage (up to 40kV), temperature (iR Camera), short term iCCD imaging, power quality measurement devices (Norma 5000, 12 channels), LabView measurement and communication cars (CRio, Ni-Daq systems).

The expertise is offered and cooperation sought in:

- power electronics (analysis, modelling, testing, prototype development, experimental analysis);
- industrial electronics (development, analysis, construction);
- frequency converter technology;
- plasma systems and non-thermal plasma technology (power electronic supply and control units, industrial applications, deodorisation, VOC reduction, NOx/SOx reduction, water purification, ozone measurement, FTIR analysis);
- measurement systems (development, data analysis), remote control units (using RF and Wi-Fi technologies);
- renewable energy conversion systems;
- electrical machine construction and control, control systems;
- measurement units;
- experimental and digital analysis;
- prototype construction and development;
- PCB development;
- DSP and microcontroller hardware and software development;
- modern measurements (high-end oscilloscopes, power quality monitors, thermal analysis, efficiency tests and optimisation).

Keywords specifying the offered expertise:
power electronics, non-thermal plasma systems and technology, control units, industry applications, industrial electronics, high voltage power supplies, pulsed supplies

Energy

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The Process Modelling Group (PMG) is a research team specialised and experienced in numerical modelling of transport processes by means of both process simulation tools and Computational Fluid Dynamics. The PMG's laboratories of Reactor Engineering as well as of Fluid Flow make it possible to experimentally validate hydrodynamic and process conditions. PMB has participated in several national and EU research projects. Modelling of energy systems with Solid Oxide Fuel Cells has been developed in the SUAV Project of FP7.

The PMG research infrastructure consists of laboratories featuring:

- facilities for numerical modelling of transport processes (6 servers and licenses for CFD code: ANSYS/Fluent, COMSOL both with fuel cell module, and for PSE code: AspenONE);
- a high pressure reactor for multiphase equilibrium measurements;
- ALPHA FT-IR Spectrometer of BRUKER with diamond ATR module, gas and liquid cells;
- a Laser Doppler Anemometer (LDA);
- stirred and static mixers.

The expertise is offered and co-operation sought in:

- numerical modelling by means of Computational Fluid Dynamics (CFD - ANSYS Fluent, COMSOL) and process simulator (PSE – AspenONE & OLI), and Computational Chemistry (CCH - Tinker) of process engineering problems;
- development of an interface enabling joint application of integrated, multiscale modelling by means of the PSE, CFD and CCH packages using the CAPE-OPEN standards;
- balance of plant simulation of process systems including fuel cell systems;
- CFD modelling of hydrodynamics, species transport and current distribution in fuel cells;
- CFD modelling of non-Newtonian fluid flow;
- R&D of reactor processes;
- experimental validation of: thermodynamic equilibrium and hydrodynamic conditions, including turbulent or complex rheology flows.

We have experience in Framework Programmes as a partner.

Keywords describing the expertise offered:
process modelling, CFD, system modelling, fuel cells, plant optimisation

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Solar Thermal Energy Lab (STEL), established in 2012 at Koszalin University of Technology cooperates with business by testing different types of solar thermal collectors. The purpose of our research is to increase thermal efficiency of solar water collectors. The durability and efficiency of solar collectors is tested with high quality testing devices, sensors and special software. The infrastructure includes an array of sensors: first class pyranometers and albedometers, electromagnetic flow meters, anemometers, temperature and pressure sensors, barometric transmitters, temperature and humidity transmitters, and thermal imaging camera. Our laboratory has several measurement stations which allow to test any kind of solar collectors.
The most important part of research infrastructure is a special dedicated hydraulic energy dissipation system which allow to examine, with high accuracy, the performance of water solar heaters according to EN 12975. The infrastructure includes also a low temperature and rain chambers for extreme weather conditions simulations. Also, the solar radiation simulator compatible with ASHRAE 93-77 standard allows to conduct steady state test procedures. Solar collectors are tested also under natural weather conditions on an outside platform.

The expertise offered includes:

- solar collector test according to EN 12975;
- determining the correlation between collector efficiency factor and material content;
- testing selective layers of absorbers;
- determining influence of absorber geometric structure on thermal efficiency;
- determining thermal characteristics of solar collectors with a modified flow path;
- thermal imaging of temperature distribution on absorbers surfaces;
- describing thermal behaviour of solar collectors under dynamically changing weather conditions;
- optimising geometrical structure of flat-plate PT and ST type solar collectors;
- evaluating effects of temperature distribution on absorber efficiency;
- determining transition states of heat pipe solar collectors.

Keywords describing the expertise offered:
solar collector, flat-plate collector, vacuum tube collector, efficiency, irradiance, geometric and physical parameters

Energy

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The unit is involved in the Regional Initiative of Cooperation in Energy Conversion (RICEC) which groups specialists in various disciplines working on the conversion of energy obtained from biomass, application of the energy carriers obtained, and quality assessment of energy processes and their environmental impact. The experts are employed at various faculties of the Koszalin University of Technology (Economic Sciences, Civil Engineering, Environmental Sciences and Geodesy, Mechanical Engineering) and the West Pomeranian University of Technology in Szczecin (Mechanical Engineering and Mechatronics, Environmental Management and Agriculture). RICEC has also members from the business sector (Bio-Tech Polska and Acuo Energy). The RICEC research is primarily focused on renewable energy resources and their application, with a particular emphasis on:

- energy-yielding plant modern cultivation methods;
- innovative methods of biofuels production from energy plants, animal wastes and municipal sewage;
- classical methods of determining the energy value of solid, liquid and gaseous biofuels;
- biofuel conversion into power and heat in distributed and centralized systems with ORC power units.

RICEC uses hi-tech laboratories and other infrastructure operated by its members. The research infrastructure includes, i.a. a Junkers calorimeter for determination of combustion heat and caloric value of gaseous fuels; a viscometer for determination of dynamic viscosity of liquid and gaseous fuels: a Höppler viscometer; a digital Brookfield DV-II+ Pro viscometer; an analogue Brookfield viscometer; a pipe furnace; an exhaust-gas analyser as well as thermal cabinets, a muffle furnace, a calorimeter, and a UV-VIS spectrophotometer.

The expertise offered includes:

- determining economic efficiency of energy plant cultivation, including cultivation and quality assessment of willow kept on light soils;
- testing biomass production for energy purposes;
- assessing of pollutant emissions in biomass combustion;
- exploring possibilities for conversion of sewage sludge from municipal sewage treatment plants to energy;
- determining energetic efficiency of annual plant species biomass;
- determining energetic efficiency of sorghum biomass;
- analysing applicability of annual plant species to biogas production;
- exploring possibilities of applying biotechnologies for production of fuels from biomass;
- examining energy characteristics of solid, liquid and gaseous biofuels;
- exploring possibilities of using small power ORC units fed with low-processed biomass in distributed cogeneration systems of electricity and heat.

Keywords describing the expertise offered:
energy plants, biofuels, bioenergy conversion, distributed cogeneration in ORC systems

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The Solid State Physics Group (SSTG) is one of four groups active at the Institute of Physics within the Faculty of Mechanical Engineering and Mechatronics. SSTG groups 6 faculty members (3 professors and 3 post-docs) and 4 PhD students.

The SSTG research focuses on:

- magnetic characterisation of magnetic nanoparticles and nanocomposites;
- investigations of paramagnetic impurities in diamagnetic matrices;
- the role of magnetic centres in catalysts;
- theory of complex geometrical optics of non-linear media;
- theory of plasma waves.

SSTG cooperates with other faculties of the West Pomeranian University of Technology and with outside scientific groups (Athens University, Demokritos Centre, Zielona Gora University, Gdansk University of Technology). Some of the SSTG members are involved in The European Atomic Energy Community (EURATOM) programme.

The SSTG research infrastructure includes:

- magnetic resonance spectrometer (Bruker E 500) with Oxford helium cryostat (4-300 K);
- X-band electron paramagnetic resonance spectrometer with high-temperature unit (up to 300°C);
- SQUID magnetometer MPMS XL-7 from Quantum Design.

The expertise offered includes:

- magnetic characterization of solid state samples (crystals, powders, nanopowders) in a wide temperature range (2-800 K) and in magnetic fields up to 7 T on SQUID magnetometer;
- registration and interpretation of paramagnetic resonance spectra of rare-earth and iron group ions in solid and liquid samples in a wide range of temperatures (4-600 K);
- registration and interpretation of ferromagnetic resonance spectra of magnetic nanoparticles.

SSTG seeks cooperation in nonlinear dynamics of plasma modes and complex geometrical optics method for beam propagation in non-linear media.

Keywords specifying the offered expertise:
electron paramagnetic resonance, magnetic nanoparticles, magnetic properties of materials, ferromagnetic resonance, plasma waves, complex geometrical optics

Energy

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Transport

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The research group's expertise involves both the specialist knowledge and extensive experience stemming from many years of sea-going work, which ensures that theoretical solutions proposed are testable in and applicable to real-life working conditions. The Department uses a well-equipped Laboratory of Marine Power Plants consisting of a real operating ship's engine and numerous devices that monitor its work. The group members' expertise involves maintenance of ship machinery: machine assembly, repairs of machines and machine elements, and machine diagnostics, with a particular reference to diagnostics of reciprocating machines. The team specialises in:

- non destructive testing of machine elements;
- quality testing of machine assemblies;
- vibration diagnostics of non-reciprocating and reciprocating machines;
- renovation of machine elements.

The expertise offered includes:

- predictive maintenance of major ship's and land-based machines with the purpose of improving their efficiency, profitability, and operational safety by integrating and optimising management and maintenance, real time monitoring, and application of decision support tools to prevent and handle emergency situations in machine operation;
- determination of machine maintenance boundaries;
- monitoring of machine condition and identification of components in need of repair during maintenance operations;
- conservation, inspections and repair technologies;
- identification of symptoms and application of permanent diagnosis sensors for piston-crank mechanism machines;
- monitoring the condition of connecting-rod head bearing, crosshead bearing, connecting-rod big end bearing and main bearings;
- model based determination of axial and torsional vibration;
- measurement and evaluation of mechanical vibration of reciprocating machines.

The research group is interested in cooperating in:

- the design and construction of diagnostic subsystems (sensors, data acquisition & analysis, decision support tools) for individual major machine types;
- identification of machine status;
- assessment of component quality before and after repair;
- evaluation of assembling quality and diagnosis;
- monitoring the state of marine & land power plants;
- determination of machine component tribological wear;
- optimization of machine repairs;
- diagnostics of machine bearings, seals, shafts, and valves.

Keywords referring to the expertise offered:
reciprocating machines, piston-crank, marine propeller shaft, tribological wear, technical diagnostics, vibro-acoustic signals, rotating shaft vibration, shaft journal centre, torsional & axial vibrations

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The Department of Automotive Engineering (DAE) groups experts in engineering sciences who specialise in construction and operation of machines for construction and operation of motor vehicles and road transport, and who conduct research on:

- improving the efficiency of engines through a variety of charging systems (dynamic, combined, sequential) and reducing load losses through the piston-ring-cylinder system;
- applicability of plant-based fuels (first and second generation bio-fuels) for power automotive engines;
- pre-treatment of catalyst coated injectors;
- vehicle life cycle analysis;
- combustion of conventional and unconventional fuels in oxygen and hydrogen.

DAE has been involved in nationally funded and international research projects.

The DAE research infrastructure a well-equipped laboratory featuring:

- two modern dyno test benches for testing internal combustion engines;
- research equipment for fuel systems;
- modern equipment to measure emissions;
- diagnostic equipment and tools.

The expertise offered includes:

- developing technically innovative solutions for motor vehicles servicing, durability testing of trucks and truck engines (STAR);
- research on engine efficiency and emission of toxic exhaust components;
- knowledge gained from using plant-based fuels and their mixtures with diesel oil;
- operational testing and evaluation of air filters for military vehicles and material modelling;
- energy modelling and environmental modelling of the vehicle life cycle.

Keywords describing the expertise offered:
motor vehicles, internal combustion engines, motor vehicles operation, vehicle LCA, energy and environmental aspects of road transport

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The Department of Logistics and Transport Economics (DLTE) groups specialists working primarily on:

- innovative transportation techniques and technologies (all transport modes);
- innovative design solutions (handling equipment, transport vehicles and loading units);
- alternative environmentally friendly engines;
- transport and storage (coolers, freezers) of processed and unprocessed foods;
- integrated transport cold chains (containers or bulk);
- modern solutions in passenger ships and boats (sea, inland and river-sea shipping);
- implementation of Intelligent Transport Systems (ITS);
- safety of transport vehicles.

The DLTE scientists focus on the concept of seagoing, inland and river-sea ships also boats used for different purposes and applications (including commercial fishing, waterborne recreation and tourism). DLTE has been involved in international and national projects dealing with development of innovative, environmentally friendly transport solutions. DLTE cooperates with businesses in the transport and manufacturing sectors, including design offices, seaports, food carriers, vehicles manufacturers, and maritime corporations. DLTE has well equipped modern computer laboratories with software appropriate to solving transportation problems including interoperability of different transport modes and co-operation multi-mode transport systems.

The expertise offered includes:

- determination of technical and operational conditions for lifting and handling equipment;
  - assessment of technical objects and developing their models;
  - supporting of freight documentation and logistics process;
- developing functional and spatial solutions (in logistics centres, seaports, container terminal, etc.);
- research in conceptual design of innovative multipurpose ships, motorized barges, inland and coastal boats, as well as other means of transportation;
  - analyses of technical and operational parameters of various transport vehicles;
  - development of safe food transport chains and fishing fleet modernization;
  - development of concepts for comprehensive enhancement of tourism industry;
  - application of alternative environmentally friendly engines in water transport.

Keywords specifying the offered expertise:

sea, inland and river-sea shipping, innovative transportation techniques and technologies, chilled and frozen cargo transportation, multipurpose transport vehicles, environmentally friendly engines

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Department of Transport Systems and Policy (DTSP) deals with wide issues of transportation, freight forwarding and logistics across modes of transport (land, sea, air, intermodal) in:

- Transport policy;
- Transport economy – road, railway, waterborne, intermodal, passenger transport;
- Technology of transport;
- International transport chains;
- Organization of forwarding and transport;
- Transport and business logistics (inventory and warehouse management, manufacturing, JIT);
- Optimisation and modelling of logistics and transport chains.

The DTSP staff has participated in national and international research projects and workshops as well as in the activities of international institutions and organizations, and has provided expertise and consultancy services for companies and institutions. The staff members have professional experience in business (transport, trade and manufacturing companies).
DTSP collaborates with universities, R&D institutes, businesses and institutions in Poland and abroad.

The expertise offered includes:

- research in effectiveness in transport and logistics;
- projects involving transport and its effects on socio-economic development;
- solving problems of integration in transport chain, transport technologies, optimisation, and process modelling.

DTSP seeks collaboration in:

- Transport policy (local, regional, national, European);
- City logistics and transport (concept of city transport functioning, transportation problems in agglomerations);
- Innovation in transport and logistics (transport and information technologies);
- Development of modelling and decision-making tools (models of logistics chains, transportation systems);
- Intermodal transport and transport chains.

We have experience in Framework Programmes as a partner.

Keywords specifying the offered expertise:
passenger transport, freight transport, logistics, supply chain, economical effectiveness, optimisation, modelling, transport policy, sustainable development, external transport costs, transport technology, transport chains, transport corridors

Transport

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The NAVDEC research group of the Faculty of Navigation consists of 16 researchers and experts representing different fields: navigation, geodesy, computer sciences, automation and control, IT, ICT.

The group includes 3 professors, 6 Ph.D.'s, 3 assistants, and 4 experts. Six of the group members are officer patent-holders, including 3 master mariners. The research infrastructure used by the group includes more than 20 specialised simulators and laboratories such as ECDIS (Electronic Chart Display and Information System), GIS (Geographic Information System), Full-Mission Simulator, ARPA (Automatic Radar Plotting Aids) and 4 computer laboratories. Important infrastructure components are research and training ships owned by the Maritime University of Szczecin, particularly the MV Nawigator XXI. The group's research achievements include building a prototype NAVDEC navigational decision support system, the world's first navigational tool to perform information functions and those typical of decision support systems. Its innovative functionalities, significantly extending the performance of devices generally carried by ships, have been a subject of patent applications filed at home and internationally; the latter involve a patent application filed with the European Patent Office for "A method and system of navigational decision support in the process of safe vessel navigation". Application of the system with new functionalities will ensure raising the navigational safety to a higher level and thus reduce the marine accident risk. **This in turn will result in the following benefits:**

- social, due to lower personnel injury rate and reduced loss of life on board ships;
- material, due to reduced cargo losses and fewer damaged or sunk ships;
- environmental, due to a better protection of the marine environment and prevention of ecological disasters that might occur as a result of collisions of ships carrying dangerous goods.

The expertise offered includes:

- analysis and assessment of navigational situations based on simulations performed using real data and modern computer technologies;
- navigation-related decision support in collision situations via a shipboard decision support system installed on the navigational bridge of merchant vessels (sea-going and inland shipping), leisure boats (e.g. sailing ships, motor yachts), and as a component of land-based vessel traffic services systems (VTS, VTMS, VTMIS, RIS);
- analysis and assessment of marine accidents at sea and on inland waterways via a system intended for experts working for maritime courts;
- marine officer training courses in Collision Regulations via application of specialised modules of navigational simulators (e.g. ship-handling, ECDIS);
- design and construction of computer systems supporting decision making processes and actions taken by navigators on board ships and in land-based centres;

The key areas include:

- automatic navigational data acquisition and distribution;
- analysis of navigational information and generation of solutions to collision situations accounting for the Collision Regulations and marine good practice;
- communication, co-operation and co-ordination of actions with other ships and land-based centres responsible for vessel traffic management (VTS and others);
- interaction with a navigator supervising the system.

Keywords describing the expertise offered:

ICT, water transport, safety of navigation, decision support systems, artificial intelligence, COLREGs, collision avoidance

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HYDROGEO is a Research and Development group consisting of specialists in various areas, including navigation, geodesy, hydrography and computer science, which results in a wide scope of the group's activities. These focuse mainly on:

Hydrography

- bathymetry: complex data processing, from acquisition to ENC;
- 2D and 3D modelling of bottom and underwater objects;
- sonar scanning and inspection of underwater structures;
- ROV-supported underwater surveys and inspection.

GIS

- GIS planning, implementation and management, including feasibility studies;
- 2D and 3D modelling;
- spatial analysis;
- laser scanning.

Navigational systems

- production of Inland Electronic Navigational Charts (ENC) and port ENC;
- inland ECDIS;
- navigational data integration;
- navigational analysis;
- target tracking.

Traffic monitoring systems at sea and in inland waters

- Vessel Traffic Systems sensors and system planning;
- River Information Systems;
- Radar systems.

The research infrastructure includes an inland boat with a variety of hydrographical and navigational equipment, such as multibeam and singlebeam echosounders, sonars, ROV, radar, AIS, InlandECDIS, autopilot. The data processing infrastructure includes computer laboratories with specialised GIS and photogrammetric software for spatial (hydrographic and land survey-acquired) data processing. Important infrastructure is also land survey equipment including a laser scanner and RTK receivers.

The expertise offered, stemming from various research projects, includes:

- problem solving in radar navigation, GIS, spatial planning, spatial analysis and hydrography. Recent examples of expertise implementation involve developing a concept for the Polish RIS system; development of the first Polish Inland ENCs; planning, design and development of GIS for seaport security via a system based on precise static and dynamic geospatial information which exceeds traditional CCTV-based monitoring system and involves GIS 2D, 3D and 4D features; advanced processing of radar signals and navigational data integration;
- land and hydrographic surveys with processing dedicated for any solution, and advanced GIS analysis;
- appropriate hardware and software infrastructure.

Transport

Keywords describing the expertise offered:

hydrography, GIS, River Information Services, spatial analysis, navigation, Vessel Traffic Systems

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LNG Transport Technology and Maritime Risk Analysis Centre groups experts providing services in:

- tanker and terminal operations risk analysis;
- Liquid Cargo Handling Simulator-based training of marine industry and sea-going personnel in liquid cargo handling;
- oil spill effects and response procedures analysis;
- marine operational risk assessment and analysis.

The group is also involved in:

- development of tanker cargo operations training and safety procedures;
- introduction of LNG marine dual-fuel diesel engines;
- essential support for LNG as implementation of dual-fuel bunkering infrastructure.

The group's research capacity is being expanded by acquisition of new infrastructure for comprehensive risk analysis.
When fully operational, the infrastructure will consist of:

- 3D technical modelling tools with materials database (CAD/CAM/CAE);
- Finished Element Method-based (implicit and explicit Nastran Solvers) structural analysis tools;
- statistical tools for Reliability, Availability and Maintainability (RAM) analysis;
- tools for examination and risk assessment of potential incidents from the initial release to far-field dispersion, including modelling of pool spreading and evaporation, and flammable and toxic effects resulting from industrial hazards;
- tools for ship traffic analysis;
- tools for analysis of ships' accidents and incidents (case study approach);
- tools for analysis of shipping routes.

The expertise offered and co-operation areas sought include:

- liquid cargo handling (training, process analysis, safety procedures);
- oil spill research (oil spill modelling, SAR action planning, coast pollution probability assessment, oil spill combat methods);
- LNG Dual-Fuel (bunkering, efficiency);
- risk analysis;
- GIS-based analysis;
- AIS and ships' traffic analysis.

Keywords describing the expertise offered:
LNG, LCHS, oil spill, risk analysis, Dual-Fuel, FEM, tankers, traffic analysis, ships' routes safety analysis, restricted water area analysis, ships' accidents and incidents, case study

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Socio-economic Sciences

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The Department of Econometrics and Statistics (DES) conducts research associated with application of quantitative methods in economics. The key issues are:

- effectiveness of management processes in the enterprise;
- econometric and statistical methods in the analysis, diagnosis and prognosis of economic phenomena;
- operational research;
- gender studies in economics;
- real estate management (management, brokerage, valuation).

The DES staff consists of 7 professors and 20 Ph.D.s who carry out their research supported by the University as well as by national and international research project. For 30 years, DES has been active in organising conferences in the areas of interest; for 15 years, DES has conducted postgraduate studies in real estate management.

The expertise offered includes:

- various forms of market research;
- business valuation;
- real estate valuation;
- analyses, diagnoses and prognoses in economics;
- analyses, diagnoses and prognoses related to gender issues.

Keywords specifying the offered expertise:
quantitative methods, econometrics, statistics, business valuation, real estate valuation, gender study, operational research

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The Department of Socio-Economic Policy and European Regional Studies (DSEPERS) pursues research in economics related to both traditional problems as well as new and current topics that are tackled as they arise and as knowledge progresses. The research, stemming from scientific interests of individual scientists, is underpinned by needs and expectations of regional and national economic policies. The major areas of interest include:

- the role of the state in economy;
- social policy;
- quality of life;
- sustainable development on the regional and local level;
- local and regional developments in social activity stimulation and labour market;
- identification and analysis of socio-economic factors influencing the development, innovation and competitiveness of regions and local communities, with a particular reference to rural areas;
- corporate social responsibility (CSR);
- the use of EU funds;
- environmental policy, awareness, and education;
- the role of local governments in the development of regions and local communities;
- environmental management and economics;
- region-scale water management;
- economic cooperation in the Baltic Sea region;
- economic cooperation in border region;
- multifunctional development of rural areas.

The expertise offered includes:

- development of strategic documents pertaining to local development;
- working out sustainable development strategy documents;
- research on labour market, including discrimination against employees;
- research on quality of life;
- implementation of sustainable development;
- development of strategies for Local Action Groups;
- research related to entrepreneurship in problem areas e.g. groups threatened by social exclusion and already excluded;
- CSR as well as on pertaining to development of social economy and social capital;
- development of training programs in environmental education and sustainable development.

Keywords describing the expertise offered:
sustainable development, strategic documents, CSR, social economy

Socio-economic Sciences

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The Bioservice Innovative Centre for Analysis and Implementation gathers an interdisciplinary group of specialists providing support services to entrepreneurs and scientists and focused on R&D and bioeconomic applications. The Bioservice facilitates and provides:

- transfer of scientific knowledge to economy;
- access to the most recent scientific knowledge and information on bioeconomy sectors and to information on businesses' needs technological solutions;
- contacts between scientists and entrepreneurs;
- support with respect to analyses of effectiveness of innovative investment and its commercialisation potential.

The Bioservice has:

- an experienced staff conducting long-term research on economic and organizational issues with respect to broadly defined bioeconomy and innovation, transfer of knowledge and technology;
- staff knowledgeable in innovative management of R&D systems in scientific units and in innovation enhancement;
- experts in substantive, technical, economic and financial assessment of innovative projects.

The expertise offered includes:

- collection and processing of information about the supply of and demand for technological developments in bioeconomy;
- staff training for innovative enterprises in the bioeconomy sector;
- transfer of knowledge in bioeconomy between scientists and businesses and knowledge commercialisation;
- assessment of economic effectiveness of investments, product and process solutions in bioeconomy;
- assessment of the potential and methods of commercialising innovation;
- professional opinion and consultancy on food economy and agribusiness;
- access to accommodation facilities and IT infrastructure for research projects.

The Bioservice seeks cooperation in:

- market research;
- analysis of market determinants for new products and services;
- examination of buyer's expectations in relation to new product groups and their prices;
- determination of economic effectiveness of new product groups;
- assessment of potential for commercialisation of new solutions;
- assessment of effectiveness and risk in entrepreneurship;
- analysis of cluster relationships within bioeconomy;
- analysis of competitiveness of economic entities;
- analysis of development potential of Polish food industry and other components of agribusiness.

Keywords describing the expertise offered:

transfer and commercialisation of knowledge, bioeconomy, science-industry co-operation, innovations, effectiveness, risk management

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The Department of Economics (DE) groups 10 scientists, including 3 senior academic staff members and 5 Ph.D.s working on technological partnerships of economic entities, science-industry relationships, determinants of innovativeness in economy, transfer of knowledge and commercialisation of technology, challenges of knowledge-based economy, problems of sustainable economic development, economic aspects of economic decision-making, risk management, importance of human and social capital and technology for economic growth and development, the role of integrated IT systems in evolution of modern organisation management, and human resources management.

The DE scientists prepare professional opinions with respect to:

- implementation of integrated IT ERP-class systems;
- effectiveness of acquired EU funds;
- assessment of development strategies of cities and municipalities;
- cluster relationships and strategic alliances;
- functioning of large agribusiness enterprises and broadly defined bioeconomy;
- development potential of Polish food industry;
- economic and financial assessment in economic and financial analysis of projects;
- substantive and technical assessment in direct investment support for the SME sector.

The expertise offered includes:

- research and analytical services with respect to functional projects for implementation of IT ERP-class systems, effectiveness of acquired EU funds, formulation and revision of development programmes concerning social capital, examination of forms and results of co-operation between science sector institutions and enterprises, analysis of the effectiveness of strategic alliances, developing studies on potential technology transfer between R&D sector institutions and industry, development and implementation of periodic staff evaluation system, and analysis of training needs in business;
- evaluation of science-industry relationships, effectiveness, strategic alliances, transfer and commercialisation of technology;
- economic, financial, substantive and technical analyses with regard to innovations, SME development and competitiveness, and regional development strategies.

Keywords specifying the offered expertise:
economics, knowledge-based economy, technology transfer, science-business co-operation, IT systems, agribusiness

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The Department of Health Economics (DHE) groups specialists working on:

- market mechanisms in healthcare;
- healthcare systems performance;
- public health;
- healthcare organization performance;
- healthcare services marketing;
- healthcare quality;
- patient consumption patterns and behaviours;
- patient-provider relationships.

DHE is also interested in problems of the service sector, public management, and relationship marketing.
DHE has been active in organizing international conferences on Health Economics (4 series of the Baltic Health Forum), cooperation with businesses from healthcare sector, developing scientific projects financed by the National Science Center in Poland, and conducting qualitative and quantitative studies on healthcare, also in international settings.
DHE is involved in many international and national projects and cooperates with various academic institutions in Poland and abroad.

DHE offers expertise and seeks cooperation in:

- conducting qualitative and quantitative studies in international scientific networks;
- preparing consumer (patient) profiles based on primary and secondary data;
- developing indicators with which to measure performance of healthcare organizations and systems;
- conducting international comparative studies on public health, patient behaviour and healthcare organization performance;
- researching marketing activities of healthcare organizations;
- managing patient-provider relationships in healthcare settings;
- managing other relationships (payer-provider, doctor-organization) in the healthcare sector.

Keywords describing the expertise offered:
healthcare economics, healthcare management, performance measurement, patient behavior, relationship management

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The Personal and Behavioural Finance Centre (CFOB) groups experts specialising in social research across all areas of personal finances.

CFOB's research is primarily focused on:

- financial decisions of households;
- financial planning of households;
- household budgeting;
- personal finance management and its rationality and effectiveness;
- behavioural economy and finances;
- insolvency of natural persons;
- social and financial exclusion;
- poverty as effect of personal finance (mis)management;
- personal and public health;
- quantitative analysis in personal finances.

In 2014, CFOB will acquire modern laboratories in the Science Inter-Lab Centre.

The expertise offered is associated with cooperation sought in:

- long-term research on personal and behavioural finances;
- development of programmes and tools with which to teach personal and behavioural finances at different levels as well as educational actions (courses, training, seminars);
- popularising personal finance knowledge through e.g. websites, articles in scientific journals and popular science magazines, conferences, seminars, courses;
- first, second, and third level university education (bachelor's, master's and doctoral theses) and postdoctoral research in personal and behavioural finances.

Keywords describing the expertise offered:
personal finance, behavioural finance, households, socio-economics

Socio-economic Sciences

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Architecture

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The Department of Theory and History of Architecture and Monument Conservation (DHAMC) groups specialists working primarily on:

- innovative thinking in adaptation and conservation of the build-up heritage;
- revitalization and modernization of historic cities;
- analyses and survey of historic architecture and urban complexes with modern means of presentation (CAD drawings, virtual 3D modelling);
- architectural and urban design in historic context (infills, reconstructions, renovations);
- transformation of post-industrial sites, focused on waterfront areas and the use of renewable energy sources.

DHAMC focuses mainly on planning and programming in architecture and investments in historic context, planning of public spaces in historic environments, adaptation and modernization of historic buildings and structures, analyses and re-use of historic sites (with a special focus on fortifications), planning of waterfront areas in cities, planning of post-industrial areas transformation, planning of constructions with renewable energy sources, historical research, strengthening of endangered buildings.
DTHAMC employs 10 specialists in monument conservation and architectural design, and co-operates with local and outside specialists. The DTHAMC knowledge base enhances a variety of tasks related to built-up environments, materials, techniques, arts and crafts, surveys of buildings and their components made of stone, timber, and bricks.
The DTHAMC research infrastructure includes CAD-laboratories, modern survey equipment, and appropriate software.

The expertise offered includes:

- research on history of architecture and urban planning;
- application of advanced contemporary methods of building survey;
- technical advice and consulting on historic buildings and their components;
- programming, new and adaptive planning in architectural design;
- co-ordination of investment processes in built-up areas;
- revitalization of worn-out districts and complexes.

Keywords specifying the offered expertise:
modernization, planning, architecture, urban planning, monument conservation, building survey, post-industrial planning, historical research

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The Cyber Urban Centre (CUC) groups scientists interested in application of computational techniques in urban design, spatial planning and architecture. In view of the extremely dynamic progress and development in 3D modelling, visualization of urban landscape and GIS, geo-information technology is developed which, within the next decades will lead to the availability of 3D city models on country-wide and supranational scales. The 3D-city-models might be a future tool for complex urban analysis of built-up environments, important for urban planning & design. The CUC mission is to expand scientific activities and to create an interdisciplinary cooperation network within the research area of 3D Advanced Urban Analysis Systems. The CUC potential derives from the traditions, experience and strengths of the West Pomeranian University of Technology in Szczecin as an important Polish centre with a multidisciplinary structure and significant experience in managing academic and intersectoral cooperation and partnerships, evidences by numerous national and European research programs (including the 7th Framework Program).

The CUC founders: Professor Waldemar Marzęcki, Drs Klara Czyńska, Paweł Rubinowicz and Adam Zwoliński have scientific and professional competences in architecture, urban design, digital simulations for spatial impact of tall buildings location, analyses of public spaces and qualitative parametric valuation of urban structures. CUC members are experienced in cooperating in national (about 6 projects implemented successfully in 2003-2013) and European research programs. Currently, CUC leads a project (2TaLL), to be carried out in 2013-2015, with support from the Polish-Norwegian Research Programme. The CUC team has already completed pioneer implementations of 3D analyses for several cities in Poland. The methods developed were applied to professional planning studies based on contracts with local governments and contributed to the development of their strategies or master plans.

The expertise offered coincides with areas in which scientific and intersectoral cooperation is sought at the European and global levels.

Specifically, the CUC expertise covers:

- information science and engineering: urban engineering, architecture, computational engineering, computer aided design, smart cities and related aspects of computer sciences incl. numerical analysis, simulation & optimization, graphics & image analysis;
- environment and geosciences: urbanization and urban planning, spatial and regional planning, geographical information systems, environment and sustainability, mobility and transportation, and others;
- selected aspects of other disciplines: economics sciences (urban and regional economics), social sciences and humanities (cultural heritage), mathematics (geometry, scientific computing, algorithms and complexity);

and involves:

- competence in the field of theory and practice of urban design and architecture;
- competence in application of 3D city models in urban and spatial planning;
- new methods of advanced urban analysis and related unique software solutions;
- as well as specialist research areas (ongoing CUC research topics):
- computer simulations of spatial impacts of tall buildings;
- geometrical parameterization of public spaces in cities;
- numerical and algorithmic interpretation of urban fabric;
- cities complexity and related fractal dimension analysis.

Keywords specifying the offered expertise:
advanced urban analysis, spatial planning, urban design, architecture, 3D city models, urban computation, computer simulation, interactive 3D city visualization, public spaces, sustainable development, protection of historical panoramas, cultural heritage

Architecture

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Design and layout
Regional Centre for Innovation and Technology Transfer
West Pomeranian University of Technology, Szczecin

Publisher/editor
Artist & Painter – Zenon Pecko

Pictures:
Shutterstock

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Support for this publication was provided by the Polish Ministry of Science and Higher Education

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ISBN 978-83-7518-628-4