University of Warsaw
Biological and Chemical
Research Centre

UNIVERSITY
OF WARSAW

SCIENCE FOR BUSINESS AND ENVIRONMENT

University of Warsaw
Biological and Chemical Research Centre

CNBCh UW

"Can you determine the content of heavy metals in tomatoes? "

"I would like to optimize the industrial synthesis process of my product. Are you able to do it for me? "

"I have a problem with cyanobacteria in my water tanks. Can you do anything about it? "

Both I and my colleagues from the Faculty of Biology and Chemistry have frequently heard such or similar questions asked by individuals as well as by employees of large industrial companies. We were contacted by those who have been looking for solutions to their often complex problems. Unfortunately, we could not always help – this was not due to a lack of competence or knowledge, on the contrary, the University of Warsaw employs outstanding and experienced specialists. This was due to institutional limitations, lack of experience in signing contracts with businesses, as well as lack of time and laboratory resources, which we mainly used to carry out scientific research and educate students.

The conditions changed in 2013, when we opened a new investment – Biological and Chemical Research Centre of the University of Warsaw – a result of the implementation of the CENT 3 project co-financed from the funds of the OP IE (Operational Programme Innovative Economy).

"We have received the funds for the construction of this complex from the Innovative Economy. Thus, the part of the research that will be conducted here will be most of all programmes focused on cooperation with industry and on cooperation with business and will have to learn the so-called transfer of technology to the outside world."

Rector Professor Katarzyna Chałasińska-Macukow
excerpt from the statement during the cornerstone laying ceremony
of the CNBCh UW Building at UW

on 30 March 2011

The new unit of the University of Warsaw is an interdisciplinary research platform with a mission to cooperate with the business environment and to transfer knowledge to the economy. Thanks to the new laboratory space (over 21 thousand m^2), the purchased equipment (over 500 devices, largely unique on a global scale) and the involvement of both administration employees, scientists and the collaborating employees of the CNBCh University Operators Corps (high-class specialists, dedicated to solving commercial issues), we are able to respond to the problems we face and engage in commercialization work, without losing our scientific identity.

The Centre was established, planned and is run by scientists, employees of the Faculty of Biology and the Faculty of Chemistry. We went through all stages, at the dream stage we created a vision of CNBCh UW, then we chose forward-looking research areas, and as a result we designed a list of the necessary laboratory equipment, which is currently used by our specialists. It is worth stressing that at each of those stages we were guided by the idea of solving commercial problems, problems that are most often untypical, complex and interdisciplinary, the solutions of which require the synergy of many talents and cooperation of scientists – specialists in various fields.

Science practiced at CNBCh UW is not only a desire to solve new riddles of the universe, it is primarily Science for business and environment.

Professor Ewa Bulska
DIRECTOR OF CNBCh UW

University of Warsaw
Biological and Chemical
Research Centre

"We would like Biological and Chemical Research Centre to be, above all, a platform for cooperation between various entities, not only universities. It will be a place to accommodate all who bring the challenging ideas in the biological, chemical or related fields.'"

Professor Marcin Pałys
Rector of the University of Warsaw, March 2013

99
partner institutions

350
researchers

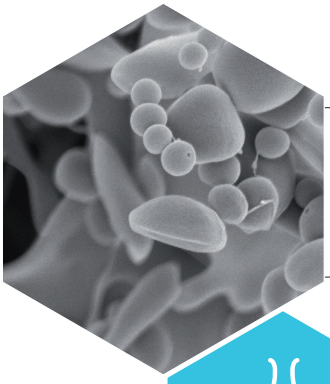
46
research teams

3
accredited laboratories

over
500
research devices

over
21 000
square meters

146
research projects



fuel and energy

food and farming

public sector

medicine and pharmacy

chemical industry

environmental protection

incubator space

laboratory sector

Biological and Chemical Research Centre of the University of Warsaw cooperates with research institutions in Poland and abroad, public sector entities, as well as partners from business. The Centre's offer is addressed to enterprises from many sectors, including laboratory, environmental protection, chemical, agriculture and food, fuel and energy, medical and pharmaceutical.

We cooperate and provide services in the following areas:

- advance investigation of chemical and biological substances regarding their structure, content and properties (including measurements with accordance to ISO/IEC 17025);
- establishing modern, efficient processes of organic synthesis;
- environmental expertise, including i.a.: mycological expertise, monitoring of water quality and biological diversity of the environment, vegetation inventory, creating maps and plans of environmental systems;
- simulation of protein molecular dynamics, designing new drugs, testing their bio-distribution and metabolism by isotopic and optic imaging techniques;
- designing and establishing new detectors, bio-detectors and electrode materials,
  as well as performing precise electrochemical measurements;
- establishing advance materials, designing a novel energy sources and methods of its storage (accumulators and batteries, fuel cells) and new methods of electro-trash recycling;
- testing the relationship between the biopolymer structure and its macroscopic properties, using physiochemically modified proteins as bionanomaterials;
- testing the physiochemical phenomena occurring at the borders of phases, testing the processes of catalysis and establishing unique catalyzers of chemical processes;
- radiochemical synthesis, including the enzymatic synthesis of aromatic and aliphatic amino acids and biogenic amines tagged with the hydrogen isotopes;
- research on phylogenesis, evolution, biogeography and taxonomy of organisms and designing methods of molecular identification;
- providing incubational space for companies carrying out projects from the border between biology and chemistry;
- sharing the power of the computing cluster;
- renting conference and seminar rooms with full technical facilities;
- carrying out research and development projects funded by national and EU funds.

Dear Readers!

it is my great pleasure to present this publication as a result of months of work carried out by the team of the CNBCh UW Development Office, an office created with the aim of facilitating cooperation between scientists and industry.

University of Warsaw, Biological and Chemical Research Centre is a place which creates opportunities for all activities related with commercialization of the results of scientific activities. Our Center accommodate outstanding scientists, giving them the excellent opportunities to work in laboratories equipped with the highest quality measuring equipment. It is also impossible not to mention the Operators Corps, a group of specialized employees who focus exclusively on commercial tasks - from typical analytical measurements to solving complex research problems.

Responsibility for the efficient connection between the world of science and the world of business was given to the Development Office, an administrative unit of CNBCh UW.

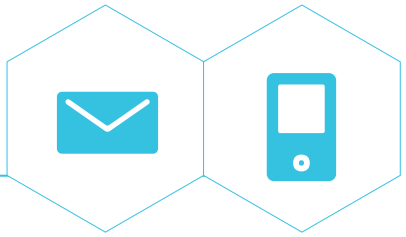
What does CNBCh UW offer?

- Research work aimed at solving specific problems or optimizing currently used technology.
- Applying for joint research and development projects financed from external sources, both national and international.
- Routine and non-routine analytical measurements, also in regulatory areas. Since 2014, we have held ***Accreditation Certificate No. AB 1525*** confirming the competence of our laboratories to work in accordance with PN-EN ISO/IEC 17025.
- Scientific expertises and consultations

How to cooperate with us?

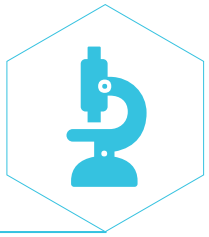
It is straightforward - please visit us on site at CNBCh UW to discusse over coffe your problems

You can also contact us:
wspolpraca@cnbc.uw.edu.pl
or call us:
+ 48 22 55 26 605 lub +48 22 55 26 711
and tell us about your idea or problem.



Our team will try to find the suitable scientists who will be able to take a comprehensive look at the issue and propose the optimal solution.

Then we will arrange a joint meeting where we can discuss the technical details of the project and evaluate the financial issues, sign a cooperation agreement and confidentiality agreement.



The Office deals with all administrative issues on behalf of the University of Warsaw and actively participates in the preparation of project applications for funding research work from external sources, such as: NCBiR, PARP, etc.

Bruce Dickinson used to say that "business is not about having customers, it is about having fans". I hope that thanks to the Office's activity you will become a fan of CNBCh UW and the entire University of Warsaw and will join an increasing number of companies and organizations cooperating with us.

I welcome you to CNBCh UW,
Eliza Kurek, Ph.D.
Head of Research and Development Office

The CNBCh UW consists of 46 research teams gathered around Leaders – excellent scientists, implementing ambitious scientific and development projects in the fields of biology and chemistry.

INDEX OF NAMES

LABORATORY OF BIONANOSTRUCTURES

TEAM LEADER

Professor Renata Bilewicz

Professor Renata Bilewicz has been a full professor at the Faculty of Chemistry of the University of Warsaw since 2002. She is an author of more than 200 papers in the field of bio- and supramolecular electrochemistry, as well as interphase surfaces and molecular layers. She cooperates with Prof. E. Landau at the University of Zurich and R. Mezzenga (ETH) in the framework of the SNSF Synergy project and the Polish-Swiss PSPB cooperation programme (2010-2018) in the field of lipid liquid crystals.

She is a member of the Bioelectrochem Society Council, she chaired the International Soc. of Electrochemistry Bioelectrochemical Section, was the secretary of PTChem (Polish Chemical Society, 1994-97) and the chairman of the Warsaw Branch of PTChem. She was awarded the Third Prize of the Polish Academy of Sciences and the Medal of the National Education Commission.

The group's research interests include the construction and properties of supramolecular and biomolecular systems, biocatalysis and molecular recognition at the phase boundaries. Research is being conducted into molecular self-organisation on solid and liquid substrates, properties of Langmuir-Blodgett mono- and multi-layers.

The group's experimental and computational work is also directed towards multi-purpose drug carriers (e.g. for anthracyclines) based on cyclic oligosaccharides (cyclodextrines), gold nanoparticles and polymer nano- and microstructures. The new carriers are constructed on the basis of two main objectives: to minimize the side effects of anticancer therapy on healthy body tissues and to maximize the amount of drug delivered to the affected cells.

In order to achieve the above objectives we focus not only on the modification of the carriers with agents targeting the specified cancer cells, but also we use the effect of EPR (increased permeability and retention effect) and the difference in pH between cancer and healthy tissue. Physicochemical research of newly synthesized drug carriers is aimed at determining the kinetics of binding and the mechanisms of drug release, e.g. anthracyclines from the carrier and the influence of the obtained carriers on the interaction of drugs with DNA and biological membranes.

The Laboratory of Bionanostructures also conducts studies on the interactions of biologically active substances with model cell membranes prepared by the Langmuir method. Our studies conducted within the frame of our projects are focused on the determination of the efficiency of transport of selected drugs (e.g. anthracyclines, statins, perfluorinated compounds) and the mechanisms of their interactions with biological membranes and their models.

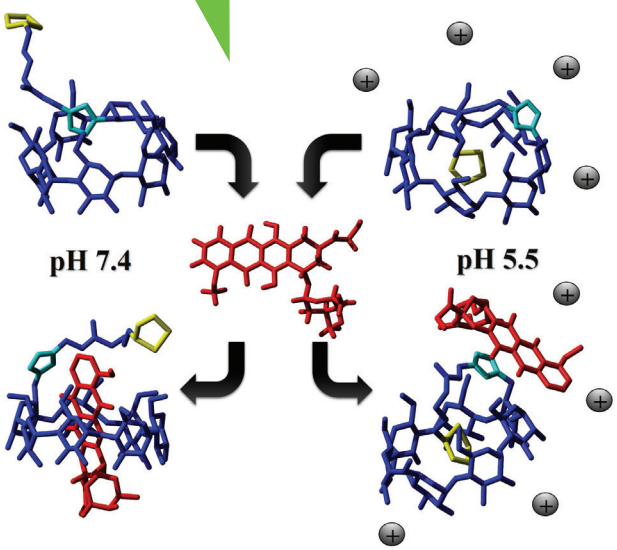
The team's achievements

Description of the charge transport for electrodes modified with molecular layers, enzymes, and/or metallic and carbon nanoparticles.

Proposing lipid cubic phases as carrier material for immobilization of drugs, soluble redox proteins and selected membrane proteins.

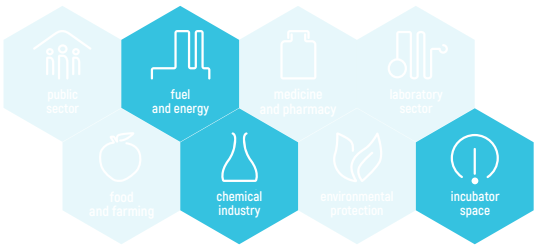
Description of interactions in the model lipid layers.

Design, synthesis and physicochemical investigation of new aromatic cyclodextrin derivatives (β-CD) as selective pH- sensitive drug carriers reducing cardiotoxic effects of anthracycline drugs.



OFFER

- UV-Vis tests at a strictly defined temperature (10-60°C range – 0.1°C accuracy) including biological samples (DNA)
- Determination of stability constants of complexes and dependence of stability constants on temperature. Physicochemical characteristics of thermo-sensitive materials.
- Electrochemical measurements – studies on redox properties, determination of diffusion coefficients, stability constants of complexes
- Surface tension measurements, surface properties of surfactants, lipids and other amphiphilic compounds
- Synthesis and characterization of the size of metallic and lipid nanoparticles
- Modification of electrodes with catalytic active layers, determination of catalytic activity



ANALYTICAL CHEMISTRY
EXPERT CENTRE

TEAM LEADER

Professor
Ewa Bulska

Professor Ewa Bulska is an employee of the Faculty of Chemistry at the University of Warsaw. Since 2005 she has been the head of the Chemical Metrology Centre at the University of Warsaw, and since 2013 she has been the director of Biological and Chemical Research Center at the University of Warsaw. She completed postdoc at the Max Plank Institute (Dortmund, Germany), then as a visiting scientist she worked at the University of Umea (Sweden), at the University of Technology In Darmstadt (Germany), and at the Institute for Reference Measurements and Materials (IRMM) at the European Commission Joint Research Centre (JRC) – Geel, Belgium.

She is a member of the Committee of Analytical Chemistry of the Polish Academy of Sciences (KChA PAN) and the chairperson of the Atomic Spectrometry Working Group of the KChA PAN. She is also a member the of the Polish Chemical Society and a member of the Boards of the Maria Skłodowska-Curie Society, POLLAB Polish Testing Laboratories Club, and the international organisation Eurolab.

Prof. E. Bulska has over 190 scientific publication in international journals, close to 40 publications in Polish journals, five chapters in monographs in English and seven chapters in Polish monographs. She is also the author of the handbook "Chemical Metrology", published by the MALAMUT, which English translation is edited by Springer (2018).

She was recognised for her scientific achievements, and she was awarded the Bunsen-Kirchoff Prize from the German Chemical Society for her outstanding contribution in atomic spectroscopy (2004). In 2006 she was obtained W. Świętosławski Award for outstanding scientific achievements in the field applied analytical chemistry than in 2012 she obtained Wiktor Kemula Medal, awarded by the Polish Chemical Society, for outstanding contribution to analytical chemistry. In 2015 she was recognised by IUPAC as an IUPAC'2015 Distinguished Women in Chemistry. She also obtained J. Fijałkowski Award for her contribution to the development of spectrometry, awarded by KChA PAN (2016). She received the Medal of 200th Anniversary of the University of Warsaw, awarded by the Rector of the University of Warsaw and the Medal on the occasion of the Medal of the 100th Anniversary of the Nencki Institute (Nencki Institute of Experimental Biology of Polish Academy of Sciences)

The team of Professor Ewa Bulska conducts research on the metabolism of various elements with particular emphasis on selenium, which is essential for the proper functioning of living organisms.

As part of interdisciplinary cooperation with medical doctors, the research on the impact of biologically active compounds on the selected diseases, e.g. cancer, Alzheimer's or Wilson's disease, are conducting.

The proteomic studies aimed at the identification and quantification of selected proteins in biological objects become the critical topic of scientific research.

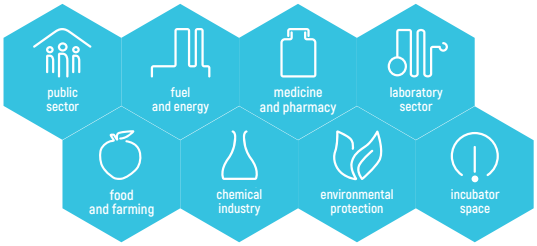
Moreover, the production and certification of matrix reference materials for environmental and forensic research has been conducted over the last years.

The results of our research are used in application projects.

In recognition of the effects of scientific activity, which are recognized worldwide and constitute a significant contribution to the development of science and technology, Professor Ewa Bulska was awarded the title of "IUPAC 2015 Distinguished Women in Chemistry" by the International Union of Pure and Applied Chemistry (IUPAC) in 2015. IUPAC is an international organisation, founded in London in 1919 (based in Zurich), which sets standards for chemical nomenclature and terminology (e.g. names, symbols and physical quantities) used by chemists all over the world.

OFFER

- Determination of elemental composition of objects of different origins (ICP MS, LA ICP MS, ASA).
- Speciation analysis of elements, a study of metabolic processes (HPLC ICP MS, UHPLC ESI-QQQ MS/MS, UHPLC-E-SI-(Orbitrap) MS/MS).
- Identification and quantification of organic substances in clinical, pharmaceutical, cosmetics and industrial samples (UHPLC-ESI-QQQ-MS/MS, UHPLC-ESI-QTOF MS/MS).
- Quantitative analysis of volatile organic substances in objects of various origin (GC QTOF MS/MS).
- Proteomic studies of biological objects (UHPLC-ESI-QQQ-MS/MS, UHPLC-ESI-(Orbitrap)- MS/MS
- Study of physicochemical processes over the surface and sub-surface domain of solids (LA ICP MS).
- Determination of isotopic ratios of elements in biological and geological samples (MC ICP MS).
- Isotopic dilution (ID) for very accurate determinations of the content of selected elements, among others in the certification of chemical reference materials.



ULTRA HIGH-PERFORMANCE LIQUID CHROMATOGRAPH HPLC-2D 1260/1290 COMBINED WITH A HIGH-RESOLUTION MASS SPECTROMETER WITH AN ESI-ORBITRAP-MS/MS ORBITRAP ANALYSER

MAIN FEATURES

- Speciation analysis of selected metals in plant, pharmaceutical and food samples.
- Qualitative and quantitative analysis of biologically active compounds, active substances and contaminants in the samples of different origins.
- Registration of high-resolution mass spectra of components of liquid samples and masses of substances after chromatographic separation.

SUPRAMOLECULAR CHEMISTRY LABORATORY

TEAM LEADER

Michał Chmielewski, Ph.D.

Michał J. Chmielewski received his doctorate from the Institute of Organic Chemistry of the Polish Academy of Sciences (summa cum laude, supervisor: Prof. Janusz Jurczak), after which he completed three postdoctoral fellowships: at the University of Wrocław (with Prof. L. Latos-Grażyński), at the University of Oxford (with Prof. P. D. Beer) and at Université Louis Pasteur in Strasbourg (with Prof. J.-M. Lehn, Nobel Laureate).

He is the author of more than 30 scientific publications, mainly in prestigious journals, which together were cited more than 1000 times (h-index 15).

Winner of, among others, the Marie Curie fellowship, the "Homing" programme of the Foundation for Polish Science and the Ministry of Science and Higher Education scholarship for outstanding young scholars. In 2011, he was elected a member of the Polish Young Academy of the Polish Academy of Sciences. Member of the Committee of Chemistry of the Polish Academy of Sciences

Supramolecular chemistry, or 'chemistry beyond molecule', is an interdisciplinary field of research at the interface between chemistry, biology and physics. Supramolecular chemistry investigates phenomena in which major role is played by weak intermolecular interactions and, as such, is a basis of biology on the one side and nanotechnology on the other.

Our major specialty is organic synthesis, which we apply in two major areas: 1) for the construction of molecules that selectively bind anions and 2) for the preparation of Metal-Organic Frameworks (MOFs), i.e. crystals with large and regularly distributed empty spaces in their structures (nanoscopic cavities, channels, etc.).

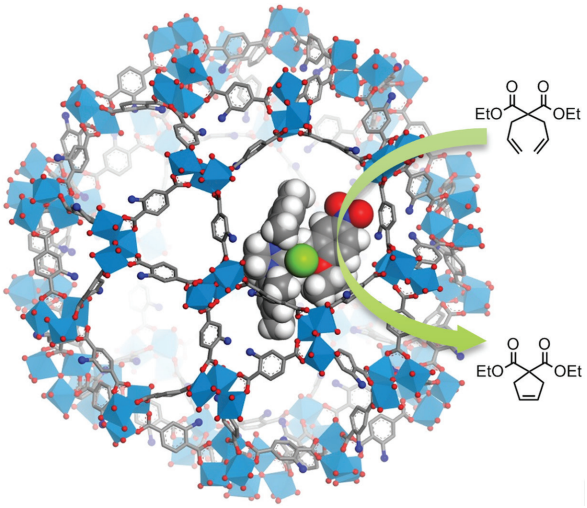
Anions play important roles in many biological and chemical processes, in medicine and in environmental protection. Development of molecules capable of their effective binding, detection and transport through biological membranes has become one of the major current trends within supramolecular chemistry.

In the SChL, we design and synthesize receptors which selectively bind anions in aqueous environment, detect them (e.g. by fluorescence) or transport them through biological membranes. The receptors thus obtained can be used in practice, e.g. as sensors for monitoring the concentration of fertilizers in soil and water, or as leading molecules in the development of new therapies for diseases, e.g. cystic fibrosis.

MOFs, on the other hand, are a new, fascinating class of materials that have been extensively studied in leading scientific and industrial laboratories all over the world. They are crystalline and porous coordination polymers in which inorganic metal clusters are connected by organic ligands into a three-dimensional framework.

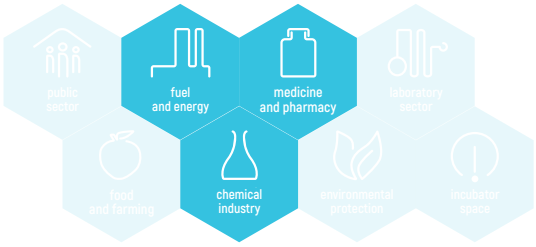
They are used in many different areas, such as gas storage and separation (especially hydrogen and methane), sensor technology, drug delivery, electronics, catalysis, etc. In the LChS we are mainly concerned with immobilization of catalysts inside the nanoscopic cavities in the crystalline structure of MOFs. MOFs modified in this way serve as nanoreactors in which chemical reactions take place in confined spaces of molecular dimensions. This makes the catalysts more selective and easier to separate and recycle.

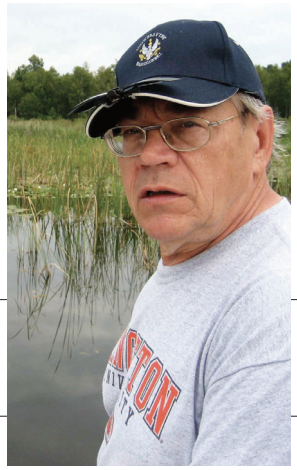
One of our latest achievements is the development of new, simple methods of immobilization of homogeneous catalysts inside nanoscopic pores in the MOFs crystal structures. Thanks to this, in cooperation with Professor Karol Grela's team, we were the first in the world to show the possibility of using MOFs to catalyse olefin metathesis reaction, important for potential industrial applications. The results were published in prestigious ACS Catalysis (IF=11.384). The method is general and we are currently working on its use for immobilisation of other transition metal catalysts inside MOFs.



OFFER

- Joint participation in R&D projects related to MOFs (Metal-Organic Frameworks) or supramolecular chemistry.
- Measurements and analyses on: automatic gas sorption analyser (Autosorb iQ-MP), HPLC, GC, CombiFlash preparative chromatograph, UV-Vis and fluorescence spectrometers.
- Various instruments for the synthesis and activation of MOFs, such as high pressure autoclaves, ovens with programmable heating, dryer for activation of porous materials with supercritical CO_2, vacuum dryer, polarization microscope, gas and vapor sorption analyzer.
- Non-standard instruments for organic synthesis, such as a microwave reactor, a ball mill for mechanochemical synthesis, a Parr apparatus, multiclaves for high pressure reactions (<200 bar) and others.





LABORATORY FOR THE PROTECTION AND REMEDIATION OF WATERS

TEAM LEADER

Professor Ryszard J. Chróst

Graduate of the Faculty of Biology at the University of Warsaw. A scholarship holder of many foreign scientific and academic institutions, including the Smithsonian Institution (USA), Max-Planck Gesselschaft (Germany), DAAD (Germany), University of: Innsbruck (Austria), Kiel, Konstanz (Germany), Copenhagen (Denmark), Uppsala (Sweden). Visiting professor at Max-Planck Institute for Limnology (Germany) for 4 years and National Museum of Natural History Smithsonian Institution (USA) for 2 years. Co-author and editor of the world's first textbook on the application of biochemical and molecular methods to the ecology of aquatic microorganisms (Aquatic Microbial Ecology - biochemical and molecular approaches, Springer Verlag 1990). Winner of the award of the Minister of Science and Higher Education and the Secretary of Science of the Polish Academy of Sciences for outstanding scientific achievements.

The research issues of the team are related to learning the processes of eutrophication of surface waters, the effects on the functioning of natural waters, the role and intensity of microbiological processes in the gradient of eutrophication of the Great Mazurian Lakes.

The members of the team examine how eutrophication processes stimulate the presence and survival of pathogenic bacteria in natural waters, learn about environmental conditions conducive to the occurrence of toxic cyanobacterial blooms and the role of aqueous bacteria in the decomposition of cyanobacterial toxins.

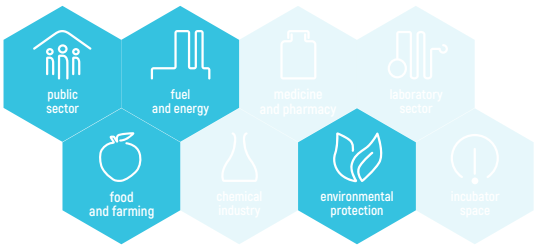
Employees of the Laboratory for Water Protection and Remediation monitor and study the effects of poor water and sewage management and the practice of draining leachate of treated wastewater from the wastewater treatment plants on the functioning and eutrophication of the Great Mazurian Lakes system.

Professor Ryszard Chróst is a co-author and holder of 2 patents: in the field of water reclamation by means of comprehensive microbiological bioremediation and technology for rapid removal of cyanobacterial blooms and detoxification of the aquatic environment with the use of the developed innovative CYANOXIDE preparation. The preparation is widely used for commercial purposes, and its efficacy has been repeatedly demonstrated under environmental conditions.

View of Magistrackie Lake before (up), and 5 days after application (down) of the CYANOXIDE.

OFFER

- Limnological and microbiological monitoring of the quality of natural waters (lakes, ponds)
- Analysis of biogen concentrations (nitrogen, phosphorus, organic carbon) in water
- Sampling of water and bottom sediments for analysis
- Microbiological examination of water samples
- Analysis of cyanobacteria and cyanobacterial toxins
- Aquatic reservoir remediation
- Removal of cyanobacterial blooms with CYANOXIDE
- Environmental consulting and expertise



THE JAN CZOCHRALSKI LABORATORY FOR ADVANCE CRYSTAL ENGINEERING

TEAM LEADER

Professor
Michał K. Cyrański

Professor Michał K. Cyrański is the co-author of over 150 original papers and 14 review papers. The main scientific interests relate to the structural chemistry of small organic systems, including cyclic pi-electronic systems, saccharides, supramolecular chemistry of boronic acids, crystalline engineering, especially in relation to gas and liquid clathrates, X-ray structural analysis, crystallochemistry, substitution effect, molecular modeling (ab initio), structural and energy aspects of the aromatic nature of pi-electronic systems. In 2015, he received an award from the Minister of Science and Higher Education for outstanding scientific achievements leading to the title of professor.

The group's scientific interests are mainly related to the design and physicochemical characteristics of new, water-rich organic systems such as alcohols, amines and other compounds which are liquids at room temperature. Other complex multi-component systems are also analysed. The main research topic is structural chemistry of gas and liquid clathrates and hydrates. One of the most interesting systems we studied was t-butylamine. This system, depending on the stoichiometric ratio between amine and water, forms as many as 7 different types of structures, which is a very unique phenomenon. Their structural analysis has shown that the crystalline structures obtained by successive amine dilutions in water can be considered as frozen degrees of hydration on the way to the infinitely diluted form of hydrate or crystalline ice. Crystals suitable for testing are obtained in our laboratory as a result of in situ IR laser-assisted crystallization. It is a unique method on a global scale, which allows to obtain crystals directly on the diffractometer head.

The basic tools we use are X-ray diffraction on single crystals and on powder material. The first one makes it possible to determine the crystal and molecule structure, the second one is used mainly to develop an optimal method of synthesis taking into account different stoichiometric composition and analysis of phase composition and phase transitions. Crystals that are of interest to us are tested for phase transitions, twinnings and disorder. Apart from structural X-ray analysis, we also use spectroscopic (Raman spectroscopy) and thermal methods using DSC and TGA/DSC to characterise individual phases. In addition to analyses over a wide temperature spectrum, high-pressure tests are also performed.

THEORETICAL ACHIEVEMENT:

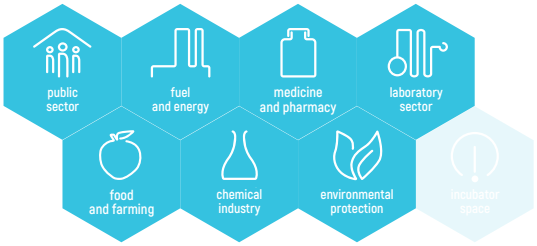
aromaticity parameters defined on the basis of three main criteria: energy, geometric and magnetic do not describe the cyclic pi-electronic delocalisation in an equivalent way, leading to the conclusion that the aromaticity phenomenon is multidimensional.

EXPERIMENTAL ACHIEVEMENT:

we have shown that phenylboronic acids interact with amino acids while retaining the tricoordinating boron atom, which is an alternative mechanism to that described in the literature. We designed and obtained the first monomeric systems of phenylboronic acids in solid form.

OFFER

- X-ray structural analysis on single crystals (XRD) in the temperature range 100-500K.
- X-ray analysis on powder material (PWXRD) in the temperature range 100-500K.
- Calorimetric measurements with DSC in the temperature range -170 to 700°C or TGA/DSC in the temperature range -150 to 1000°C.
- Raman spectroscopy of solids and liquids in the temperature range 100-500K.



ELECTRON DENSITY MODELLING

TEAM LEADER

Paulina Dominiak

Ph.D., D.Sc.

Paulina Dominiak specializes in the development of new methods of X-ray diffraction data analysis, modelling electron density and estimating the energy of intermolecular interactions in protein and nucleic acid complexes and in crystals of organic compounds. She received her PhD in crystallography from Warsaw University and did her postdoctoral research with Prof. P. Coppens at Buffalo University in the United States. In 2013 she obtained a habilitation degree in chemistry. Head of research projects financed by MNiSW, FNP and NCN. Member of the Quantum Crystallography Commission of the International Union of Crystallography. Together with her colleagues she has published many scientific articles and programs in the field of crystallography and chemistry and structural biology. Open to cooperation related to the use of methods developed in her team.

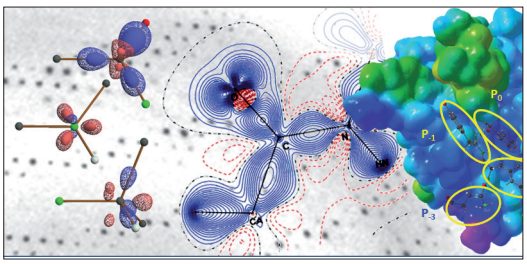
Our primary goal is to develop methods that provide more information from routine X-ray diffraction data. On the one hand, they are intended to improve the quality of geometric data already obtained from this type of measurement and, on the other hand, they are intended to provide access to new types of information, i.e. to electron density and to the energy of interactions. Our intention is that the methods of modelling the electron density and estimating the energy of intermolecular interactions we develop should fill the space between the methods of classical mechanics (force fields) and the methods of quantum mechanics. Our research is mainly based on the UBDB aspherical pseudoatom bank, which we are developing and which enables quick reconstruction of the electron density of organic molecules and biomacromolecules. We are also working on more simplified models of electron density in the context of even faster estimation of the energy of interactions and applications going far beyond crystallography. Very recently we started to adapt our methodologies to analyze electron diffraction data.

The methods we have developed are applied in practice (both in the experiment and in theory) to understand the role of intermolecular interactions in protein and nucleic acid complexes as well as in the crystals of organic compounds. We are focusing in particular on the importance of electrostatic interactions. We are interested in the relationship of intermolecular interactions with the architecture of crystals, the structure of macromolecules or the process of molecular recognition in the context of drug design. The biological systems we are currently studying are HIV protease and IFIT protein complexes with RNA (in cooperation with dr Górna's Structural Biology Team). In the case of organic crystals, we deal with nucleobases. As part of our research, we combine experimentation (monocrystalline X-ray and neutronography, small molecule crystallization, DSC/TGA) with theory (UBDB Bank, force fields, DFT geometry optimization, electron density topological analysis, DFT- SAPT interaction energy, etc.).

OFFER

- Analysis of intermolecular interactions in protein and nucleic acid complexes using various models of electron density
- Experimental determination of electron density of crystals of organic molecules using monocrystalline X-ray diffraction

Our most important achievement is the UBDB aspherical atoms bank, which is constantly being developed and verified, and its applications including structural X-ray, experimental methods of determining electron density, crystal engineering, as well as molecular modelling, drug design and mechanisms of biomolecular recognition. We are also proud of our experimentally determined electron densities of nucleobase crystals and their derivatives and of our new aug-PROmol electron density model.



X-RAY PHOTOELECTRON SPECTROMETER (AXIS SUPRA) INTEGRATED WITH SECONDARY ION MASS SPECTROMETER (TOF.SIMS^5)

MAIN FEATURES

- The set is dedicated to research aimed at identification and analysis of quantitative elemental composition of materials, as well as the type of chemical bonds in which particular elements present on the surface of solid materials (powders, crystals, foils, films) take part. The measuring capability of the unit can be extended by the use of ion etching and angular measurements.

LABORATORY OF MICROSCOPY AND ELECTRON SPECTROSCOPY

TEAM LEADER

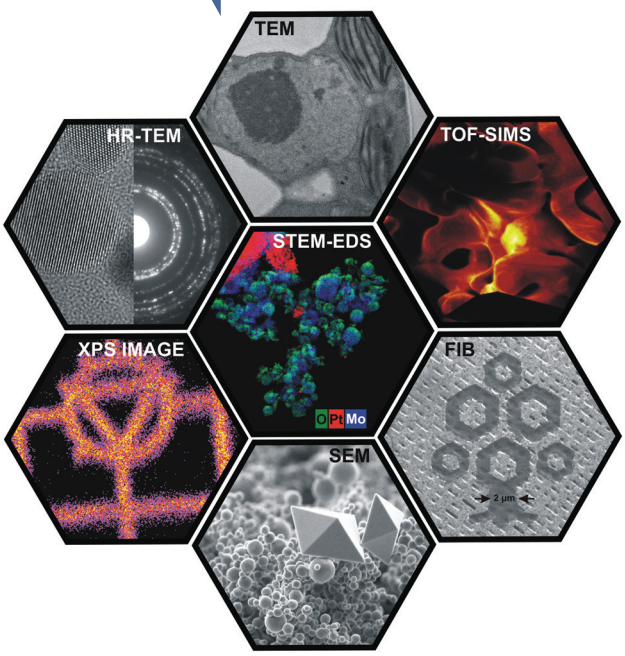
Professor Mikołaj Donten

Professor M. Donten specializes in research concerning the electrodeposition and characterization of tungsten alloys and the synthesis of nanoparticles and conductive polymers composites for catalytic applications For his scientific work he received the MNSiW Award and 6 Rector's Awards. He completed numerous scientific internships (USA, Sweden, Germany) and industrial internships (USA). He cooperated with companies from the AT sector (electroplating processes for the electronics industry). His most important dissertation entitled "Electrodeposition and properties of Ni-W, Fe-W and Fe-Ni-W amorphous alloys. A comparative study" has been published in Electrochim. Acta.

Laboratory of microscopy and electron spectroscopy (LMiSE) deals with the surface and internal structure characterization of many types of materials, both biological and in scope of material engineering. LMiSE provides services and conducts research aimed at determining, among others, the morphology of materials, i.e. shape and distribution of particle size (SEM, TEM), crystalline and porous structure (TEM), distribution of elements in materials (STEM-EDS, SEM-EDS), changes in morphology and chemical composition into the volume of investigated samples (FIB, ISS), and imaging of preparations in 3D (tomography S/TEM) with reconstruction of the obtained images (Inspect 3d, Amira, Avizo). For micro-destructive elemental or density contrast analysis (SEM-FIB) of the sample volume (from 103 to 106 μm^3) with nanometer resolution, in three dimensions, Atlas software is used. LMiSE has the capability to prepare materials using FIB (Focused Ion Beam) for TEM thin lamellas preparation. The laboratory's offer also includes the analysis of qualitative and quantitative composition (TOF-SIMS, XPS, Auger, ISS) of the surface layer of solid materials (crystals, foils, powders, films, vaporized layers). Depending on the depth at which the information regarding elements or ions is to be obtained, the laboratory offers XPS (~10 nm depending on the material), Auger (1-5 nm) or TOF-SIMS (~1 nm) tests. LMiSE also uses the potential of UPS technology to explore the electronic valence band of the surface layer of solids.

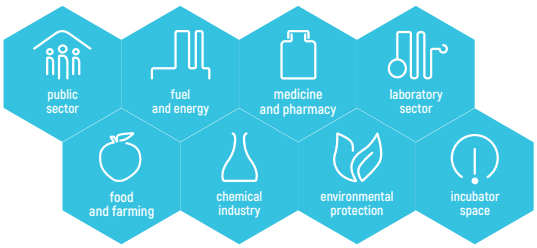
In addition to the research carried out in the framework of providing services to various entities, the research group carries out work on characterization of bioluminescence markers and topological isolators. The team is open to cooperation with domestic and foreign centres, both in terms of using the research potential of their equipment and providing substantive support in the analysis of the results obtained.

Prof. M. Donten provided analytical support to the industrial R&D sector in order to significantly improve the control systems of electroplating processes in the production of microprocessors and storage media. Many of his papers are devoted to the production of materials with exceptional catalytic and mechanical properties, as well as to the analysis of the transport of substances to the surface of electrodes. Since 2004 he has headed the analytical laboratory of the Faculty of Chemistry, and in 2017 he established a research group dealing with the characteristics of functional materials using methods of electron microscopy and spectroscopy.



OFFER

- High resolution transmission electron microscopy (HR-TEM)
- Scanning transmission electron microscopy (STEM) Z- Contrast
- X-ray energy dispersion spectroscopy (EDS) in STEM mode
- Electron diffraction
- S/TEM tomography
- Conventional scanning microscopy SEM with possibility of elemental composition analysis (EDS)
- Cutting/deposition of layers with FIB/GIS, preparation of lamellas for TEM
- Qualitative and quantitative analysis of the chemical composition of solid samples (crystals, foils, powders, thin films, evaporated layers)
- Determination of chemical composition into the volume of solid materials (cross-sections)
- Determination of the type of chemical bonds in which the elements present on the surface are involved



RESEARCH GROUP ON EVOLUTIONARY GEOCHRONOLOGY

TEAM LEADER

Professor
Jerzy Dzik
full member of the Polish Academy of Sciences

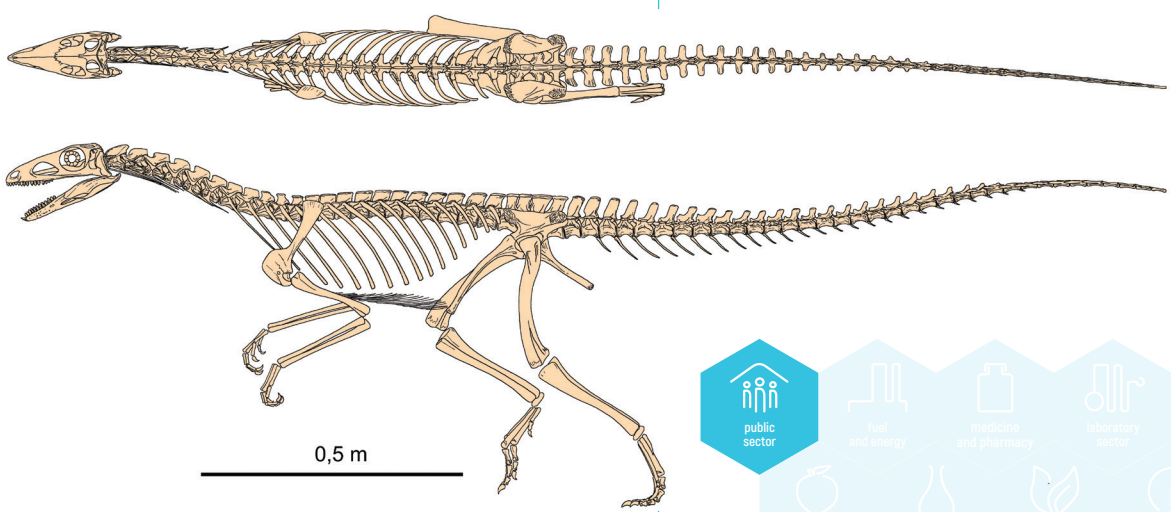
Professor Jerzy Dzik D.Sc. is the author of articles published, among others, in Nature, Geology and Paleobiology, textbooks on palaeobiology, zoology, biology and geology. He completed postdoctoral fellowships in Uppsala, Columbus, Ohio, Tübingen and Southampton. He participated in oceanological research in Antarctica, organized scientific expeditions to Siberia, China, and Kazakhstan, and supervised excavations in Upper Silesia. He lectured in Łódź, Sosnowiec and at the Faculties of Geology and Biology of the University of Warsaw. He has promoted six PhDs and many Masters of Sciences. He is the director of the Institute of Palaeobiology of the Polish Academy of Sciences.

The activities of the Evolutionary Geochronology Research Group cover various aspects of evolution reconstructed on the basis of the fossil record. The model objects of palaeobiological research on evolution are conodonts — extinct chordates similar to small lampreys. Thanks to the clear daily increments of their teeth visible in the scanning electron microscope, it is possible to calibrate their individual development in days and follow its evolution at population level over millions of years. The second area of research, mainly using computer tomography, is the evolution of the skeleton and biogeographical links between Cretaceous dinosaurs in the Gobi Desert and primitive lizards. At the same time, the most ancient animals are being studied in order to reconstruct their anatomy and to determine the links with present-day forms on the basis of materials from Podolia, Siberia and China.

OFFER

- Drying samples for SEM in critical point dryer
- Separation of micro fossils in the Franz electromagnetic separator and heavy liquids (sodium polytungstate)

The best-known research by the Department of Paleobiology of the University of Warsaw concerns the Silesaurus opolensis pra-dinosaur, whose bone remains were found in Krasiejów near Opole in rocks about 230 million years old. It is the most thoroughly studied of the early representatives of the dinosaur evolutionary lineage and its illustrations, or at least references to it, are in most vertebrate palaeontology textbooks and publications on the origins of dinosaurs.



LABORATORY OF BIOPHYSICAL CHEMISTRY

TEAM LEADER

Professor Wojciech Dzwolak

Graduate of the Faculty of Chemistry of the University of Warsaw (1996 - MSc) and the University of Ritsumeikan in Kyoto (2000) - PhD). Author of over 60 papers in the field of biophysics and physical chemistry of proteins (index H=21). Laureate of, among others, the 2008 Faculty III Awards of the Polish Academy of Sciences; leader and participant in a number of national and international research projects.

The research conducted by Wojciech Dzwolak (also in cooperation with leading research hubs in Japan, Germany and the USA) focuses on the broadly understood problem of thermodynamic control of self-organizing non-native biopolymer structures.

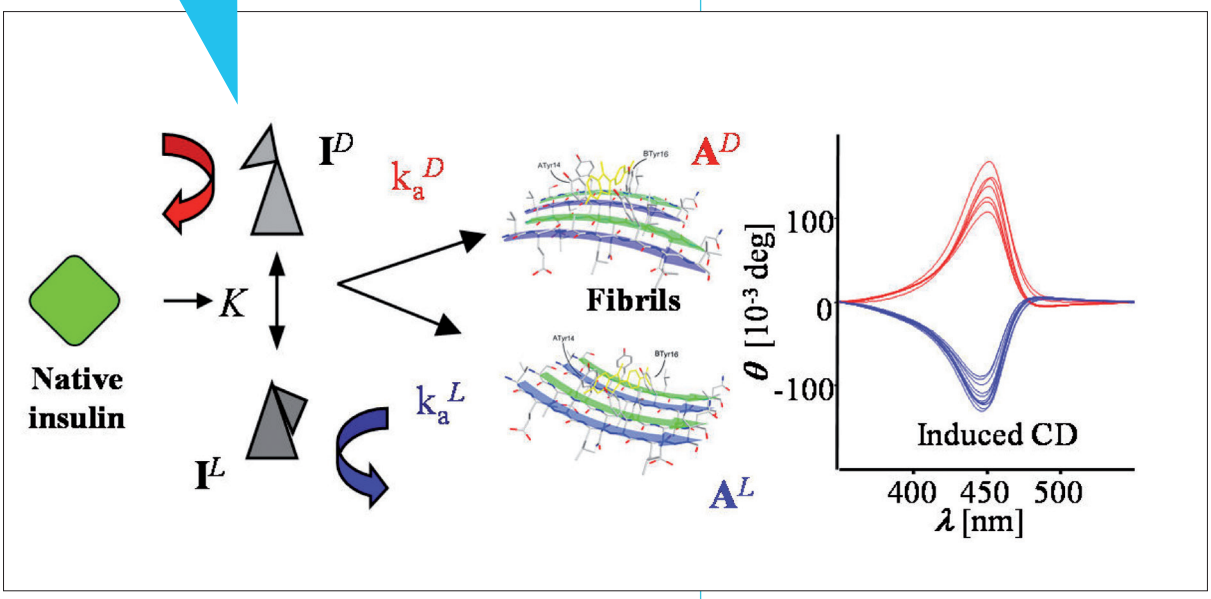
The research conducted in the Laboratory of the Group of Biophysical Chemistry is focused on cross-roads of chemistry, biology and physics, namely:

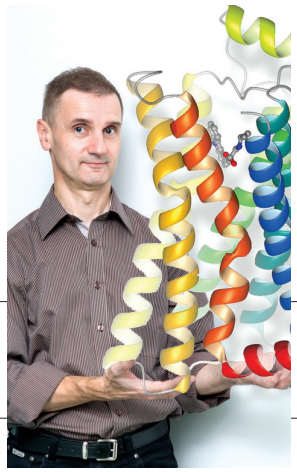
1. biological "soft matter": the relationship between the structure and dynamics of biopolymers (especially proteins) and their macroscopic physicochemical properties, as well as applications of physico-chemically modified proteins as new functional bionanomaterials;
2. physicochemical and molecular basis of conformational diseases, aggregation and amyloidogenesis of proteins; the problem of unequivocal encoding of structural information upon amyloid propagation; exotic beta-card structures;
3. non-Anfinsenian behavior of proteins: the conformation memory effect and the phenomenon of chiral bifurcation as examples of highly far-from-equilibrium processes accompanying misfolding of polypeptides and proteins;
4. Applications of optical spectroscopy (in particular vibrational spectroscopy and electronic circular dichroism) to study structural transitions of biomacromolecules.

OFFER

The discovery of the phenomenon of chiral bifurcation in the aggregation of insulin consisting in stochastic selection of one of the two types of chiral superstructures of insulin amyloid with different chiraloptical properties. This phenomenon is a unique case of symmetry breaking in molecular biophysics. (Dzwolak et al. J. Amer. Chem. Soc. 129 (2007) 7517-7522)

- Studies on thermodynamic stability and amyloidogenic properties of recombinant proteins
- Study of secondary structures of proteins by circular dichroism





BIOMODELING LABORATORY

TEAM LEADER

Professor Sławomir Filipek

Professor Sławomir Filipek conducts scientific activity in the field of molecular modeling and molecular dynamics simulations of biological systems, mainly the membrane proteins and their complexes with small ligands, drugs, as well as with other proteins. His scientific interests also include research on the activation processes of these proteins, in particular G-protein coupled receptors (GPCRs) under the influence of agonist binding, and how the allosteric factors (lipids, ions, etc.) affect the functions of these proteins. Prof. Filipek completed his scientific internship in 2001-2002 in the group of Prof. Palczewski in Seattle USA, just after crystallization of the structure of the first GPCR receptor – rhodopsin – in this laboratory and publishing it in 2000.

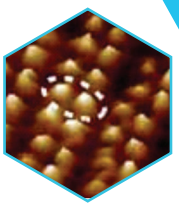
The group studies proteins, especially in the cell membrane environment. This research includes ligand docking and revealing the activation mechanism of GPCRs. This family of receptors includes, among others, adrenergic, dopamine, adenosine, histamine, serotonin, opioid, cannabinoid receptors, and many others. Modelling allows predicting the action of ligands (activate or block the receptor) in order to design selective drugs with desired function.

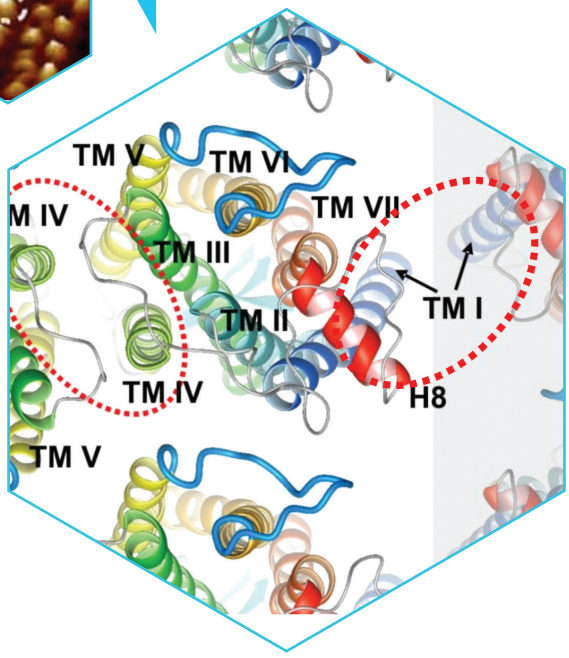
To model GPCRs more effectively, the Biomodeling Laboratory has developed a web service GPCRM (http://gpcrm.biomodellab.eu/) for the homology modelling of these receptors. This service is available for all research groups and allows for obtaining models of GPCR structures in automatic mode for casual user as well as in the manual mode for experienced users. The service is regularly updated upon the availability of new structures of GPCRs in the Protein Data Bank database.

The Biomodeling Laboratory also designs drugs against various molecular targets, including APP cutting proteases producing beta-amyloid, as well as drugs preventing beta-amyloid aggregation and formation of deposits, which are found in the brains of patients with Alzheimer's disease. We also study the interactions of proteins with graphene, carbon nanotubes and other electrode materials for use in bio-sensors.

OFFER

Building a model of rhodopsin oligomer on the basis of AFM (atomic force microscope) images. This model was published together with the results of AFM study in Nature in 2003. The model was experimentally confirmed a few years later by other researchers and was used by many theoretical groups for modeling of GPCR receptor oligomers. GPCRs are responsible in most cell, including neurons, for cell signaling, and therefore about 30-50% of currently available medicines target these receptors.



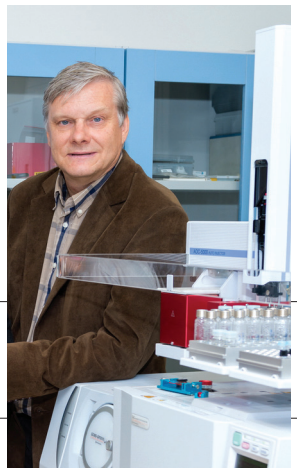


- Advanced modeling of GPCRs (modeling by homology, optimization in cell membrane model).
- Docking of small ligands to orthosteric and allosteric sites of GPCRs.
- Virtual screening of databases of small molecules as potential ligands of GPCRs.
- Molecular dynamics simulations of GPCRs with ligands – study of stability of these systems, optimization of ligand-protein interactions, study of activation processes, influence of allosteric factors.
- Predicting the function of GPCR ligands (agonist/non-agonist).

TWO GLOVE CHAMBER SYSTEM UNILAB 9113 AND UNILAB 9111 WITH KIT FOR DRYING AND DISTILLATION OF SOLVENTS MB SPS-800 UNILAB 1950/780

MAIN FEATURES

- Glove box with solvent drying and oxidation kit, MB-SPS-manual-5 model Unilab 1950/780 operating in argon atmosphere (N6.0). Equipped with a programmable automatic air purification system allowing to achieve H_2O/O_2 contamination level in the interior below 0.1 ppm.
- Working with substances sensitive to moisture or air in a controlled inert gas atmosphere.
- Reactions can be carried out in the temperature range -40 to 150 °C.
- Solvent cleaning system with five independent lines (methylene chloride, toluene, n-hexane, THF and diethyl ether) for solvents containing up to 1 ppm H_2O/O_2. Solvents can be extracted both inside and outside the chamber by means of special valves.



LABORATORY FOR RADIOCHEMISTRY AND ATMOSPHERIC CHEMISTRY

TEAM LEADER

Professor Tomasz Gierczak

Head of the team Professor Tomasz Gierczak is an employee at the Faculty of Chemistry University of Warsaw, where he conducts research in the field of atmospheric chemistry and the determination of trace amounts of organic compounds in environment. He has visited the Chemical Science Division National Oceanic and Atmospheric Administration in Boulder, Colorado, several times. He is the author of over 75 publications published in peer reviewed journals.

The main group's research interest focuses on the analysis of organic compounds by chromatographic methods coupled with mass spectrometry, in particular:

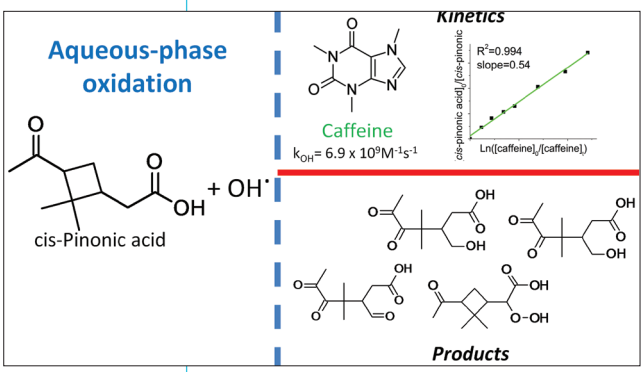
- developing analytical methods for the determination of organic compounds using GC/MS and LC/MS/MS,
- studying chemical processes taking place in the atmosphere, mainly the formation mechanism of secondary organic aerosol (SOA),
- studying degradation processes of natural dyes in historical fabrics and analysis of organic compounds in archeological samples.

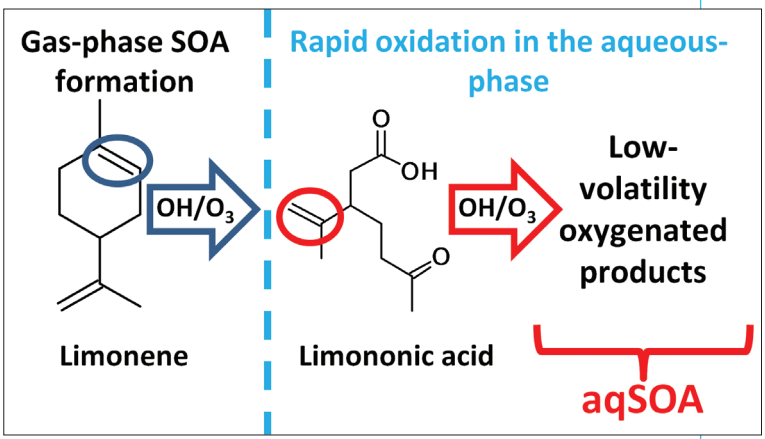
A high-performance liquid chromatography coupled to a tandem mass spectrometry (HPLC/MS/MS) and a capillary gas chromatography equipped with various detectors, e.g. a flame ionization detector (GC/FID) and a mass spectrometer (GC/MS), are used for the determination.HPLC/MS/MS is equipped with atmospheric pressure- operating sources: ESI and APCI and triple quadrupole mass analyser combined with a linear ion trap for MSn regime operation.

OFFER

Construction and use a flow reactor to investigate the mechanism of the reaction of mono- and sesquiterpenes ozone oxidation processes in the gaseous phase leading to the formation of secondary organic aerosols (SOAs). The purpose of the experiments using the flow reactor was to propose a new way of SOA formation by oxidation of the primary products of mono- and sesquiterpene ozonolysis reaction, which takes place in the liquid phase.

Determination of organic compounds by chromatographic methods





STRUCTURAL BIOLOGY GROUP

TEAM LEADER

Maria Górna

Ph.D.

Maria Górna specializes in the study of structure-function relationships of proteins involved in processes important for human physiology or related to disease conditions. She also conducts applied research aimed at drug discovery or proteins engineering for applications in biotechnology and diagnostics. She completed her doctoral studies at the University of Cambridge and a 5-year postdoctoral internship at the Research Centre for Molecular Medicine in Vienna. She led projects financed by NCN, NCRD, FNP, EMBO, MNiSW and EU Horizon 2020. Winner of the EMBO Installation Grant and LIDER programme, two-time winner of scholarships within the framework of Maria Skłodowska-Curie Actions, Board Member of Marie Curie Alumni Association. Open to collaborations on obtaining or analysing structural models of proteins.

The Group studies the structure and function of proteins using structural biology methods such as protein crystallography and small angle X-ray scattering (SAXS), bioinformatics analysis and molecular dynamics simulations, as well as by functional assays both in vitro and in cell culture. The structural models obtained may be the basis for designing drugs or used for diagnosing diseases, or developing new insights for therapeutic strategies. The group employs also various biophysical methods for characterizing protein-ligand interactions, in order to assay protein activity or to aid the drug discovery process.

The group's major research projects focus on human proteins whose structure is poorly understood or proteins which may be attractive targets for medicines. This includes human antiviral effectors, mitochondrial post-transcriptional regulators, deubiquitinases or bacterial proteases. Some of the group's interests include proteins working on RNA, helical repeats, protein engineering and molecular diagnostics. The group also uses structural models of proteins to elucidate the molecular mechanisms underlying selected human diseases or to aid anticancer or antimicrobial drug discovery. Through their findings and inventions, group members would like to help combat cancer, viral and bacterial infections or to treat human inflammatory disorders.

OFFER

Since 2015, Maria Górna received funding to set up her own research group from several prestigious programs: Marie Skłodowska-Curie Individual Fellowship, EMBO Installation grant, LIDER NCBR, NCN Sonata and FNP FIRST TEAM. She is the first MSC-IF laureate in Horizon 2020 at the University of Warsaw and one of the few scientists awarded EMBO-IG in Poland. Among the laureates of the LIDER programme, her project received the highest ranking in the field of life sciences. This support has led to the creation of a strong, international research group carrying out ambitious basic and applied research.

- Protein crystallization: high-throughput screening and crystal optimisation
- Crystallization of membrane proteins: automatic setting of LCP plates together with visualization
- Protein-ligand interaction measurements: microscale thermophoresis, differential scanning fluorimetry (thermofluor assay), isothermal calorimetry, biolayer interferometry
- Measurements of molecular weight and polydispersity of proteins and protein-ligand complexes: SEC-RI-MALS and DLS
- Protein expression in prokaryotic and eukaryotic systems
- Chromatographic purification of proteins
- 2Obtaining and analysis of structural models of proteins – experimental or computational

HERBARIUM

TEAM LEADER

Maja Graniszewska

Ph.D.

Maja Graniszewska is the Head of the Herbarium at the Faculty of Biology at the University of Warsaw. She developed her research technique at the University of Warsaw in the Białowieża Forest while studying the dynamic processes of vegetation. In her doctoral thesis at the Jagiellonian University she focused on plant taxonomy, discovering at the same time the beauty and value of herbariums. She is eager to share her passion for herbaria. She cooperates with museums, non-governmental organizations and universities at organization of classes or exhibitions, as well as with commercial companies on projects related to botany.

The first area of interest of the team are the historical collections of plants, fungi and algae located in the herbarium of the Faculty of Biology of the University of Warsaw. The past of these collections and the biographies of their authors are studied.

Herbarium specimens are identified and historical plant names are analyzed. The studies reveal also how these plants were used both in medicine and in folk cuisine. Folk beliefs and customs related to plants are also being studied in the herbarium. The team takes an interdisciplinary approach to the subject of herbarium studies and cooperates with the conservators-restorers.

The second area of interest is botanical education. The team has tested new ways of sharing the botanical knowledge, mainly through the educational portal www.zycieaklimat.edu.pl which in an optimal way presents digitized plant specimens online.

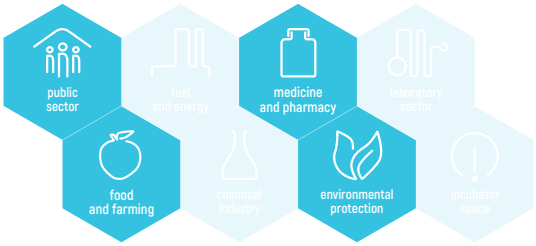
The team takes part in the creation of the electronic key for plant identification. It also promotes participation in field research (available to the general public) proposing different botanical projects.

The third area of interest to the team is evolution of plants. The research is carried out on the example of the genus Euphorbia (spurge). In cooperation with various institutions, genetic tests (ITS, AFLP) of Carpathian spurges group were carried out. A new method of germination and cultivation of selected species is being developed in order to obtain comparable material for subsequent analyses, which will be carried out with the use of other methods.

OFFER

The members of the team started to archive the collections accumulated since the beginning of the University's existence, i.e. since 1818. Among the thousands of herbal materials, unknown and very valuable herbal collections were found. Some of them, such as e.g. herbariums by Michał Federowski, have already been digitised and scientifically developed. As a result, valuable source material was made available (both via the Internet and in the form of printed publications), documenting the use of plants at the end of the 19th century.

- Digitisation of objects up to size A3



HERBARIUM


72
Hypnum vernicosum
Hypnum arcuatum
Hypnum cupressiforme

ORGANOMETALLIC SYNTHESIS LABORATORY

TEAM LEADER

Professor
Karol Grela, F CPSE

Professor Karol Grela deals with issues related to the synthesis of organic compounds, olefin metathesis and organometallic chemistry in general.

He received his Master Engineer's degree at the Faculty of Chemistry of the Warsaw University of Technology, and then his PhD degree at the Institute of Organic Chemistry of the Polish Academy of Sciences. After a doctoral internship with Professor Alois Fürstner at the Max Planck Institute in Mülheim, he returned to Poland, where he defended his habilitation (Institute of Organic Chemistry) in 2003 and was awarded the title of professor in 2008.

He has won numerous awards and his scientific output includes more than 160 publications and 18 patent families. Professor Grela's research results are applied in practice in the industry, and several catalysts developed in Warsaw have been commercialized.

Prof. Grela is a member of the boards of chemical journals publishing houses, a member of many chemical societies, a member of the Team of Experts of the National Science Centre and the Scientific Advisory Board of Polpharma SA, as well as a Scientific Advisor to Apeiron Synthesis SA.

The research conducted by the group concerns the design and synthesis of transition metal complexes and their use in catalytic organic reactions, with particular emphasis on the synthesis of biologically active compounds and pharmaceuticals, as well as on the use of renewable raw materials.

Currently, the group's work focuses primarily on obtaining innovative ruthenium catalysts with unique features:

1. facilitating purification of reaction products from ruthenium complexes residues;
2. with increased stability in relation to air and ethylene;
3. leading to the selective formation of valuable products by cross metathesis reaction and ethenolysis
4. containing functional groups enabling their immobilisation on a solid medium, which enables their reuse, as well as their application in continuous processes (flow);

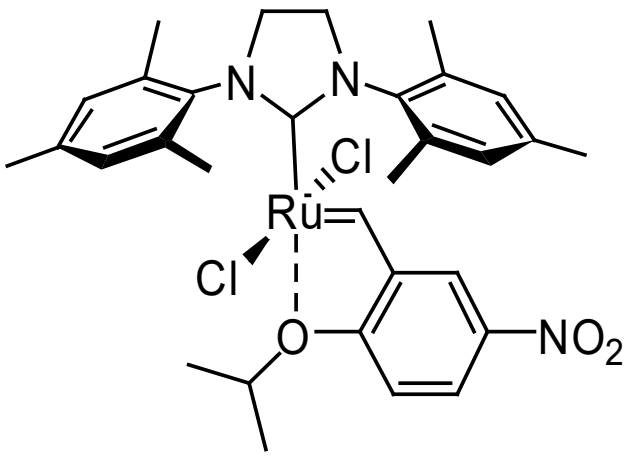
and their use in the synthesis of useful organic products with the use of modern laboratory techniques, such as:

1. conducting reactions in a microwave reactor;
2. use of flow reactors;
3. use of fluorinated aromatic hydrocarbons (FAHs);
4. conducting reactions in the autoclave at elevated pressure.

Prof. Karol Grela is the editor of the book "Olefin Metathesis: Theory and Practice" published by Wiley, which is a compendium of knowledge on the possibilities and limitations of olefin metathesis reactions.

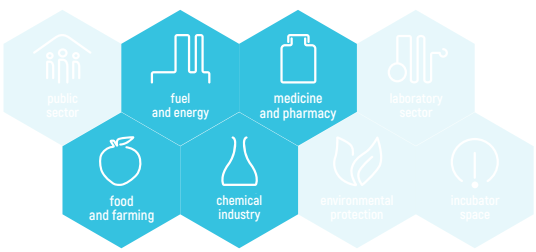
Prof. Grela received the Award of the Foundation for Polish Science in 2014 for the development of new catalysts for olefin metathesis reaction and their application in industrial practice, as well as the Stanisław Kostanecki Medal awarded to members of the Polish Chemical Society for outstanding achievements in organic chemistry.

Prof. Grela invented and developed a method for synthesizing the nitro analog of the Hoveyda-Grubbs catalyst with a broad spectrum of effects in olefin metathesis. This complex is available on the market.



OFFER

- NMR measurements
- Determination of small quantities of water in liquid and solid samples (Karl Fisher titration)
- Preparation of reports on the existing state of knowledge in organic and metal-organic chemistry
- Optimisation of existing synthetic pathways
- Synthesis of model compounds according to provided synthetic procedures
- Synthesis of compound libraries
- Development of new synthesis methods for a given compound
- Development of transition metal complexes with predefined properties



BIOMACROMOLECULE MODELLING

TEAM LEADER

Dominik Gront

Ph.D., D.Sc.

Dominik Gront is the co-author of more than 40 papers cited 560 times in total (H factor 15). He has completed postdoctoral internships at the University of Virginia, Charlottesville and the University of Washington, Seattle. He is one of the Principal Investigators at Rosetta Commons, an organization that develops Rosetta software for protein modelling and design. In 2016, Dominik Gront was awarded the postdoctoral degree of doktor habilitowany

Awards and distinctions:

2008/11 – Marie Curie Scholarship

2012 – Scholarship of the Minister of Science and Higher Education for Outstanding Young Scientists

2017 – individual award of the Second Degree of the Rector of the University of Warsaw for teaching achievements

The Group develops innovative methods for studying the structure and dynamics of biomacromolecules. We use both molecular modelling methods and bioinformatic approaches. The main research tasks concern the design and implementation of a multiscale protocol for modelling proteins and their complexes. Such a protocol consists of two or three models definedat different resolution levels, combined into a single algorithm. In our work, we develop both coarse-grained models, in which a group of atoms (e.g. an amino acid residue) is replaced by a single interaction centre (e.g. the SURPASS model), as well as all-atom models. Among the latter are the algorithms specifically designed to exploit graphics cards (GPUs) for computing. Development of novel modelling methods consists mainly in deriving new mean-field (statistical) potentials and devising new simulation algorithms.

We are also developing new bioinformatical methods, such as three-dimensional protein threading for accurate sequence-to-structure alignment. We develop software for analysing sequences and structures of proteins and nucleic acids. We also use template-based modelling methods (comparative modelling).

We implement the theoretical methods developed in software packages: BioShell and Rosetta, which are made available free of charge to the wide academic communit

Rosetta and BioShell software, used in many scientific laboratories around the world.

BioShell

Rosetta Commons

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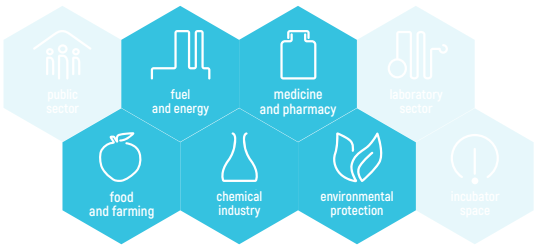
- Comparative modelling of protein structures
- Rational design of new protein structures
- Mutations in-silico, increasing protein stability, change of enzymatic activity
- Analysis of biomacromolecule sequences and structures
- Docking ligands (drugs, substrates, etc.) to protein receptors
- Development of software for biomacromolecule modeling



GREENMET LAB

TEAM LEADER

Wojciech Hyk

Ph.D., D.Sc.

A scholarship holder of the Foundation for Polish Science and of the NSF-NATO program at the City University of New York. Author of scientific publications on practical and theoretical issues of transport to micro and nanoelectrodes, metrology and quality control of measurements, characteristics of new gel materials and innovative methods of recovering non-ferrous metals from e- scrap.

Co-author of 3 patent applications and a textbook "Statistical analysis in a laboratory" (Wydawnictwo Naukowe PWN, Warsaw, 2016).

Author of the e-stat system for conducting statistical calculations via the Internet (www.e-stat.pl), whose exceptional usefulness in everyday laboratory practice is confirmed by the constantly growing number of users in Poland. List of active users of e- stat services from outside the academic community (including faculties of many public and private universities in Poland) includes about 150 laboratories performing important social and economic functions in the country.

Cooperation with the industrial sector (Greenmet Technology, TOMAD, Tesla Recycling, CBJ KGHM) and with research and development units (IPC PAS).

In 2013, we initiated the implementation of a project called "Greenmet" under Measure 1.4 of the Innovative Economy Operational Programme. As part of this project, we carry out research on the selective recovery of non- ferrous and precious metals from technological waste and electronic scrap, with innovative (in terms of technology, environment and economy) chemical and electrochemical methods (at macro, micro and nano-scale). The project has a strictly application character in the area of environmental protection. The innovativeness of the proposed solutions is expressed by their selective action on a selected metal (targeted recycling), simplicity of operation and environmental friendliness (lack of toxic by-products, ease of regeneration of key reagents). The quantitative indicators of the developed methods confirm their belonging to the area of eco-friendly technological solutions (green chemistry). In order to achieve the assumed indicators, we are also making efforts to design and synthesize new materials.

New inorganic compounds and gel materials (e.g. ferro-gel materials, i.e. gel materials sensitive to changes in the external magnetic field) are designed and characterized for selective extraction or accumulation of selected metals. The development of fast and reliable methods for multi-element chemical analyses is also an important part of the research work. Analytical procedure schemes built are subject to full validation. The process of quality control of the obtained measurement results (including validation of the method, estimation of measurement uncertainty, comparative activities) is carried out with the use of our in-house e-stat service.

The Greenmet project

Internet service e-stat “Statistical analysis online in the laboratory”

www.e-stat.pl

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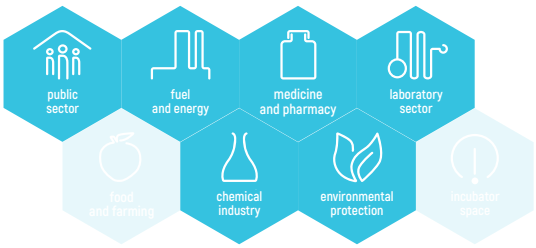
- Electroanalytical measurements using macroelectrodes (industrial samples), microelectrodes (environmental samples) and nanoelectrodes (extremely small volume samples including intracellular measurements)
- Fabrication of nanoelectrodes
- Chemical analysis of solid samples by X-ray fluorescence technique (XRF).
- Determination of metals in solid samples with measurement capability directly at the place where the material is stored, without the sample having to be transported to the laboratory.
- Consultations/workshops on validation of test methods and construction of budgets for uncertainties of methods
- Developing schemes of validation / estimating the uncertainty of analytical, physico-chemical and physical methods in research laboratories
- Analysis of large data sets using chemometric techniques



NEW MATERIALS ELECTROCHEMISTRY

TEAM LEADER

Rafał Jurczakowski

Ph.D., D.Sc.

Rafał Jurczakowski is a co-author of 48 scientific papers published in prestigious international journals in the field of chemistry and electrochemistry, co-authored 12 national and 8 international patent applications. Five international patents have already been granted in the countries of the European Union, the USA and Japan.

Selected awards for scientific and didactic activities:

- Scientific Award of the Second Degree of the Council of the Faculty of Chemistry at the University of Warsaw (2016)
- Teaching Excellence Award of the Second Degree of the Council of the Faculty of Chemistry at the University of Warsaw
- Antoni Grabowski Scientific Award of the Council of the Faculty of Chemistry, University of Warsaw for outstanding scientific achievements, which contributed to the increase of prestige of Polish science in the world (2007)
- Distinction of the doctoral thesis, University of Warsaw, Faculty of Chemistry (2003)

Impedance spectroscopy (IS) is a relatively new and powerful method allowing for the investigation of electrical properties of matter and relaxation phenomena with time constants ranging over nearly ten orders of magnitude. Impedance measurements can be performed with high accuracy in automatized and remotely controlled systems, however, a broader application of IS in material science and electrochemistry (EIS) is still impeded by the limited number of comprehensive explanations and theories describing different physicochemical systems. In general, impedance technique requires also physicochemical information on a given system acquired by using other complementary methods.

The research group is interested in the innovative use of the electrochemical methods in chemical science. Our work is related to the theoretical development and use of impedance spectroscopy for kinetic and thermodynamic studies of (electro)chemical systems under both supported and unsupported (solid state) conditions. Special emphasis has been placed on the hydrogen sorption phenomena and electrode reactions involving hydrogen adsorption and absorption. Impedance spectroscopy has been also used for the characterization of nonmetallic hydrogen stores by monitoring dielectric properties in solid state during hydrogen release from hydrogen-rich ammonia borane and its alkali metal derivatives.

Research Interests:

- Electrochemical Energy Conversion and Storage Technologies
- Hydrogen sorption
- Heterogeneous Catalysis
- Photoelectrocatalysis
- Nanostructured Materials

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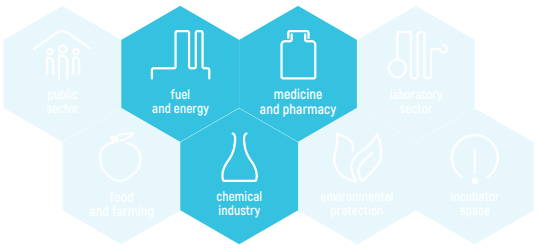
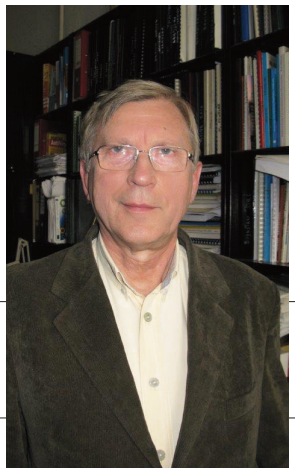
- Development of a theoretical model of impedance of electrocatalytic systems.
- Development of methods for the synthesis of nanomaterials
- Studies on stability and segregation of nanostructured bimetallic alloys.
- Development and characterisation of a stable catalytic system accelerating the hydrogen absorption process.
- Demonstration of ionic conductivity of amidoborates of alkaline metals and innovative application of IS to monitor hydrogen desorption processes from non- metallic hydrogen storage.

- Classical transient and impedance spectroscopy electrochemical measurements
- Impedance tests, conductivity and charge transport dynamics measurements
- Interpretation of impedance spectra
- Research and synthesis of materials for applications in electrocatalysis and heterogeneous catalysis
- Synthesis and testing of sorption materials
- Synthesis of nanomaterials for applications in heterogeneous catalysis





ENVIRONMENTALLY SENSITIVE POLYMER MATERIALS AND COMPOSITES

TEAM LEADER

Marcin Karbarz

Ph.D., D.Sc.

Professor Zbigniew Stojek

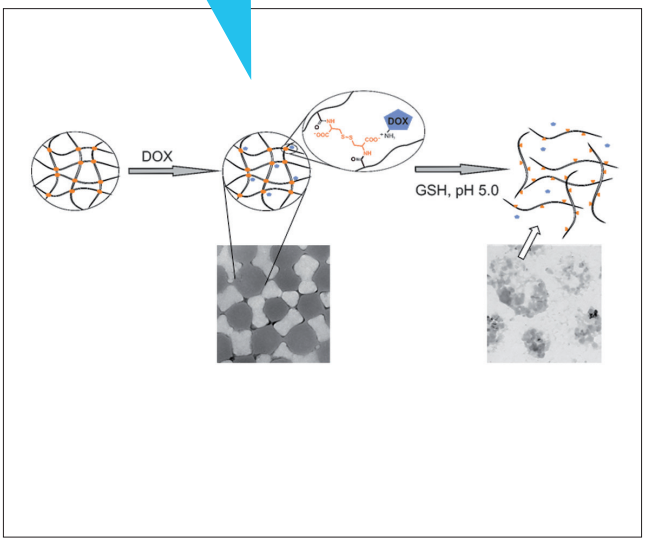
Marcin Karbarz: co-author of over forty publications in magazines from the so-called Philadelphia list, mainly concerning various aspects related to environmentally sensitive "intelligent" polymeric materials; was the manager of four grants from the National Science Centre and the Ministry of Science and Higher Education; received a number of awards and distinctions for scientific activity, including the A. Grabowski Award for achievements in the field of materials chemistry (UW, 2015) and the Rector's award for achievements affecting the development and prestige of the University of Warsaw (2015); cooperates with teams from Germany and Cyprus and several centres in the country (NIL, PW and PG).

The main trend of research carried out in the group is to obtain new, structurally advanced and multifunctional gel polymeric materials. The research aims at modifying the polymer gels to give them the desired properties. We want them to undergo the phenomenon of volume phase transition under given conditions, to degrade as external conditions change appropriately and in the presence of specific substances, to become sensitive to new environmental factors, to self- assemble and be capable of self-healing. We use them also as drug carriers enabling controlled release of active substances.

It is important to obtain these gels in micro- and nano-size in order to reduce phase transition times as much as possible and to achieve a rapid balance with the environment, and to use them in biology and medicine. Thin gel membranes will also be produced on conductive surfaces (electrode surfaces) as the starting substrates for the construction of advanced bioanalytical sensors.

Degradable micro and nano-gels cross-linked with cystin-derivative as systems for delivery and controlled release of active substances in cancer cells.

We obtained a series of micro and nano-gels stable in physiological conditions, which accumulated doxorubicin (DOX, an anti-neoplastic drug) with high efficiency. Only in cancer cells did a significant amount of doxorubicin escape from the gels. The carriers were then degraded. Cytotoxicity studies have shown that DOX transported in gel carrier had a significantly stronger effect on cancer cells.



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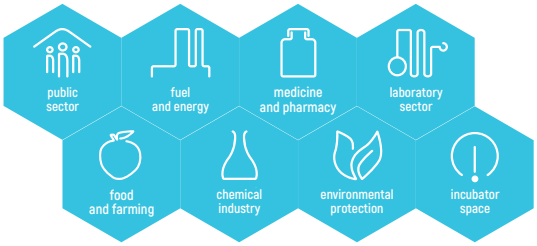
- Measurement of the size of micro- and nanoparticles using a dynamic light diffusion technique (DLS).
- Electrochemical measurements using potentiometers, classic electrodes, microelectrodes and nanoelectrodes (allowing measurements e.g. inside cells).
- Measurements using a quartz microbalance with measurement capability of energy dissipation. Testing/controlling the coating of surfaces with nanometer thick layers and determining the structure of these layers.
- Process heat measurement using differential scanning calorimetry (DSC).
- Precise UV-Vis spectroscopic measurements.
- Synthesis of macro-gels and micro and nano-gels with specific properties
- Modification of conductive surfaces with thin polymer films.
- Synthesis of functional monomers and other compounds, e.g. molecular receptors.



CENTER FOR PRECLINICAL RESEARCH AND TECHNOLOGY **CePT**

TEAM LEADER

Krzysztof Kilian

Ph.D

CONTENT COORDINATOR

Professor Grzegorz Chałasiński

The Centre is a cluster of interdisciplinary laboratories located at the Ochota Campus, committed to bringinga new scientific quality into medicine and technology. Thanks to the work of outstanding scientific teams, over 160 grants are allocated and realized in CePT laboratories in cooperation with 110 scientific entities and 20 companies.

The CePT laboratory consists of 3 environmental centres:

- Centre for Large Scale Biomedical Data Modelling and Processing(computing?),
- Centre for Physical and Chemical Research of Biologically Significant Systems and Materials,
- ^{11}C and ^{15}O Radiochemistry Laboratory

The centres constitute a part of the biomedical-biotechnological project of the Centre for Preclinical Research and Technology (CePT), which is being developed on the Ochota Campus.

The Centre for Large Scale Biomedical Data Modelling and Processing operates high-performance computing clusters with data visualization and mass storage systems. The systems are available to CePT teams as well as external users for computing in biomedical sciences, including biomolecular modelling, biophysics and biochemistry.

Centre for Physical and Chemical Research of Biologically Significant Systems and Materials integrates the research work of groups advancing the new methods and technologies to be applied in the diagnosis and prevention of civilization diseases.

^{11}C and ^{15}O Lab is a radiopharmaceutical laboratory manufacturing isotopically labelled substances. The equipment enables to obtain radiotracers used in molecular imaging techniques (PET, SPECT) for the diagnosis of civilization diseases (oncology, neurology, cardiology), studies of physiological processes and molecular patterns of pathological changes, as well as in pre-clinical studies of new drugs.

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- Innovative tissue engineering methods to support healing and regeneration of tendons and ligaments.
- An innovative method of functional evaluation of coronary artery stenosis by modelling in- silico flows,
- Integration of multimodal dynamic, pictorial and functional information in diagnostics and therapy planning.
- New energy sources (high-energy battery with active mass deposited on porous glass coal),
- Synthesis and characteristics of cyclic peptidomimetics with anti-angiogenic activity,
- Imaging of hypoxia in small animals with
- ^{18}F-fluoromisonidazole.

- Chromatography: UPLC and nano-UPLC with MS detection
- Cultivation of thin layers and low- dimensional structures using molecular beam epitaxy (MBE)
- Atomic force microscopy - Contact mode (C-AFM) and non-contact (AC-AFM)
- Chemical force microscopy (CFM)
- Determination of magnetisation and magnetic susceptibility in the range of temperatures 2.0 to 800.0 K and fields 0.0 to 7.0 T.
- Photomagnetic measurements (with sample illumination) in the range of 200-2000 nm.
- Raman and/or IR spectra measurements, XPS spectra measurements
- ICP-MS and GC-MS analyses
- Synthesis of substances labelled with ^{11}8F, ^{11}C, ^{68}Ga and imaging small animals by PET/SPECT/CT techniques
- Storage of data (databases, digital biobanks, etc.), creation and maintenance of the analytical system (BigData, data science, machine learning, artificial intelligence, etc.) and analysis of the image information

ULTRA HIGH-PERFORMANCE LIQUID CHROMATOGRAPH UHPLC 1290 COMBINED WITH MASS SPECTROMETER AND PASSAGE TIME ANALYZER QTOF MS/MS 6540

MAIN FEATURES

- Analysis of organic compounds in plant, pharmaceutical, food, cosmetic and environmental samples.
- Recording of high-resolution spectra of masses of components of liquid samples and masses of substances after chromatographic separation.
- Execution of MS/MS spectra – message about the structure of compounds.

LABORATORY OF COMPUTATIONAL BIOLOGY

TEAM LEADER

Sebastian Kmiecik

Ph.D, D.Sc.

Sebastian Kmiecik received his doctorate in 2007 at the Faculty of Chemistry of the University of Warsaw.

In 2007, he started working for Selvita, a biotechnology company in the start-up phase. There, initially as a project manager and later as a modeling department manager, he worked on research and development projects that included software development and drug design support services for pharmaceutical companies.

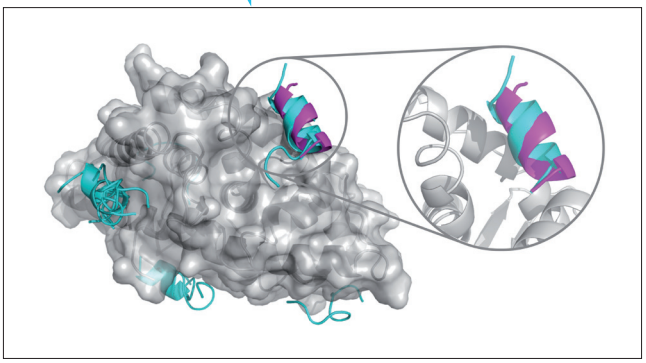
In 2010, Sebastian Kmiecik started working at the Faculty of Chemistry, University of Warsaw, where he develops new methods of multiscale modeling of proteins and their application to the study of protein functions. In 2015, Sebastian Kmiecik received a D.Sc. degree, and in 2016 the award of the Minister of Science and Higher Education for his scientific achievements of the first degree.

The main interests of the laboratory are:

1. multiscale modeling of protein structure and complexes
2. bioinformatics, structural biology, biological statistics
3. computer-assisted drug design, drug design based on the molecular target structure
4. protein structure prediction
5. molecular docking: protein-peptide, protein-protein, protein-ligand
6. efficient simulations of dynamics of proteins and protein complexes, simulation of molecular dynamics
7. development of software for molecular modeling of proteins
8. application of computational methods in biology, biotechnology, pharmacy and medicine
9. the use of high-power computers in the analysis of biological data and in the simulation of biological systems

Development of multiscale methods for molecular modeling of proteins and their application in the study of mechanisms of protein functions. The developed modeling methods have been made available to the scientific community in the form of publicly available web servers, which are used in the rational design of drugs:

- CABS-dock for protein-peptide molecular docking: http://biocomp.chem.uw.edu.pl/CABSdock/
- CABS-flex for fast simulations of protein structure fluctuations: http://biocomp.chem.uw.edu.pl/CABSflex/
- AGGRESCAN3D for prediction of protein aggregation properties and rational design of protein solubility: http://biocomp.chem.uw.edu.pl/A3D/
- CABS-fold for protein structure prediction: http://biocomp.chem.uw.edu.pl/CABSfold/



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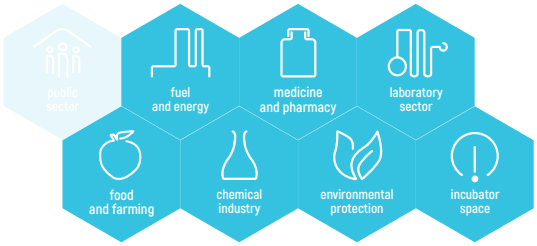
- Support of drug design using computer methods
- Support for structural biology research by using bioinformatic methods and molecular modeling
- Development of software dedicated to simulation of proteins and other biological systems
- Development of web-servers for computer support of drug design and biological research support
- Development of biological databases
- Analysis and prediction of protein properties
- Protein modeling and engineering
- Statistical analysis of biological data
- Use of a supercomputer to simulate biological systems
- Use of a supercomputer for biological data analysis
- Visualization of biological data



ECOLOGY OF ANIMALS

TEAM LEADER

Professor
Michał Kozakiewicz

Professor Michał Kozakiewicz is the author or co-author of over 70 scientific publications, which have been cited 561 times in total (H factor 15). He supervised nine PhDs and eighteen bachelors and more than sixty masters. He has experience in teaching, scientific work and leading a research team. For his scientific, didactic and organizational work he has received numerous awards from the Rector of the University of Warsaw and the Dean of the Faculty of Biology of the University of Warsaw. He completed a one-year scientific internship at Laboratory of Landscape Ecology, Carleton University, Canada. At the Faculty of Biology of the University of Warsaw, he held the positions of Vice- Dean for student affairs and Dean.

The Animal Ecology Research Group is mainly involved in research on population genetics and evolutionary ecology, as well as modeling ecological processes and analysing factors affecting biodiversity.

A significant part of the research concerns the urban ecology – in particular, the processes of synurbisation, i.e. the adaptation of organisms to live in a specific urban environment (impact of isolation, noise, pollution, etc.). The work also covers the creation and application of IT networks as a tool to support biodiversity research – the work of the National Biodiversity Information Network, which is a member of the World GBIF Network, is coordinated within the Animal Ecology Research Group. As part of the research on evolutionary ecology, work is being carried out on the co-evolution of the parasite-host system at the molecular level.

OFFER

- Environmental expert opinions
- Modelling of ecological processes
- Spatial and statistical analyses

Particular achievements of the last few years include the recognition of the role of the synurbisation process in shaping the genetic structure of the population of selected animal species and the inter-species relations and biodiversity in urban areas, as well as the development of a new method for modelling the population and the comprehensive development of the fauna of the Polish beetle.

NEW METHODS OF NMR SPECTROSCOPY

TEAM LEADER

Professor Wiktor Koźmiński

Research career:

1982-87 studies at the Faculty of Chemistry of the University of Warsaw.
1987-94 doctoral studies at ICHO PAN. 1993 PhD
1994-96 postdoctoral internship, University of Zurich, group of prof. W. von Philipsborn (30 months).
1996 employment at the Faculty of Chemistry of the University of Warsaw.
2001 habilitation
2010 title of professor.
2016 position of full professor

136 scientific publications Scientific and didactic activities: author or co-author of more than 130 scientific publications, manager and contractor of numerous research projects both national and international, supervisor of 8 completed doctoral dissertations, supervisor of approx. 10 diploma theses. For his scientific, didactic and organizational work he has received numerous awards from the Rector of the University of Warsaw

The NMR nuclear magnetic resonance spectroscopy is a source of unique information about the structure, interactions, and dynamics of molecules. In particular, it allows to determine the spatial structure of macromolecules of biological significance in solutions, i.e. under conditions approaching physiological, where X-ray crystallography is not possible.

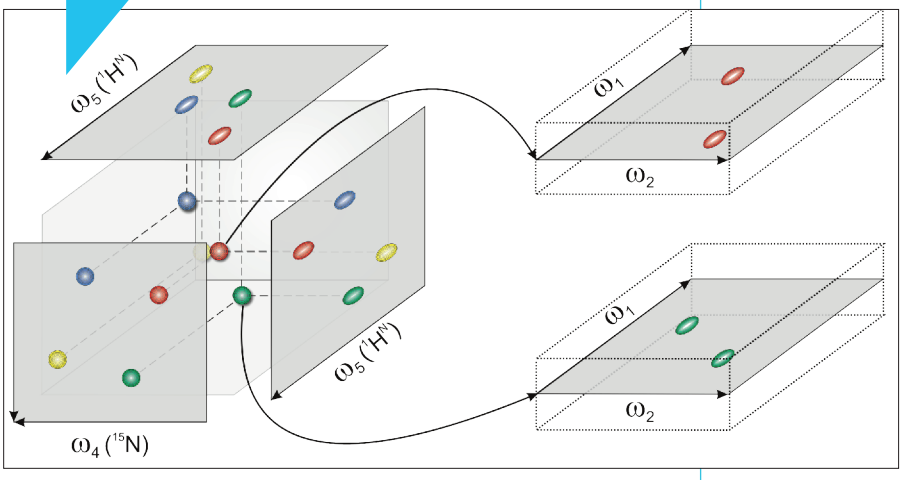
The main goal of our research is to search for new experimental techniques of NMR spectroscopy, their applications in chemistry and biochemistry, as well as new methods of signal processing. We are also working on appropriate computer algorithms, necessary for the analysis of spectra with non- classically sampled indirectly measured time dimensions, as well as for the determination of structurally significant parameters. Due to the great interest and importance of this subject, new ideas and solutions can also be expected.

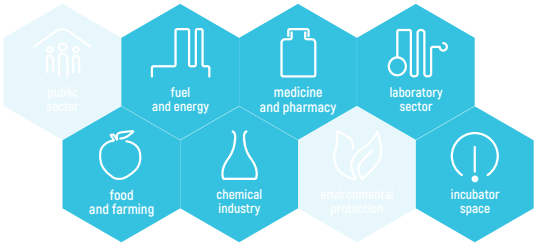
Our group is the only one in Poland to address the issues of NMR spectroscopy methodology. In recent years, the focus has been on the acquisition and processing of NMR spectra with a high number of dimensions and high resolution capability.

OFFER

Creating and developing new methods for measuring and processing multidimensional NMR spectra and their application in the study of intrinsically disordered proteins. These achievements represent a breakthrough in NMR multidimensional spectroscopy and its applications, especially in biomolecule research. The methodological breakthrough can be compared with the introduction of impulse NMR spectroscopy more than forty years ago.

- NMR spectra in liquids, signal assignment, structural tests, identification
- Metabolomics of body fluids, e.g. blood serum, urine
- Identification of metabolites in food, e.g. honey, oils, etc.
- Protein-ligand impact testing, e.g. screening potential medicines
- Structural studies on proteins





MOLECULAR MICROBIOLOGY LABORATORY

TEAM LEADER

Agata Krawczyk-Balska

Ph.D., D.Sc.

The research carried out by the team aims understanding of virulence mechanisms, resistance to antibiotics and adaptation to the different stress conditions of Gram- positive bacteria using the model bacteria Listeria monocytogenes. The research focuses on functional analysis and explanation of the mechanisms of regulation of the expression of genes that play an important role in these processes. In this context, we are particularly interested in discovering the biological function and mechanism of action of small RNAs and in identifying of new targets for chemotherapeutics in bacterial cells. In our research we use techniques of molecular biology (isolation of RNA, DNA and proteins, PCR, qRT-PCR, Northern and Western Blot analyses, co-immunoprecipitation, in vitro transcription, overproduction and purification of proteins, DNA cloning, construction of deletion and point mutants etc.), biochemistry (enzyme activity test) and microbiology (tests of bacterial susceptibility to antibiotics and other substances with an antibacterial effect).

Agata Krawczyk-Balska; employee of Department of Applied Microbiology at the Faculty of Biology of the University of Warsaw; member of COST international actions: TD0803 – "Detecting evolutionary hot spots of antibiotic resistances in Europe (DARE)", 2010-2014 and ES1403 – "New and emerging challenges and opportunities in wastewater reuse" (NEREUS), 2014-2018

Awards and internships:

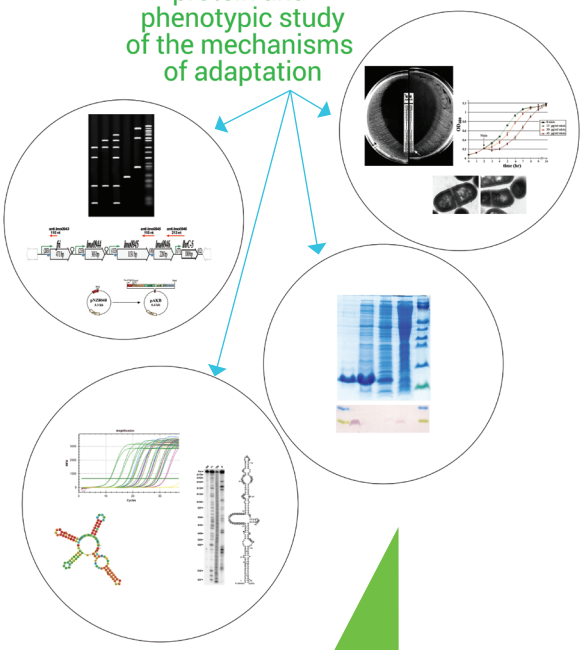
- Scientific Award of the Polish Society of Microbiologists for young microbiologists (2006 and 2014)
- Award of Rector of the University of Warsaw for scientific achievements (years 2005, 2013, 2014,
- EMBO (European Molecular Biology Organization) Short Term Fellowship for Young Scientists, Denmark, Odense, 2013

stress, antibiotics, immune system

Listeria monocytogenes

stress responses

genetic, transcriptional, protein and phenotypic study of the mechanisms of adaptation



Identification and characterization of genes that promote tolerance and innate resistance to β- lactam antibiotics of human pathogenic bacteria Listeria monocytogenes and demonstration of the relationship between the genetic basis of the analysed antibiotic resistance and the ability of bacteria to survive under abiotic stress conditions.

OFFER

- Isolation of nucleic acids from microbiological material; determination of the bacterial species on the basis of sequence analysis 16s rDNA of the submitted microbiological material or after the isolation of the bacteria from the submitted material
- Determination of bacterial susceptibility to antibiotics and other active substances on the basis of the MIC value by double dilution assay
- Amplification, cloning, deletion and point mutagenesis of bacterial genes
- Designing and consulting genetic constructs of varying degrees of complexity
- Analysis of the level of transcription of bacterial genes by qRT-PCR and/or Northern blot methods using submitted RNA or after RNA isolation from submitted microbiological material
- Determination of stability of bacterial transcripts using the Northern Blot method
- Determination of structure of bacterial transcripts using the method of secondary structure enzymatic probing

CHIRAL OPTICAL SPECTROSCOPY

TEAM LEADER

Professor Magdalena Pecul-Kudelska

She deals with calculations and partly with measurements of chiral-optical properties and NMR. She did one of the first simulations of the influence of solvent on these properties.

She has completed scientific internships at CNR, Pisa, Italy and the University of Tromso, Norway. She received the Prime Minister's award for her doctorate in 2000.

The most important publications of the last 5 years are:

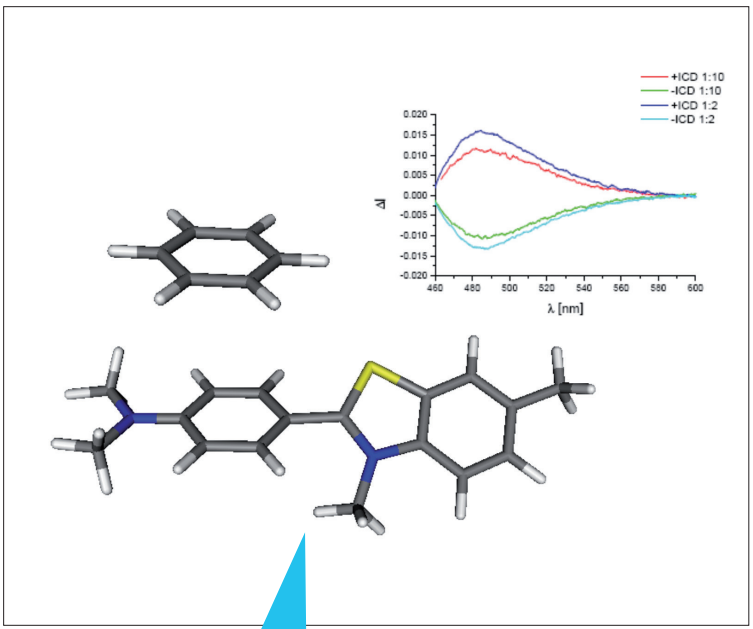
M. Kamiński, J. Cukras, M. Pecul, A. Rizzo and S. Coriani, A computational protocol for the study of circularly polarized phosphorescence and circular dichroism in spin-forbidden absorption, Phys. Chem. Chem. Phys., 2015, 17, 19079

A. Rybicka, G. Longhi, E. Castiglioni, S. Abbate, W. Dzwolak, V. Babenko, and M. Pecul, Thioflavin T: Electronic Circular Dichroism and Circularly Polarized Luminescence Induced by Amyloid Fibrils, Chem- PhysChem, 2016, 17, 2931

The team deals with modelling and partially measuring the chiral-optical properties: parameters of electronic and vibratory circular dichroism, optical rotation, circular polarized luminance and Raman optical activity, as well as modelling parameters of Nuclear Magnetic Resonance (NMR): nuclear shielding constants and spin-spin coupling constants. Our specialty is to take into account in the quantum-chemical calculation relativistic effects and the influence of the molecular environment (including solvent). We offer cooperation in the study of absolute configurations of natural compounds which are difficult to crystallize (e.g. oily) and in other structural problems, in which the above mentioned spectroscopic properties may be diagnostic parameters. In our calculations we use a wide range of quantum-chemical methods, from the density functional method (DFT) to advanced *ab initio* methods such as *coupled cluster* method. The use of relativistic Hamiltonians enables calculations to be carried out for molecules containing heavy atoms (e.g. organometallic compounds). We cooperate with laboratories of the University of Brescia (Italy) in the field of chiral-optical spectral measurement and the University of Tromso (Norway) in the field of quantum-chemical calculations.

OFFER

- Circular dichroism
- Circular dichroism including total fluorescence
- Magnetic dichroism



One of the most important achievements of recent years has been the development of procedures enabling the calculation of circularly polarized luminescence spectra, both in the case of spin-permitted and spin-prohibited excitations (circular polarized phosphorescence). The calculations were made for thiophlavine-T, among others. Comparisons of the results with the experimental measurements indicate that the luminescence of the thioflavine-T associated with the amyloid fibrils is likely to be the result of the proximity of aromatic residues of the amino acids at the intercalation of the dye between the beta-sheets.

LABORATORY FOR ADVANCED STRUCTURAL AND ELECTROCHEMICAL STUDIES OF FUNCTIONAL MATERIALS

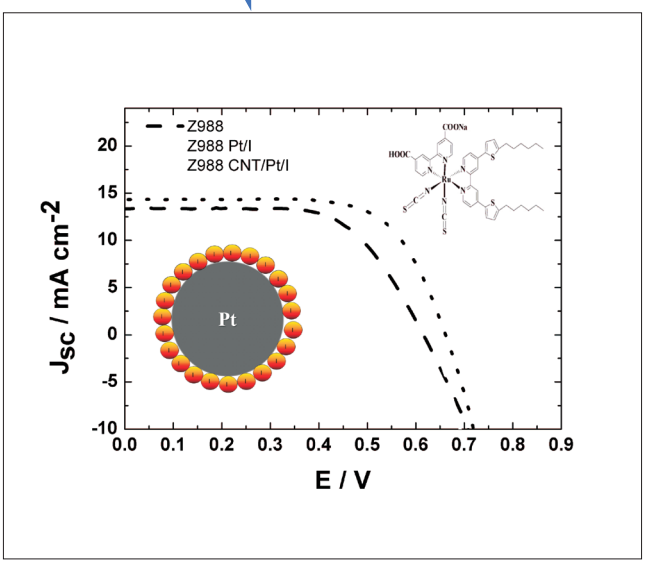
TEAM LEADER

Professor
Paweł Kulesza

Scientific interests of Professor Paweł J. Kulesza involve electrochemistry, material chemistry and analytical chemistry. In his works he uses functional nanostructured materials for the purpose of accumulation and processing of energy (chemical, solar) and environmental protection. His body of work encompasses nearly 250 publications. He is also the author of scientific monographs, review articles, and patents. He has realized more than 15 grants and scientific projects. He presented the results of his research at over 500 conferences in Poland and abroad. He is the editor of *Electrochimica Acta* (Elsevier) and a member of the editorial committees of the *Journal of Solid State Electrochemistry*, Electrocatalysis and Russian Journal of Electrochemistry (Springer). He is a correspondent member of the Polish Academy of Sciences and a member of the board of directors of the Electrochemical Society (USA).

- Electrochemistry, inorganic and analytical chemistry, nanomaterial chemistry
- Alternative energy sources, low temperature fuel cells, supercharge capacitors, solar cells
- Electrochemical and photoelectrochemical conversion of carbon dioxide to simple organic fuels,
- Electrocatalysis, bioelectrocatalysis.
- Mechanisms and kinetics of charge transport in solid materials showing redox properties, accumulation and controlled electron transfer capability
- Electrode processes in systems incorporating cross-linked nanoparticles of precious metals and transition metal oxides and carbon nanostructures (e.g. graphene)
- Design and physico-chemical characterisation of advanced materials with a specified organisation and functionality for alternative energy sources and other applications
- Structure and reactivity of hybrid electrocatalytic, bioelectrocatalytic and photoelectrocatalytic layers
- Hierarchically organised systems (“nano-reactors”) capable of rapid, controlled and induced (catalysed) transport of charge for possible use in low temperature fuel cells or for photogeneration of energy.
- Catalytic and electrocatalytic materials
- Corrosion protection
- New measurement and diagnostic concepts for chemical electroanalysis
- Amperometric sensors and biosensors

Semi-solid redox electrolytes as ultra-fast charge relays Redox electrolyte plays a very important role as a mediator (charge relay) in the dye sensitized solar cells. Often used liquid electrolyte containing redox couple iodine / iodide is subject to physical (ability to vaporize easily) and kinetic (necessity of breaking the bond I-I in iodine molecule) limitations. Our team proposed a semi-solid redox electrolyte in the form of a three- dimensional catalytic system *metal-organic-framework* capable of rapid charge propagation. A prototype of such a solar cell with a high coefficient of conversion of sunlight into electricity was prepared.



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- Preparation and physico-chemical characteristics of materials for the needs of electrochemical charge capacitors and thin-film high-power batteries; catalysts for hydrogen power generation, in particular low-temperature hydrogen-oxygen cells; electrode materials of low- temperature (electrolytic, photoelectrochemical) conversion of carbon dioxide to simple organic fuels
- Development of sensors or amperometric biosensors for selective determination of selected reagents.

LABORATORY OF ASYMMETRIC CATALYSIS AND HIGH-PRESSURE ORGANIC SYNTHESIS

TEAM LEADER

Piotr Kwiatkowski

Ph.D.

Assistant professor at the Faculty of Chemistry of the University of Warsaw, co-author of approximately forty publications in international scientific journals (eight of them in Org. Lett.). He completed his doctoral thesis at the Institute of Organic Chemistry of the Polish Academy of Sciences in Warsaw under the supervision of Prof. J. Jurczak. Afterwards, he spent one year as a postdoctoral researcher at the Princeton University in the group of Prof. D. W. C. MacMillan. In 2012, he received an MNiSW scholarship for an outstanding young scientist, and in 2013, he was awarded the Prof. M. Mąkosza Scientific Award. He received FNP scholarships under the Start and Kolumb programs. For his doctoral thesis, he received the awards of the Prime Minister, PTChem and Sigma-Aldrich and Białkowski Award. At the Faculty of Chemistry of the University of Warsaw, he was the supervisor of six Master's theses and an assistant supervisor of one doctorate. Hirsch index – 16.

The research in our laboratory focuses on the methodology of stereocontrolled organic synthesis, with particular emphasis on enantioselective reactions with the use of chiral organocatalysts and transition metal complexes. We are looking for effective catalytic systems that enable us to conduct new and difficult asymmetrical organic reactions. These include processes where a quaternary stereogenic centre is generated. Our interests include various types of additions / cycladditions to the carbonyl and imine group, conjugate additions with the application of various Michael acceptors and cascade-type reactions. In addition, we are working on new solutions for asymmetric synthesis of fluoroorganic compounds, important from the point of view of biomedical chemistry – mainly chiral trifluoromethyl derivatives.

Another important direction of our research is the application of high-pressure technique in organic synthesis, in order to obtain compounds that are difficult to obtain by classical methods. We are particularly interested in the influence of pressure (up to 10 kbar) on the course of catalytic processes, including enantioselective reactions.

The methodologies developed by us are used in the syntheses of selected building blocks, including biologically active compounds and their analogues.

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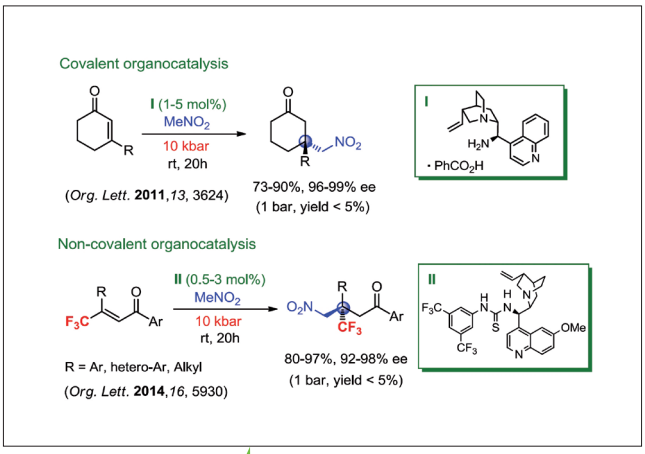
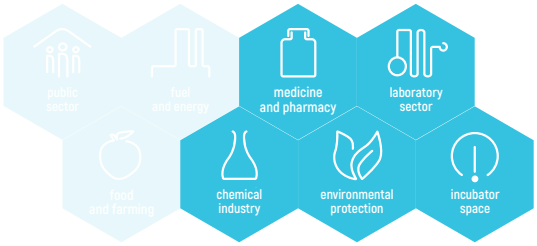


One of the most important achievements of our studies over the last few years, are the results of research on the high-pressure activation of enantioselective organocatalytic reactions. This approach has proven to be particularly effective in additions of carbon nucleophiles to sterically congested Michael acceptors, resulting in generation of quaternary stereogenic centers. Under classical conditions, small quantities of products (<5%) were formed, while pressure of 8-10 kbar ensured efficiency often above 80%, and what is important, with high enantioselectivity (up to 99% ee).

- High-pressure organic synthesis (up to 11 kbar; volume up to 20 ml)
- Determination of the enantiomeric purity of chiral compounds using chromatographic methods (HPLC, GC)
- Measurements of optical rotation
- Synthesis of selected organic compounds, including enantiomerically enriched compounds



NUCLEAR MAGNETIC RESONANCE SPECTROMETER NMR 400-MR

MAIN FEATURES

- 400 MHz nuclear magnetic resonance spectrometer (NMR) for self-service measurements with OneNMR probe (channels: 1H/19F, 15N-31P + 2H broadband) with AS-7600 auto-sampler. Self-service mode with queuing of measurements (max 90 samples). Possibility of measuring in the temperature range 25 to 80°C in manual mode. Measurement results in the form of standard *.fid files for self-processing. In auto-mode, possibility of programming (independently for each sample) routine spectra such as 1H, 13C, DEPT, 11B, 19F, 31P, COSY, HSQC, HMBC, studies of NOE effects and spin-spin couplings.

LABORATORY OF ORGANIC NANOMATERIALS AND BIO-MOLECULES SYNTHESIS

TEAM LEADER

Wiktor Lewandowski

Ph.D.

Wiktor Lewandowski - a graduate of international doctoral studies at the University of Warsaw under the direction of Prof. J. Mieczkowski. During his studies he completed his internship in the group of prof. Swager MIT, USA, followed by a postdoctoral internship under the guidance of prof. Liz-Marzan at the CICbioma-GUNE Institute in Spain. He is currently working on a dynamic self-assembly of nanomaterials.

TEAM LEADER

Michał Wójcik

Ph.D.

Michał Wójcik - completed his doctoral studies (summa cum laude) at the University of Warsaw, under the supervision of Prof. J. Mieczkowski. In the years 2011-2013 he continued his research at the Faculty of Chemistry of the University of Warsaw in cooperation with prof. E. Górecka. In his work, he focuses on obtaining and practical application of metallic and organic nanomaterials. He has held research internships at the University of Halle (Germany), Colorado University (USA) and INSP in Paris (France).

The group focuses on using organic chemistry tools in nanotechnology for the purpose of achieving functional nanomaterials with potential applications, e.g. in photonics and medicine. The library of nanomaterials we use includes metallic nanoparticles, semiconductor nanoparticles, ferrite nanoparticles and graphene derivatives. Our strength is the ability to program the properties of these nanostructures, which is achieved by attaching organic compounds designed by us to their surfaces. This allows us to effectively control the stability of materials, the spatial arrangement of building elements (self-assembly process), solubility in various fluids or bio- activity. We have also developed procedures for analysing the structure and functions of the nanomaterials we obtain, which allows us to determine their application potential.

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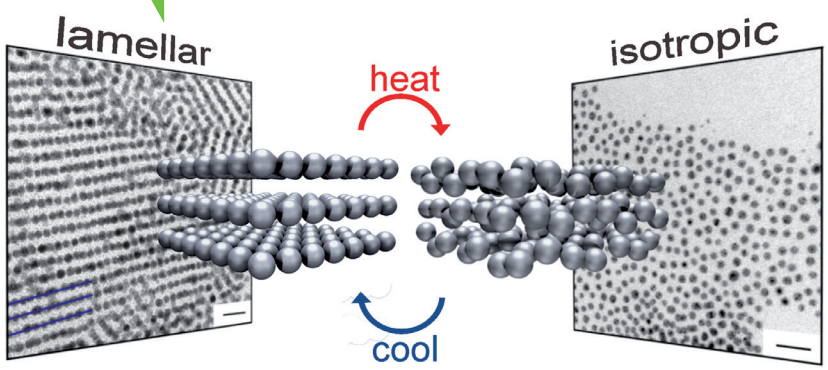
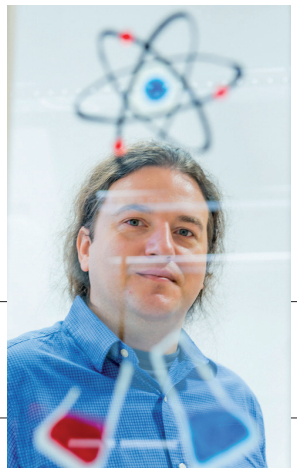
Over the past few years, we have been able to prove that by designing the organic coating of the nanoparticles properly, we are able to prepare nanomaterials with an ordered and simultaneously switchable structure. With the reorganisation of the nanoparticles, we are witnessing changes in the optical properties of our materials, which has enabled us, among other things, to achieve the first switchable metamaterial made up of nanoparticles (Nat comm, 2015, 6590). We have also succeeded in obtaining similar structures whose properties can be controlled with the help of light.

- Synthesis of metallic (Au, Ag; spherical, nano-triangles, nano-rods), semiconductor (PbS; spherical) and iron oxide (Fe_3O_4; spherical, cubic) nanoparticles
- Design and synthesis of functional nanomaterials for the drug delivery





CATALYSIS AND PHYSICOCHEMISTRY OF SURFACE

TEAM LEADER

Adam Lewera

Ph.D., D.Sc.

Adam Lewera is employed as an assistant professor at the Laboratory of Electroanalytical Chemistry of the Faculty of Chemistry at the University of Warsaw. He is the author of 43 scientific publications in international peer-reviewed journals from the ISI Master Journal List cited 1253 times (Hirsh index: 17). Adam Lewera is also a co-author of 7 inventions protected by 10 international patents (EU, USA and Japan), one domestic patent and 26 patent applications (5 domestic and 20 foreign). He is a laureate of the "Polish Top500 Innovators" programme of the Minister of Science and Higher Education (2013). For his scientific activity Adam Lewera received the following awards and distinctions:

1. Nomination for the scientific award of the Polityka weekly in science category (2011).
2. Scholarship of the Minister of Science and Higher Education for Outstanding Young Scientists (2010).
3. Didactic Award of the Second Degree of the Council of the Faculty of Chemistry of the University of Warsaw for Non-Lecture Didactic Classes (2010).
4. Antoni Grabowski scientific award of the Council of the Faculty of Chemistry, University of Warsaw (2009).
5. Scholarship of the Rector of the University of Warsaw (2008).

The main area of research are catalytic processes at the surface of platinum group metals, with particular emphasis on the relationship between the surface electronic properties and the catalytic activity. His laboratory develop and synthesize a wide range of catalysts, including industrial reaction catalysts, designed and optimized for particular applications. The aim of the research is to gain a better understanding of the mechanisms of catalytic reactions and to develop new, more efficient and selective catalysts for industrial applications or for applications in new, more efficient sources of electricity, e.g. fuel cells.

The research group "Catalysis and physicochemistry of surface" uses, among other things, the following test equipment: surface preparation set (surface etching, suputtering, ion implantation), X-ray and UV Photoelectron Spectormeter working in Ultra High Vacuum and at elevated pressure (up to 20 mbar), fuel cell test bench (PEM with emphasiszis on DMFC/DEFC) consisting of Scribner Associates 850e allowing for DC and AC FC characterization coupled with gas chromatograph Agilent 7890A dedicated for on-line analysis of products of fuel oxidation products, potentiostats and a mass spectrometer/gas analyser to test the gaseous products of the catalytic reactions.

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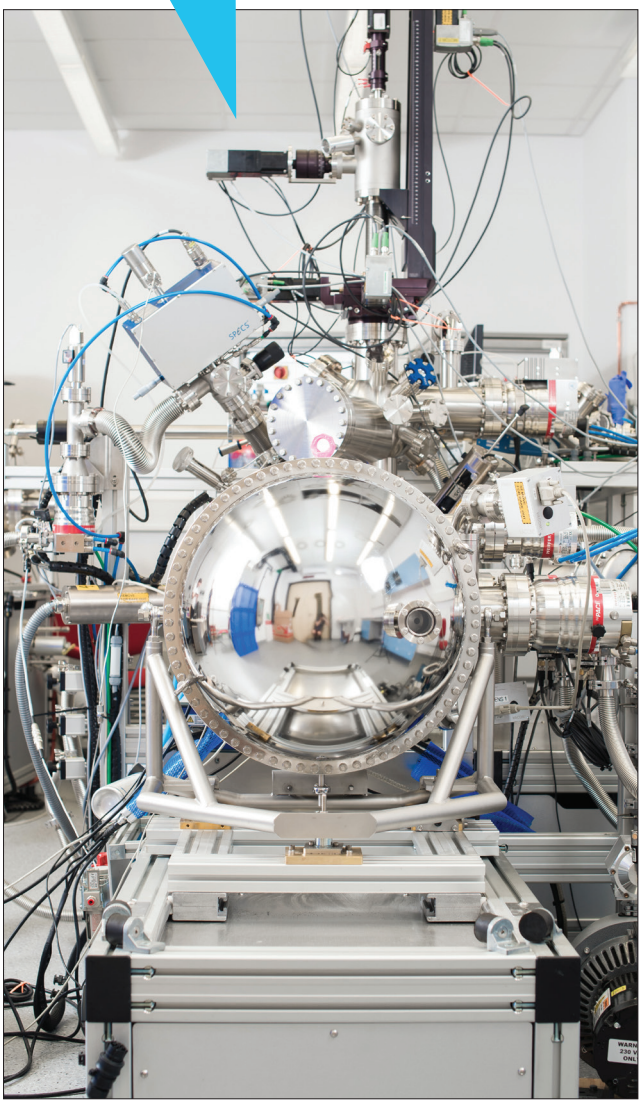
NAP XPS Surface Analysis Kit used by the team



- Design, optimization and synthesis of heterogeneous catalysts
- Analysis of gaseous products of catalytic reactions
- Analysis of composition and properties of the surface of materials using X- ray and UV photoelectron spectroscopy (XPS and UPS), with particular emphasis on research of catalysts and nanomaterials; including tests at elevated-pressure
- Surface preparation (sputtering, etching, ion implantation)
- DC and AC characterization of fuel cells
- Synthesis of nanomaterials

LABORATORY FOR ORGANIC FUNCTIONAL MATERIALS TECHNOLOGIES

TEAM LEADER

Professor Grzegorz Litwinienko

Grzegorz Litwinienko (specialization: physical organic chemistry, doctorate in 2000, habilitation in 2006, title of professor in 2017) is the author of over 50 publications (number of citations > 2000, index h=21) and three chapters in the monographs.

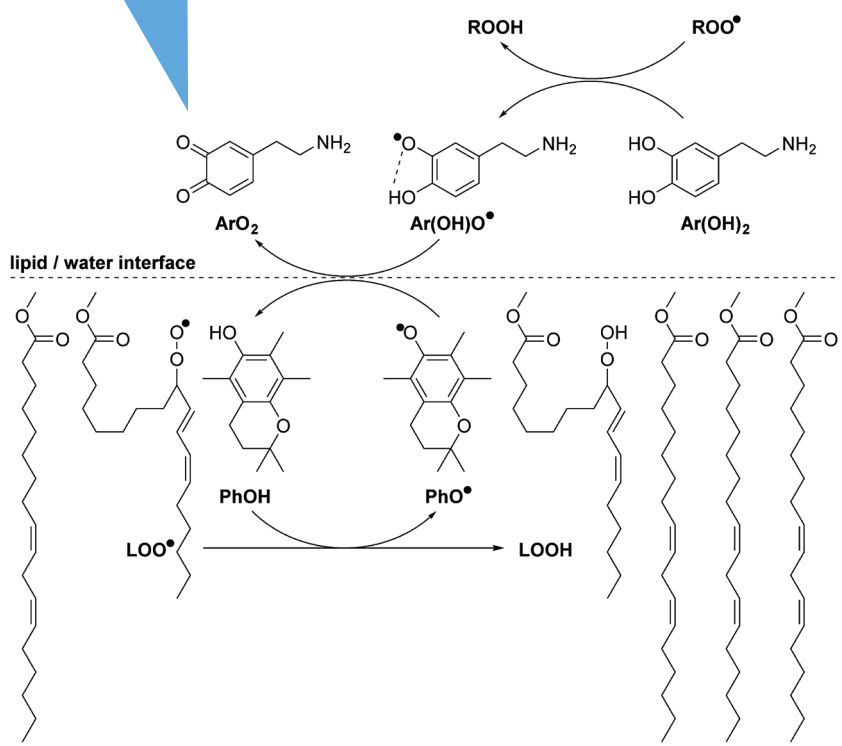
He completed his postdoctoral scientific internship at the National Research Council of Canada in Ottawa in a research group of K.U. Ingold.

He received the W. Kemula Award, A. Grabowski Award, Rector of the University of Warsaw Award, 12-month Foreign Scholarship of the Foundation for Polish Science, 12-month Scholarship of the Natural Science and Engineering Research Council of Canada. He is also a laureate of the A. Piekara award for teaching activities.

He has supervised four PhDs and 24 Masters of Sciences. He managed projects financed by the Ministry of Science and Higher Education and by the National Centre for Science.

1. Study of the rate of initiation of lipid peroxidation. Konowledge on the rate of initiation process is crucial for the studies of the mechanism and kinetics of autoxidation and the action of antioxidants. The experiments concern emulsion systems and liposome suspensions.
2. Antioxidant activity of polyphenols in homo- and heterogeneous systems. This area includes determination of the influence of acid-base equilibrium on the activity of phenolic antioxidants, connection of the mono- and polyphenols structure with their reactivity, determination of the effect of microenvironment on the activity of phenolic and polyphenolic antioxidants and determination of synergistic effects between antioxidants.
3. Study of antioxidant activity of catecholamines. Neurodegenerative diseases (such as Alzheimer's disease, Parkinson's disease and amyotrophic lateral sclerosis) lead to progressive nerve cell atrophy, accompanied by excessive production of reactive oxygen forms (oxidative stress). The aim of the research is to determine the potential protective properties of catecholamine neurotransmitters in relation to lipid systems exposed to reactive oxygen forms.
4. Research on carbonylation processes catalyzed by palladium and its complexes. Carbonylation of aromatic nitrocompounds with carbon monoxide is an alternative, waste-free and phosgene-free method to obtain aromatic isocyanates, carbamates or urea. Carbamates and urea are widely used as plant protection products, as an intermediate during production of polyurethanes. Many derivatives of urea and carbamates are biologically active and are used in medicine. Our work is aimed at development of environmentally friendly, selective and highly active catalysts for the carbonylation reaction of nitro compounds and amines.

Vitamin E, flavonoids and catecholamines can minimise the effects of oxidative stress. In order to gen insight into the mechanisms of their antioxidant action it is necessary to take into account the phenomena occurring at the lipid membrane boundary. The series of studies showed that the interactions with lipids, water, ions, radicals, antioxidants, and other substances present in the solution have a decisive influence on kinetics and lipid oxidation mechanism. This research contributes to the understanding of the action of bio-antioxidants at the cellular level and their effects on the human body.



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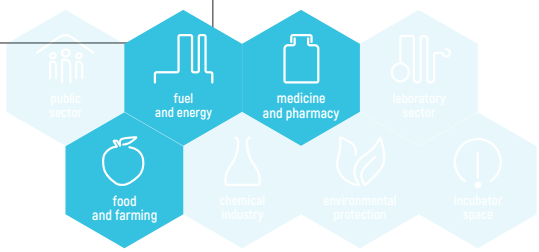
- Antioxidant activity studies
- Measurements of reaction kinetics with model radicals
- Thermal stability test of materials and nanomaterials at 0-1000°C



POLYMER RESEARCH LABORATORY

TEAM LEADER

Paweł W. Majewski

Ph.D

Paweł W. Majewski completed his PhD studies at Yale University in the United States in 2013, and then worked as a researcher at the Brookhaven National Laboratory (Center for Functional Nanomaterials). He returned to Poland after receiving a return Maria Skłodowska-Curie Polonez fellowship granted by the National Science Centre.

He currently works at the University of Warsaw Biological and Chemical Research Centre, where, as part of the First Team grant received from the Foundation for Polish Science, he leads a team investigating polymeric materials.

Research:

- Since 2018 – PI of the First Team research project, University of Warsaw, Poland
- 2016-2018 – the Polonez return fellowship, Department of Chemistry, University of Warsaw, Poland
- 2013-2016 – research associate, Brookhaven National Laboratory, USA
- 2005 – Research Internship, University of California at Santa Barbara, USA

Our team specializes in soft matter research with a special focus on block copolymers and their use as a matrices for the synthesis of functional nanomaterials. We are fabricating and studying nano-structured surface coatings used, among others, as ultra-thin conductive layers, elements of photovoltaic cells, chemical sensors or electrocatalysts.

As a part of our projects, we are developing directed self- assembly (DSA) methods for long-range spatial ordering of block copolymer domains using the directional action of external fields (electric, magnetic, thermal). These experiments are in part conducted in-situ utilizing X-ray scattering in collaboration with researchers from the American synchrotron centre at Brookhaven National Laboratory. These studies, in addition to having a direct impact on our understanding of complex polymer physics, will provide a universal experimental platform for rapid screening of other materials. Another direction of our research is the extension of the library of structural motifs available through the self-assembly of BCPs. We are searching for them in non-equilibrium structures produced, among others, in multi-layer system. The long-term aim of this research is to synthesize innovative functional materials based on obtained copolymer matrices for practical applications, e.g., chemical sensors in air pollution monitoring devices.

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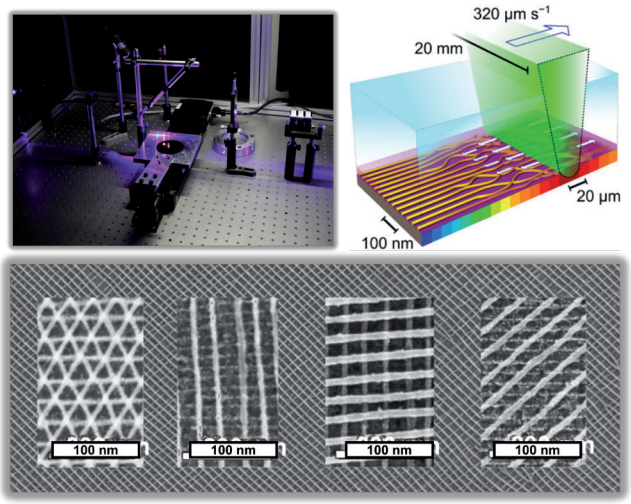
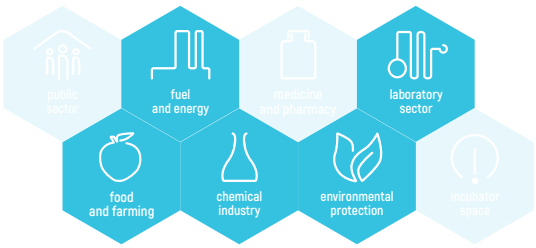
- Surface characteristics of soft materials by X-ray diffraction and electron microscopy
- Small-Angle X-ray Scattering, SAXS, Grazing Incidence SAXS GISAXS, X-ray Reflectometry, synchrotron techniques
- Engineering of thin organic and inorganic coatings
- Expertise in polymer and surface science, self-assembled monolayers, surface coatings, polymeric electrolytes, membranes and charge transport in soft materials



A special achievement of the last few years is the development of an innovative method of accelerated ordering of block copolymer films in optical and thermal fields, which also opens new perspectives for basic research on the physics of the self-assembly process. This method allows obtaining highly ordered matrices which are the starting point for the synthesis of two and three dimensional inorganic, organic or hybrid nanostructures by chemical polymer conversion.



BIOANALYTICAL LABORATORY

TEAM LEADER

Professor Magdalena Maj-Żurawska

Professor Magdalena Maj-Żurawska is the author of 60 works in international scientific journals, which have been cited jointly approximately 1200 times (h factor 21). She has supervised nine PhDs and more than 30 Masters. She has experience in teaching, scientific work and leading a research team. She was awarded a gold medal of merit and a KEN medal. She has undergone internships in foreign centres: ETH University of Technology in Zurich, Switzerland (postdoctoral internship and long-term cooperation), Abo University of Turku, Finland (visiting professor and long-term cooperation), KTH University of Technology in Stockholm (visiting professor), University of Florence, Italy (visiting professor). She was a lecturer in ERASMUS at the University in Isparta, Turkey, and at the University of Alcala, Spain.

The Bioanalytical Laboratory conducts interdisciplinary research on the border of chemistry and biology.

One of the areas of research interest of our group is the study of the interactions of nucleic acids with various substances. We conduct voltammetric and spectrometric analyses of nucleic acid interactions with various chemical substances, e.g. therapeutic, toxic, antioxidant. The aim of our study is to determine the affinity of different substances to nucleic acid chains and the nature of their interactions. We are particularly interested in the interactions of deoxyribonucleic acid with chemical compounds with anticancer properties, including both drugs currently used in chemotherapy and new derivatives of these drugs. We investigate the dependence of the interactions occurring on the nucleotide sequence, the concentration of the chemical compound, as well as its structure. Our research allows us to check how even small modifications in the structure of a chemical compound affect its interactions with nucleic acids, and thus to indicate the direction of further research into new derivatives. The procedures we use can also be applied as a screening method to select from the group of many derivatives, those that interacts with nucleic acids the most strongly.

The second area of research interest of our group is ion-selective electrodes and determination of ion content in clinical and environmental samples. We work on new ion-selective electrodes based on new ionophores and new materials, and on their application to clinical and environmental sample analyses. We are currently working on a new design of a carbonate ion-ensitive electrode and its application in clinical specimen analysis.

Our research group is open to the initiation of research on new topics, the establishment of cooperation and the implementation of joint scientific and business projects.

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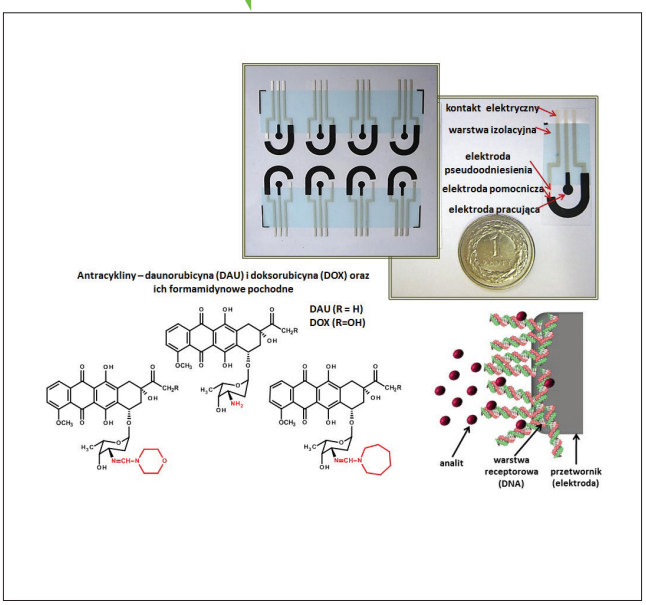
- Analysis of chemical substances interactions with nucleic acids
- Testing of the ion content in different types of samples
- Construction of chemical and biochemical sensors on screen-printed electrodes for different purposes

As our special achievement in recent years, we consider the construction of DNA electrochemical sensors on the screen- printed electrodes which have been successfully used by us to investigate the interactions of substances with anticancer properties – anthracyclines and their new derivatives – with deoxyribonucleic acids.

These studies, in combination with spectrometric analyses, provided a wealth of information on the nature of the existing interactions, relevant to the search for new chemical compounds with anti-neoplastic properties.



BioNanoLab

TEAM LEADER

Professor
Maciej Mazur

Maciej Mazur, professor of the University of Warsaw, is the author and co-author of over 70 publications, including such prestigious journals as Science, Science Advances and Chemistry - A European Journal. He is a laureate of the Scientific Award of the Polityka weekly, as well as the Grabowski Award. After receiving his PhD degree at the Faculty of Chemistry of the University of Warsaw, in an open competition he received a NATO scholarship for a postdoctoral internship at the Faculty of Chemistry of the Michigan State University in the group of prof. Gary Blanchard.

He cooperates with many scientific centres, including the Institute of Palaeobiology, Polish Academy of Sciences (Prof. Stolarski), the National Medicines Institute (Prof. Wiktorska, Prof. Szterk), the Medical University of Warsaw (Dr. Kuźma-Mroczkowska) and the Mossakowski Medical Research Centre, Polish Academy of Sciences (Prof. Kaczyńska).

The research interests of the group focus on a few main issues.

The first is to develop methods for the preparation of nanoparticles from inorganic, organic and hybrid materials. The obtained nanoparticles are examined using a wide range of physicochemical methods including microscopic, spectroscopic, thermal, electrochemical, and other techniques. The structures obtained are employed in many applications, e.g as drug carriers or contrasting agents in medical imaging methods (CT, MRI, SPECT and PET).

The second collaborative research path developed together with the Institute of Paleobiology, involves research on biomineralisation processes and polymorphic transformations of calcium carbonate in skeletons of invertebrates, such as corals, sponges, crinoids, etc. This research is carried out using spectroscopic (mainly Raman spectroscopy) and microscopic (SEM, TEM, AFM) methods.

The third research area is diagnostics of kidney diseases, with emphasis on nephrotic syndrome. The aim of the research is to develop new methods of diagnosing proteinuria in nephrotic syndrome and to modify the existing protocols of steroid therapy.

This research is carried out in cooperation with the Medical University of Warsaw.

The last topic of research is the use of nanostructured materials in cosmetic products. In particular, such studies are conducted from the perspective of application of the nanomaterials as novel preservatives.

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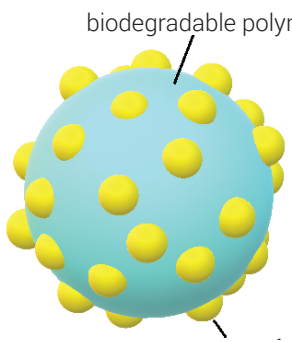
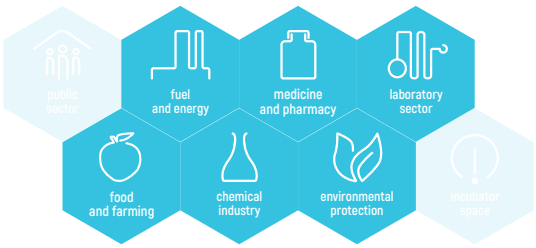
- Raman measurements (spectra and Raman maps)
- Microscopic measurements (AFM, fluorescence microscopy)
- Thermogravimetric measurements

One of the greatest achievements is the development of universal methods for preparation of hybrid particles from biodegradable polymers modified with inorganic radioactive nanoparticles. Such particles may be used as drug carriers as well as contrast agents in medical imaging methods, such as CT and SPECT (single photon emission tomography).





LABORATORY FOR BIOLOGICALLY ACTIVE COMPOUNDS

TEAM LEADER

Professor Aleksandra Misicka-Kęsik

Professor Misicka-Kęsik has published over 100 original research articles in the field of peptides. She is also a co-author of patents and a laureate of many awards in the field of innovation. She has completed many research internships, in the United States, Belgium, Japan and France, among others.

Professor Rafał Siciński

Professor Siciński (deputy head) has published over 80 scientific papers and is a co-author of nearly two hundred patents related to group D vitamin analogues. He completed many years of research internships in the United States.

The scientific interests of the Laboratory of Biologically Active Compounds are focused on solving the problems of dependence of activity on the structure of biologically active compounds (SAR – Structure-Activity Relationship). The scope of this type of work includes not only the design, synthesis and determination of the structure and properties of new molecules, i.e. typically chemical issues, but also pharmacological studies, both in vitro and in vivo. A characteristic feature of such studies is the close cooperation between chemists and pharmacologists.

The Laboratory of Biologically Active Compounds consists of two teams:

1. the team of Prof. Aleksandra Misicka-Kęsik, whose interests are focused on the design and synthesis of peptide analogues and peptidomimetics:
   - exhibiting antiangiogenic activity by blocking the VEGF165/NRP-1 complex;
   - which are analgesically active.
2. the team of Prof. Rafał Siciński, which deals with the chemistry of D-group vitamins. Many years of research into these vitamins have allowed us to establish beyond any doubt that the vitamin hormone (calcitriol), in addition to regulating calcium-phosphate metabolism in the body, also controls cell division and differentiation, and participates in immunological processes. This diversified spectrum of activities contributed to the undertaking of research aimed at finding structurally modified analogs of calcitriol with selective activity, e.g. calcemic and anticancer.

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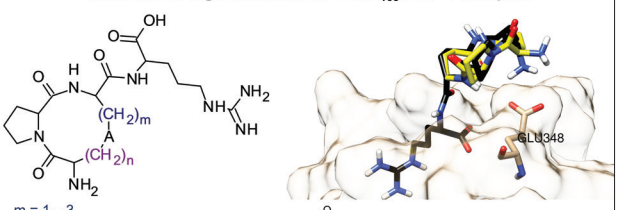
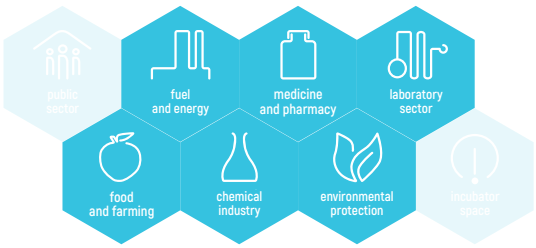
The development of low molecular weight chemical compounds inhibiting the angiogenesis path (formation of new blood vessels) depends on the VEGF growth factor. Such compounds have a very high potential for anticancer therapies, as well as for the treatment of other diseases caused by growth disorders of blood vessels, e.g. retinopathy.

Design and synthesis of vitamins D with a modified carbon skeleton, characterized by a higher durability and selective biological effect. One of them has been used since 1998 in the USA as a secondary osteoporosis drug (Zemplar).

Analogs of cyclic peptide H-c[Lys-Pro-Glu]-Arg-OH, which show high inhibition to $VEGF_{165}$/NRP-1 complex



- Identification of API, impurities and residues of organic solvents in pharmaceutical, cosmetic, industrial and environmental samples using LCMS and GCMS techniques
- Testing enzymatic degradation of the active substance by the LCMS technique
- Analysis of environmental pollution using LCMS and GCMS techniques
- Quantitative determination of chemical substances in different matrices using LCMS and GCMS techniques
- Validation of analytical methods using HPLC, LCMS, GCMS
- Synthesis of linear and cyclic peptides
- Synthesis of steroids and other low molecular weight organic compounds
- Performing calorimetric titration



TEAM OF MOLECULAR AND STRUCTURAL BASIS OF CHLOROPLAST ACTIVITY

Professor Agnieszka Mostowska

Professor Maciej Garstka

Professor Agnieszka Mostowska (Head of the Department of Plant Anatomy and Cytology, Institute of Experimental Biology and Biotechnology of Plants of the Faculty of Biology, since 2012, Dean of the Faculty of Biology of the University of Warsaw) and Professor Maciej Garstka (Head of the Department of Metabolism Regulation, Institute of Biochemistry of the Faculty of Biology, Deputy Dean of the Faculty of Biology of the University of Warsaw) conduct joint photosynthetic research including: chloroplast biogenesis, relation of the 3D structure of thylakoids with their protein and lipid composition, changes in the chloroplast proteome and lipidome under stress conditions, mechanisms of programmed cell death. Recent major publications: Kowalewska et al. (2016) The Plant Cell, 28: 1-17, Skupień et al. (2017) Plant Physiol. Biochem. 111: 107-118, Kowalewska and Mostowska (2017) chapter [in] Handbook of Photosynthesis, Mazur et al. (2018) Plant Physiol. Biochem, 122:102-112

Chloroplasts, and in particular their inner membranes – thylakoids – are one of the most complex spatial systems occurring in nature. Our research group is engaged in a comprehensive analysis of the relationship between the composition, structure and function of chloroplasts in different environmental conditions and at different stages of development. Using complementary measurement methods we examine chloroplasts at various levels of organization, starting from protein-lipid composition (molecular methods, HPLC, mass spectrometry), through organization and interaction between photosynthetic complexes (electrophoresis, spectroscopic methods), spatial structure of thylakoid membranes (electron microscopy and tomography, confocal microscopy, 3D modeling), up to functionality of the photosynthetic apparatus (in vivo fluorescence measurements).

CNBCh UW hosts our "Lab for high-pressure freezing and substitution of TEM samples", in which microscopic samples are fixed by freezing and by chemical methods. At later stages the preparations are studied by electron and confocal microscopy for 2D and 3D analyses.

Our particular achievement is creation of a dynamic spatial model of biogenesis for the thylakoid network, from the paracrystalline tubular structure of the prolamellar body to the lamellar system of grana and stroma thylakoids. Three - dimensional reconstructions of the plastid inner membranes by electron tomography explained the way of a direct rearrangement of the thylakoid systems during their development in the light and indicated the key role of the helical grana structure in the creation of a photosynthetically active thylakoid network. Subsequent steps of 3D reconstruction of the chloroplast membranes are shown in the figure below.

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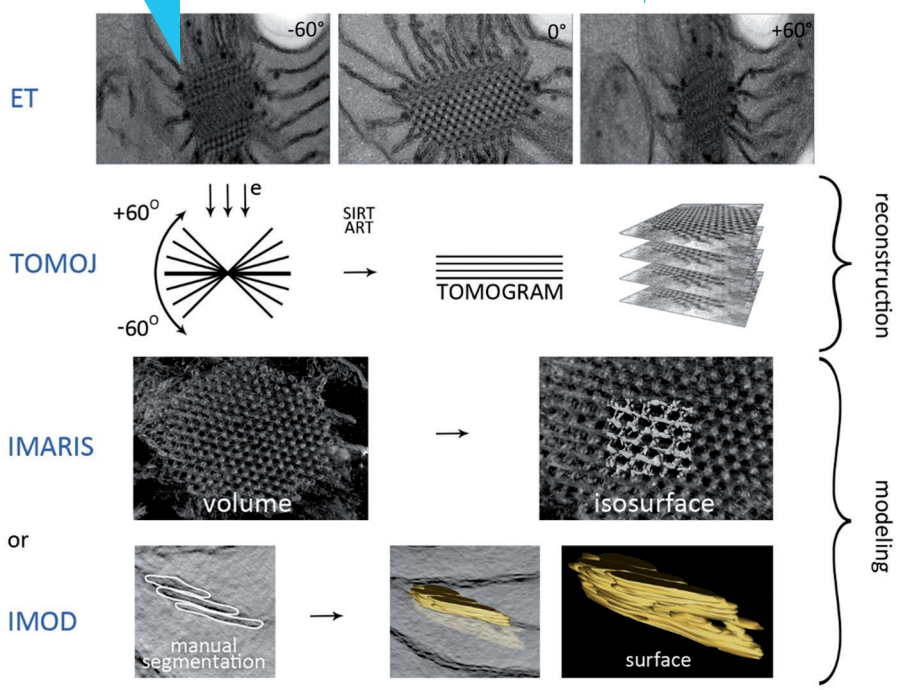
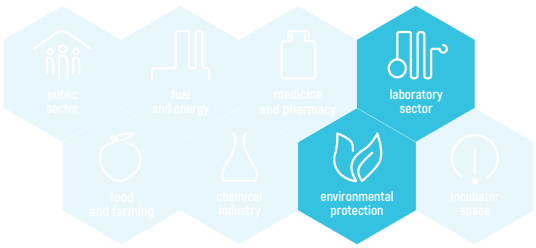
- Chemical fixation of biological samples in a framework of common research
- High-pressure freezing fixation of biological samples in a framework of common research





MATERIALS FOR BIOSENSORS

TEAM LEADER

Professor Barbara Pałys

The research group Materials for Biosensors deals with obtaining and testing physico-chemical properties of surfaces, materials or nanostructures which exhibit electrocatalytic properties, or may be matrices for the deposition of enzymes or other substances used in biosensors. The materials to which scientists pay most attention are graphene oxide, nanostructures made of conductive polymers, supramolecular polymer gels and metallic nanostructures. Chemical modifications of graphene oxide in order to influence its electrocatalytic properties and its bonding with metal nanoparticles or enzymes are the subject of the research.

Professor Barbara Pałys is the author of 62 papers in international scientific journals, cited a total of 1200 times (h factor 21). She has supervised three PhDs and 21 Masters, including current team members. She has experience in teaching, research and team leadership. She received the Kemula Scientific Award from the Faculty of Chemistry and two faculty didactic awards. She completed internships in foreign centres: University of Twente in the Netherlands (doctoral studies), University of Eindhoven in the Netherlands (postdoctoral internship) and University of Brussels (postdoctoral internship)

Examples of team members' publications:

- Effect of the polymerization bath on structure and electrochemical properties of polyaniline-poly(styrene sulfonate) hydrogels, A. Jabłońska, B. Pałys, J. Electroanal. Chem., 784 (2017) 115-123
- Enhancement of Direct Electrocatalytic Activity of Horseradish Peroxidase on Polyaniline Nanotubes, A. Jabłońska, M. Gniadek, B. Pałys, J. Phys. Chem. C, 119 (2015) 12514-12522
- Electrochemically Reduced Graphene Oxide on Electrochemically Roughened Gold as a Support for Horseradish Peroxidase, P. Olejnik, A. Świetlikowska, M. Gniadek, B. Pałys, J. Phys. Chem. C, 118 (2014) 29731-29738
- Supramolecular polyaniline hydrogel as a support for urease, A. Słoniewska, B. Pałys, Elechtrochim. Acta, 126 (2014) 90-97
- Application of Polarization Modulated Infrared Reflection Absorption Spectroscopy for electrocatalytic activity studies of laccase adsorbed on modified gold electrodes, P. Olejnik, A. Pawłowska, B. Pałys, Electrochim. Acta, 110 (2013) 105-111
- Electrodeposited graphene nano-stacks for biosensor applications. Surface groups as redox mediators for laccase, A. Świetlikowska, M. Gniadek, B. Pałys, Electrochim. Acta, 98 (2013) 75-81
- Layers of Polyaniline Nanotubes Deposited by Langmuir-Blodgett Method, P. Olejnik, M. Gniadek, B. Pałys, J. Phys. Chem. C, 116 (2012) 10424-10429

OFFER

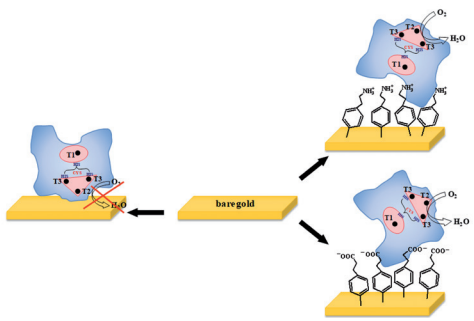
- Infrared spectra – standard in transmission or KBr
- Imaging of infrared samples
- Raman imaging
- Standard Raman spectra (activating lines in the range of 455 nm, 532 nm, 633 nm, 780 nm)

We are investigating the possibilities of using composites of metal nanoparticles and graphene oxide as substrates for surface-reinforced Raman Spectroscopy (SERS) and surface-reinforced infrared spectroscopy (SEIRA). Graphene oxide in this type of composites acts as a fluorescence suppressant.

The group deals with the study of the structure of immobilized enzymes on surfaces or in matrices. Infrared spectroscopy, including reflective techniques (PMIR-RAS and ATR), infrared imaging and spectroelectrochemistry are among the research methods used. We also use Raman spectroscopy, Raman imaging, UV-VIS spectroscopy, spectrofluorimetry and a number of electrochemical methods. The members of the group have experience in recording and interpreting oscillating spectra of proteins and other substances of biological significance.

A special achievement of the last few years is the study of the orientation of surface immobilized enzymes with infrared reflective spectra and the demonstration that the surface charge or coating with reduced graphene oxide affects the orientation of the molecule and its activity on the surface.

Moreover, we demonstrated that the oxygen groups present on the graphene oxide surface may mediate the charge transfer between the active centre of the enzyme and the electrode.



ECOLOGY OF AQUATIC HABITATS AND AQUATIC ORGANISMS

TEAM LEADER

Professor
Joanna Pijanowska

Body of work encompasses about 80 items, including over 40 original articles in JCR journals, over a dozen conceptual and review articles, reviews, expert opinions, and short notes. Speeches at international and national conferences, reviews for the KBN/MNiSW/ NCN, NCBiR, FNP and many international journals, member of editorial committees of domestic journals. Former Vice-Dean and Dean (2005-2012) of the Faculty of Biology of the University of Warsaw, former President of the State Council for Nature Conservation. Coordinator of the training of humanists in natural sciences at the Faculty of Artes Liberales, University of Warsaw.

Our interests focus on the ecology of aquatic organ-isms, In inland lakes, small reservoirs andrivers. We are interested in water quality, lake eutrophication processes, blooms of toxic cyanobacteria and water pollution – e.g. spresence of xenobiotics (especially pharmaceuticals) and light. We are interested in invasions of alien species of invertebrates and fish in our waters, as well as in the mechanisms that determine the success of invasive species. We proposed as the first a method of vital monitoring of invertebrate fauna, which does not require unnecessary killing of animals. We have successfully tried to improve lake water quality through biomanip-ulation and reclamation procedures. Our body of work also concerns the ecology of various aquatic organisms and theircommunities, among others phytoplankton, zooplankton, benthos and fish in the littoral zone and the open waters of the lakes, as well as in the rivers. A significant part of our research concerns inter-specific interactions, mainly predator- prey relations and evolution of mechanisms of defense against predation, e.g. behavioural, morphological and life history recon-struction, including changes in reproductive mode from parthenogenetic to sexual and the evolution of diapause.

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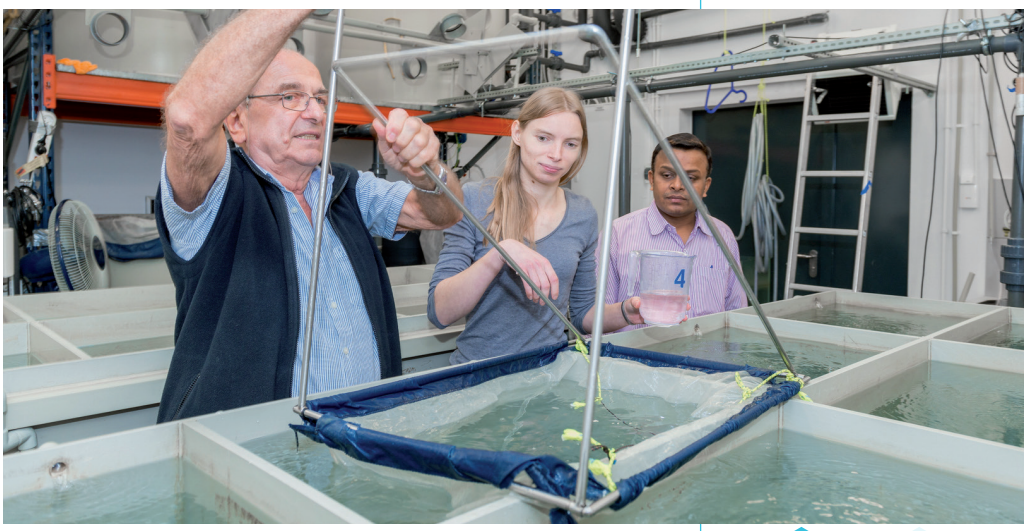
We have significant achievements in the field of research on chemical communication in the predator-prey relationship, mainly the effects of compounds released into water by fish (kairomones), as well as by injured prey (alarm substance). They both are perceived by their prey as an information about the threat and initiate defensive reactions (including diel vertical migrations, swarming and escape), Recent research has focused on the diet of fish and on neurological mechanisms that govern food selection and fish learning. We pay a lot of attention to the ecology of stress, i.e. the influence of stress factors on behaviour and individual life history, and the role of g maternal effect in shaping the phenotype of an individual, the evolution of longevity and ageing of clonal organisms, as well as the evolution.

- Chemical analyses of water and bottom sediments samples
- Taxonomic analyses of phyto- and zooplankton, macrophytes, macrofauna and fish
- Evaluation of water quality
- Monitoring of environment and biota in aquatic habitats
- Field and laboratory analyses of populations dynamics
- Ecotoxicological surveys



RADIOCHEMISTRY FOR MEDICINE AND INDUSTRY

TEAM LEADER

Zbigniew Rogulski

Ph.D., D.Sc.

Zbigniew Rogulski is the author of 40 publications in international scientific journals. He holds several patents and has multiple patent applications pending in fields of energy storage and radiochemistry. His great commitment and scientific contribution have been recognized at numerous innovation exhibitions by ten gold and seven silver medals. He received prestigious research team awards including the Competition for the Polish Product of the Future, the Prime Minister Award for Scientific and Technical Achievements, the International Federation of Inventors Associations Award for "Recycling technology of zinc-carbon and alkaline batteries". He won individual Prime Minister's Award for the outstanding doctoral dissertation and two other prestigious research awards of W. Kemula and A. Grabowski.

This group's research interests lie in three main areas:

1. application of radioisotopes in medicine, in particular, studying the affinity of chemical substances to body tissues,
2. monitoring of radioactive wastes
3. Energy storage and transformation: batteries, fuel cells.

We closely cooperate with industry therefore most of our inventions have multiple industrial applications. Our group members conduct pre-clinical research on pharmaceuticals and radiopharmaceuticals using PET/SPECT/CT techniques, they also modify and recycle electrochemical power sources and study the phenomena of oxidation of precious and base metals. The group has modern and unique equipment at its disposal which enables world-class research in the field of molecular imaging, synthesis of radioisotope-tagged compounds and studying materials used in electrochemical power sources. The equipment includes: three-module PET/CT/SPECT scanner, a system of individually ventilated cages (IVC) for mice and rats, hot cells, isotope generators and modules for the synthesis and portioning of radioisotope-labelled compounds (among others 18F, 64Cu, 68Ga), a quality control system for radiopharmaceuticals, an EDXRF X-ray fluorescence spectrometer for quantitative and qualitative analysis of samples, equipment for spectroelectrochemical tests (UV-vis spectrometers, potentiostats), potentiostats, galvanostats and battery testers.

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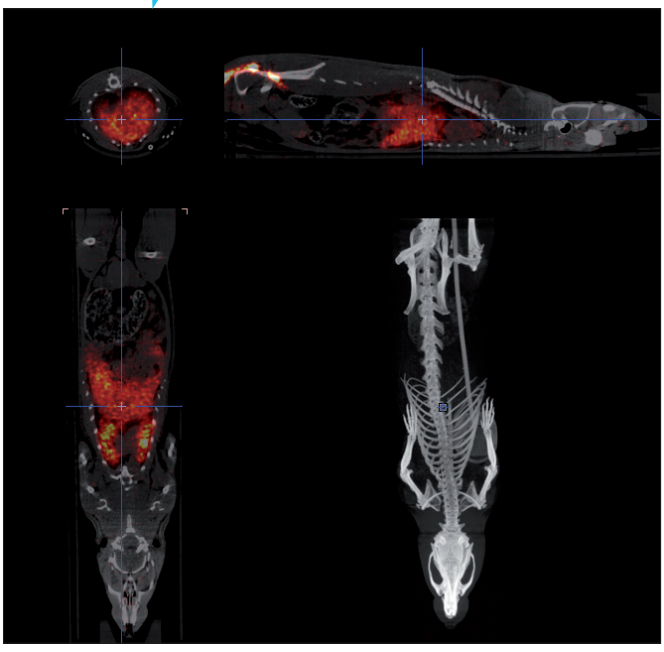
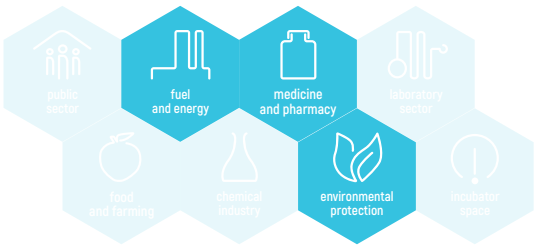
Development of techniques for labelling biological materials with radioisotopes and for monitoring their biodistribution in vivo. The optimized method allows short, medium and long-term monitoring of the colonization process and the therapeutic effect of, e.g. stem cells used for regeneration of the cardiac muscle or skeletal system.

Monitoring of pathological changes in animal models using compounds containing radioactive isotopes.



- Monitoring of disease development and treatment progress (oncology,neurology, cardiology, bone diseases, metabolic and autoimmune diseases, infectious and inflammatory conditions, etc.) in animal models using radioisotopic and optical techniques such as PET and SPECT
- Developing a methodology for the radioisotopic labelling of chemical compounds and biological materials, including stem cells,
- Radiochemical synthesis using isotope and metallic isotopes e.g. ^{64}Cu, ^{68}Ga
- Optimisation of the recycling process of metals and their compounds from batteries.
- Prototyping of electrochemical energy sources
- Organisation of training courses, conferences, scientific and educational workshops, including those disseminating knowledge in the field of ionising radiation and energy storage



LABORATORY OF SURFACE CHEMISTRY

TEAM LEADER

Professor Sławomir Sęk

The Surface Chemistry group conducts research on the phenomena occurring at interfaces including chemisorption and physical adsorption of organic compounds on electrified solid surfaces. In particular, the studies are focused on physicochemical characterization of biomimetic lipid membranes and their interactions with biologically relevant molecules, such as antimicrobial peptides and lipopeptides. This enables evaluation of their membranolytic activity in nanoscale and helps to understand molecular aspects of their action on biological membranes. In addition, the team investigates long-range electron transport processes in peptides and proteins. The purpose of this research is to gain insight into the mechanisms of electron transfer in biological systems and understand the correlation between peptides structural motifs and their ability to mediate electron transport. Such knowledge might be useful for the emerging field of molecular electronics and suitably designed peptides can serve as components of biosensing devices or nanoscale bioelectronic circuits.

Awards:

- Włodzimierz Kołos Award, Faculty of Chemistry, University of Warsaw, 2003.
- Antoni Grabowski Award, Faculty of Chemistry of the University of Warsaw in 2008.
- Scientific internships: University of California, Berkeley (USA); California State University, Long Beach (USA); University of Guelph (Canada).

Main publications:

- J. M. Wenda, J. Juhaniewicz, D. Tymecka, D. Konarzewska, S. Sek, Modulation of Activity of Ultrashort Lipopeptides toward Negatively Charged Model Lipid Films, Langmuir 33(19), 4619-4627 (2017).
- J. Pawlowski, J. Juhaniewicz, A. Guzeloglu, S. Sek, Mechanism of Lipid Vesicles Spreading and Bilayer Formation on a Au(111) Surface, Langmuir 31(40), 11012-11019 (2015).
- S. Sek, T. Laredo, J. R. Dutcher, J. Lipkowski, Molecular Resolution Imaging of an Antibiotic Peptide in a Lipid Matrix J. Am. Chem. Soc. 131(18), 6439-6444 (2009).

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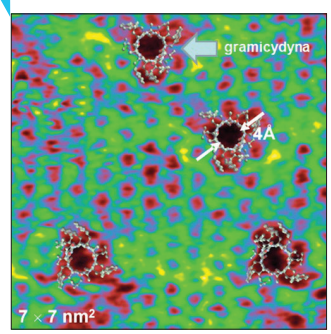
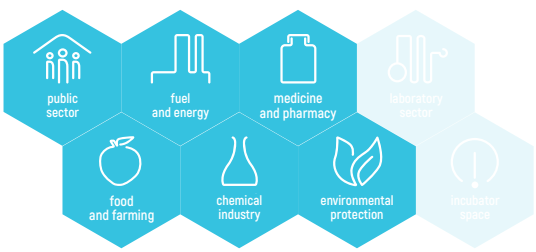
- AFM imaging of solid surfaces (metals, semiconductors, ceramics, plastics, polymer/organic layers): topography, mapping of nanomechanical properties, electrical conductivity.
- Mapping of specific intermolecular interactions (e.g. antigen-antibody) with the use of AFM-based molecular recognition mode.
- AFM and STM imaging under electrochemical conditions.

Molecular scale structural characteristics of the ion channel formed in the lipid film by an antibiotic peptide – gramicidin. STM imaging enables the evaluation of the conformation of the active form of the channel, the degree of the peptide aggregation and its effect on the molecular arrangement of the lipids composing the membrane.





SCANNING ELECTRON MICROSCOPE FIB/SEM

MAIN FEATURES

- Characteristics of various materials (conductive, semi-conductive and nonconductive) to obtain information on topography, morphology, structure, crystallization, particle size distribution, phase distribution and chemical composition of multiphase porous materials. Possible FIB 3D-research of morphology changes.

LABORATORY OF PHOTOELECTROCHEMISTRY

TEAM LEADER

Professor
Magdalena Skompska

Field of research interest: electrochemistry of conductive polymers, semiconductors and organic-inorganic hybrid systems and their applications in electrocatalysis, photocatalysis and solar cells.

Prof. Skompska is a co-author of 75 scientific papers and numerous conference presentations. She has completed scientific internships at the University of Bath (UK), University of Leicester (UK), University of Burgundy (France) and University of Freiburg (Germany). She has been a Principal Investigator of eight scientific grants. She supervised 7 PhDs and 18 Master's theses. She obtained the title of professor in 2011.

Currently she cooperates with research groups from France (University of Burgundy), Portugal (University of Lisbon) and USA (Adelphi University, NY).

The scientific interests of the Team is focused on synthesis and characterization of organic, inorganic and composite materials for applications in electrocatalysis, photocatalysis, photoelectro-catalysis and solar cells.

The first group of materials comprises functionalized conducting polymers (poly(1,8-diaminocarbazole), polyalkylthiophenes, polyalkoxythiophenes and poly-aniline derivatives) electrodeposited on the electrodes and used as the matrices for noble metal (Ag, Au) or bimetallic (Au@Pt, Pd@Au) nano-particles. These systems are applied in catalytic and electrocatalytic reactions of the solution species (reduction of 4-nitrophenol, electrooxidation of formic acid and methanol). Very high activity of the systems is achieved owing to excellent dispersion of the nanoparticles in the polymer films. The conducting polymers synthesized by the group are also applied as the hole transporting layers in organic-inorganic solar cells.

The hybrid systems from the second group of synthesized materials are based on nanostructured semiconductors, TiO_2, ZnO and $SrTiO_3$, and their composites. These large band-gap semiconductors and their composites are modified by doping and decoration with metal nanoparticles to obtain the visible-light driven photocatalysts. The fabricated hybrid systems are used for photocatalytic and photoelectrocatalytic decomposition of organic pollutants such as dyes and phenol derivatives.

The third direction of the studies is focused on the third generation of solar cells based on nanostructural ZnO (nanorods and nanoplates) sensitized with low band-gap semiconductor nanoparticles (CdS, CdSe) or composites containing conducting polymer and fullerene derivatives.

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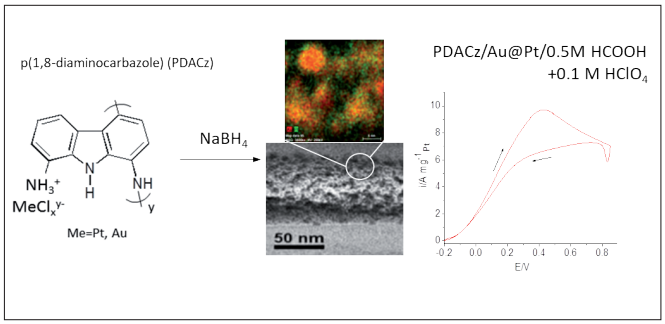
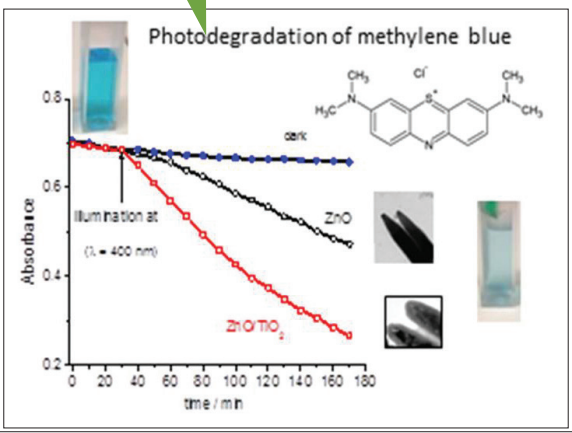
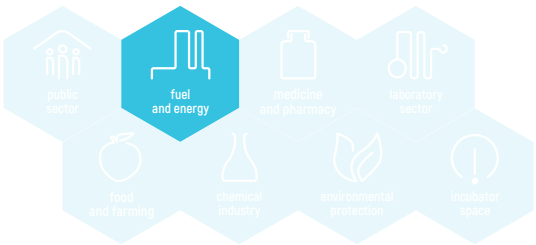


Development of organic-inorganic hybrid systems of increased catalytic activity in formic acid electrooxidation.

Development of nanostructural photocatalytic hybrid systems based on metal oxides (ZnO/TiO_2) for degradation of organic pollutants in visible light.



- FTIR measurements of liquid and solid samples in the range of 4000 – 180 cm^{-1}
- UV-vis measurements in the wavelength range 190 – 3100 nm in transmission and reflection modes
- Cooperation in the field of:
  - hydrothermal synthesis and characterization of new materials
  - electrochemical, photoelectrochemical and photocatalytic studies of nanomaterials and hybrid systems preparation and characterization.



PLANT PHYLOGENY AND EVOLUTION GROUP

TEAM LEADER

Professor Krzysztof Spalik

Author or co-author of nearly 40 scientific papers on ecology, evolution and plant taxonomy, and more than 40 Polish-language publications on popular science, teaching (school textbooks), and educational research; Chairman of the Committee of Environmental and Evolutionary Biology of the Polish Academy of Sciences; recipient of the Ministry of National Education Award for habilitation and the Polish Academy of Learning Award for the best school textbook; winner of the "Academic Teacher of the Year 2013" plebiscite in the category of science at the University of Warsaw.

We work on the phylogeny, evolution, biogeography and taxonomy of Apiaceae, a family of flowering plants that includes many important crops (carrots, celery, parsley, fennel, etc.), spices (cumin, caraway, aniseed, coriander, etc.) and those used in traditional medicine (many species of Ferula, fennel, etc.). Essential oils and oleo-gum-resins of Apiaceae contain many biologically active compounds that are of potential medicinal use. The knowledge on the evolutionary relationships within the family is therefore of great practical importance for bioprospecting.

We are currently conducting the following research projects:

1. phylogeny and taxonomy of the genus Ferula, comprising species providing valuable oleo-gum-resins such as asafoetida, galbanum, ammoniacum, and sagapenum;
2. phylogeny and evolution of tribe Daucinae, including carrots (Daucus) and several genera of medicinal plants (Laserpitium, Laser, Thapsia and others);
3. evolution of Apiaceae pollen in the context of applying fossil palynomorphs for the calibration of the molecular tree of the family;
4. evolution of secondary woodiness in Apiaceae subfamily Apioideae;
5. evolution of pseudantial inflorescence in Apiaceae subfamily Apioideae.

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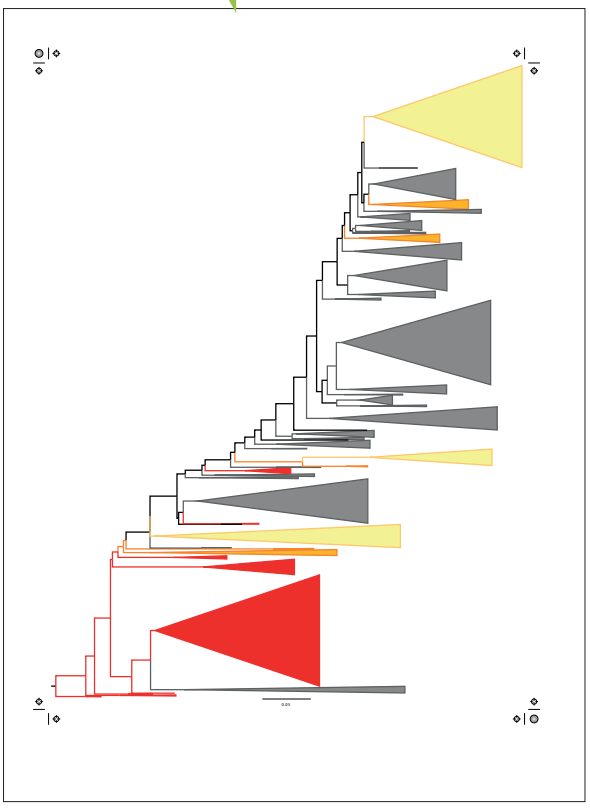
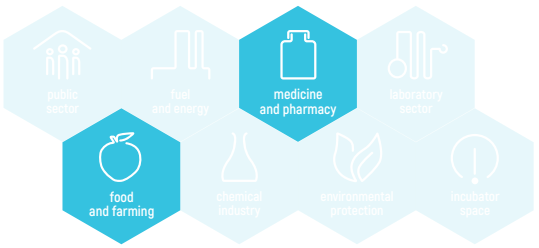
- Identification of fresh and herbarium specimens of Apiaceae
- Identification of the palynological material of Apiaceae
- Identification of plant samples using molecular barcodes

New classification systems of several tribes, subtribes and genera of Apiaceae subfamily Apioideae based on molecular trees.





BIOGEOCHEMISTRY, ECOLOGY AND ECOSYSTEM CONSERVATION

TEAM LEADER

Małgorzata Suska-Malawska

Ph.D., D.Sc.

She is the author or co-author of numerous original scientific papers, one book and five chapters in books (in English), several popular science publications, and EU reports. Scientific expert in the EC for the framework programme (FP7) IncoNet Eastern Partnership, Inconet Central Asia Countri, Member of the Working Group for ERA NET within the Programme Committee SC5: Climate action, environment, resource efficiency and raw materials. Leader of numerous national and international science projects. Leader/coordinator and participant of numerous scientific excursions to, among others, Central Asia (Kazakhstan, Uzbekistan, Mongolia).

We conduct research in the fields of: ecology and ecosystem conservation, species/population ecology, biogeochemistry and environmental toxicology. The group is composed of seven interdisciplinary research teams, specialised in the following fields:

- Biogeochemistry and environmental toxicology (M.Mętrak, Ph.D & M. Suska-Malawska, Ph.D., D.Sc.) – biogeochemical control over the functioning of terrestrial ecosystems; processes of chemical degradation of the environment,
- Ecology and toxicity of cyanobacteria (I. Jasser, Ph.D., D.Sc.) – occurrence, diversity and ecophysiological properties of toxic and non-toxic cyanobacteria,
- Vertebrate ecology (M. Brzeziński, Ph.D., D.Sc. & J. Jedlikowski, Ph.D.) – ecology of vertebrate communities and invasive species; behavioural ecology of wetland birds,
- Plant ecology and biogeography (P. Pawlikowski, Ph.D & Professor B. Sudnik-Wójcikowska) – ecology of peat-forming, aquatic, steppe and grassland ecosystems, biogeography of environmental islands,
- Land-plant ecology (M. Wódkiewicz, Ph.D., D.Sc. & H. Galera, Ph.D.) – plant ecology; morphological and genetic diversity of island populations,
- Plant ecology and nature conservation (W. Kotowski, Ph.D, D.Sc. & E. Jabłońska) – ecology and restitution of plant communities (peatlands, river valleys) and their links with habitat gradients,
- Random uncertainty in biological studies (T. Wyszomirski, Ph.D) – treatment of statistical uncertainties in research practice.

Assessment of changes in species diversity and soil characteristics in wetland and halophyte plant communities in the Eastern Pamir (Tajikistan), with special focus on type of water supply. Mętrak M., Chachulski Ł., Dovutsho D., Pawlikowski P., Rojan E., Sulwinski M., Suska-Malawska M. 2017. Nature's patchwork: How water sources and soil salinity determine the distribution and structure of halophytic plant communities in arid environments of the Eastern Pamir. PlosOne. DOI 10.1371/jour- nal. pone.0174496.

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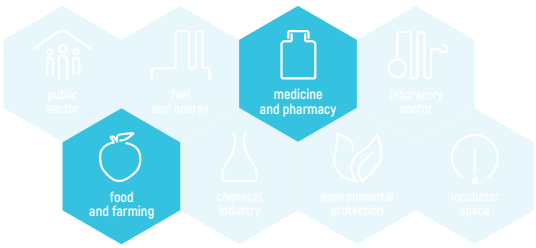
- Laboratory for Biogeochemistry and Environmental Conservation (LBiOŚ) specialises in performing spectral analysis (FAAS, ICP MS) of the elemental composition of soil, water, sediments and biological materials. Moreover, using LC QTOF MS; GC MS techniques, performs analyses of organic (e.g. soil lipids) and toxic substances in environment (e.g. organochlorine pesticides, cyanotoxins, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs)).
- The Experimental Ecology Laboratory (LED) includes testing facilities for experiments involving the cultivation of plants under controlled conditions (phytotrons), analysis of soil seed bank (greenhouses), and analysis of DNA variability (molecular laboratory). The laboratory conducts analyses of inter- and intrapopulation morphological, phenological and genetic variability.



LABORATORY FOR PHYSICOCHEMISTRY OF MATERIALS

TEAM LEADER

Professor
Robert Szoszkiewicz

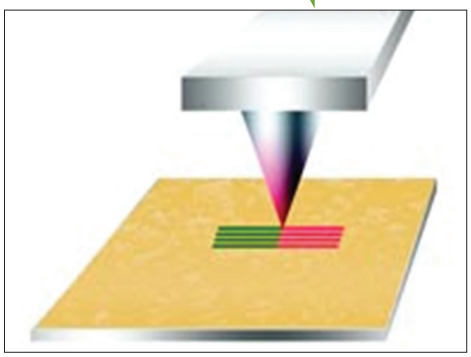
I am a material physico-chemist, the main inventor of the thermochemical nanolithography method. I have dealt with and I have been involved in physical and chemical characterization of arbitrary surfaces mainly by methods of atomic force microscopy. Examples of such research include studies of friction and viscosity of individual water layers at micro- and nano-scale, and research into the adhesion, friction and abrasion of engineering materials at micro- and nano-scale. At present, at the Faculty of Chemistry of the University of Warsaw, at CNBCh, I focus on micro and macro-scale surface research of selected 2D materials such as MoS_2 for future applications in the electronics and energy industries. Nevertheless, I have also substantial research experience in nano-mechanical characterization of individual biological objects such as proteins, and I plan to develop such research as well in CNBCh.

Our current research focuses on the application of atomic force microscopy methods to

- measure nano-mechanical properties of nano- and micro-objects such as single molecules of selected proteins, as well as
- modify the physico-chemical properties of surfaces of 2D materials such as MoS_2 at the nano- and micro-scale.

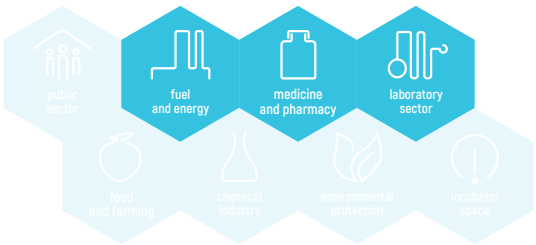
For our research we also use other modern methods of studying materials at local scales, including selected lithography methods, methods of electron microscopy (SEM, TEM), methods of chemical composition analysis, such as energy-dispersive X- ray spectroscopy (EDS), local Raman spectroscopy, and other methods. The members of the team are employees of the Faculty of Chemistry of the University of Warsaw.

TCNL is a lithographic technique based on atomic force microscopy capable of modifying chemistry and topography of virtually any sample. The essence of this method is that it induces a chemical reaction on the sample surface by heating the sample locally to temperatures of several hundred degrees Celsius and with a resolution of tens of nanometers or less. The TCNL method was originally developed for producing local changes in the water repellency of selected polymeric materials, but was later also used in many other applications including forming conductive nano-wires on graphene oxide surfaces due to their thermal reduction. In my laboratory at CNBCh, I intend to extend the use of the TCNL method to include local, heat-induced chemical modifications of thin MoS2 crystals to provide an understanding of processes of oxidation and formation of thermally induced defects in the surface structure of these crystals.



OFFER

Atomic force microscopy in non-contact and contact modes for a very wide range of materials ranging from flexible, soft and elastic biological materials such as single molecules of DNAs, RNAs, cell membranes and their substitutes, protein layers and protein/peptide films, and ending with typical engineering materials.



INTERDISCIPLINARY LABORATORY OF ARCHAEOMETRIC RESEARCH

TEAM LEADER

Barbara Wagner

Ph.D., D.Sc.

2013: Faculty of Chemistry, University of Warsaw, 2012: Second degree education award for a lecture "Instrumental analysis in the protection of monuments"

2002: Faculty of Chemistry, University of Warsaw, PhD of Chemistry (Award of the Committee of Analytical Chemistry of the Polish Academy of Sciences for the best doctoral thesis in the field of analytical spectrometry in 2002)

2002: University College London Centre for Sustainable Heritage, London, course: Science and technology of the environment for sustainable protection of cultural heritage

1998: International Centre for the Study of the Preservation and Restoration of Cultural Property, Rome, course: Non-destructive and Micro-destructive Analytical Methods for the Conservation of Works of Art. and Historic Buildings

1995: Faculty of Conservation and Restoration of Works of Art of the Academy of Fine Arts in Warsaw, Master of Arts with honours.

The Interdisciplinary Laboratory of Archaeometric Research specializes in interdisciplinary investigations of works of art and archeological objects related to:

- learning about old technological processes;
- identification of artistic materials;
- studies on provenance, and detailed chemical characterization of analysed objects (including
- evaluation of average and local elemental composition, as well as research focused on visualization of distribution

Interdisciplinary Laboratory of Archaeometric Research carries out a number of joint research and development projects with archaeologists and conservators, having the ability to conduct analyses based on micro-quantities of collected material from objects. When any sampling, even of the smallest amount of material, is not advisable, then access to a portable X-ray Fluorescence Spectrometer (p-XRF) allows the measurements of objects that cannot be transported to the laboratory.

OFFER

Bruker's XRF TRACER SD-III portable X-ray fluorescence spectrometer enables elemental analysis in the Mg-Pu range. X-ray tube with anode Rh can operate within the voltage range up to max. 45 kV and current beam from 2 to 25 µA. The analysis can be carried out in field conditions at ambient temperatures from -10°C to 50°C. Application of a pump running continuously, enables increasing of the analytical sensitivity for light elements.

- Determination of the elemental composition of solids
- Physico-chemical research of historic objects
- Micro-invasive laser sampling for isotopic and elemental investigations
- Micro-destructive analyzis of glass objects, pigments and ceramics using mass spectrometry
- Non-invasive determination of elemental composition using XRF method

STRUCTURAL AND BIOCHEMICAL RESEARCH LABORATORY

TEAM LEADER

Professor
Krzysztof Woźniak

Professor Krzysztof Woźniak, F CPSE, Faculty of Chemistry of the University of Warsaw, and Biological and Chemical Research Centre University of Warsaw Expert in X-ray structural and experimental research, X-ray quantitative studies on electronic density.

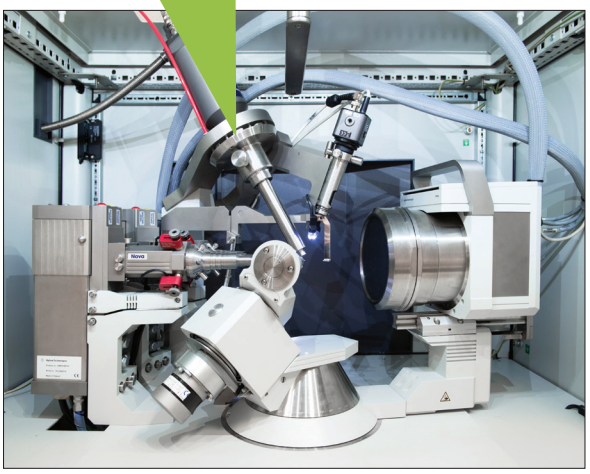
CV: doctorate (1992), habilitation (1998) – Faculty of Chemistry, University of Warsaw; postdoctoral (1993-1994) and sabbatical (2014) stays at the Department of Chemistry of Cambridge University (UK); Head of the Crystallochemistry Laboratory (2008- onwards) and Laboratory of Structural Research at the Faculty of Chemistry of the University of Warsaw (from 2007 onwards), Laboratory for Structural and Biochemical Research at Biological and Chemical Research Centre (powinna byc angielska nazwa skoro wszystko inne jest po angielsku) University of Warsaw (from 2016-). Co-chairman (2016-2018) and chairman (2018-2021) of SIG2 of the European Crystallography Association, chairman of the Scientific Council of the Pharmaceutical Institute in Warsaw (from 09/2017-), full professor appointed by the President of Poland since 2002, approx. 10 scientific internships abroad and more than 25 measurement sessions at various synchrotron and neutron centers; more than 30 grants, including MAESTRO FNP, MAESTRO NCN, Team Tech Core Facility FNP; >65 invited lectures (conferences and in the various research centers) throughout world; 18 supervised PhDs, H=36, >5560 citations, >350 publications in peer-reviewed scientific journals, invited participant of the 21st Solvay Conference (2007); from 2015 onwards, Fellow of ChemPubSoc – Society of European Chemical Societies.

Crystallographic Group (CG) of Professor Krzysztof Woźniak conducts structural research (and studies of electron density) for crystals of organic and inorganic compounds. In particular, we examine crystals of compounds of pharmaceutical significance (or potential significance), compounds of biochemical or biochemical significance, supramolecular chemical compounds (rotaxanes, catenanes, macrocyclic complexes of the d and f electron metal ions, crystals of model compounds used for X-ray methodological research, minerals and inorganic compounds, etc.). The aim of most of our studies is to find a correlation between the internal structure of crystals and the properties of quantitative distribution of electron density in crystals, as well as the macroscopic properties of crystals (physical, chemical, pharmaceutical, biochemical, etc.), to develop new approaches in diffraction methods of X-ray analysis of solids, and to introduce and test new methodologies in diffraction studies aimed at estimating the accuracy and precision of these methods, and to study the processes of crystallization of organic and inorganic compounds.

OFFER

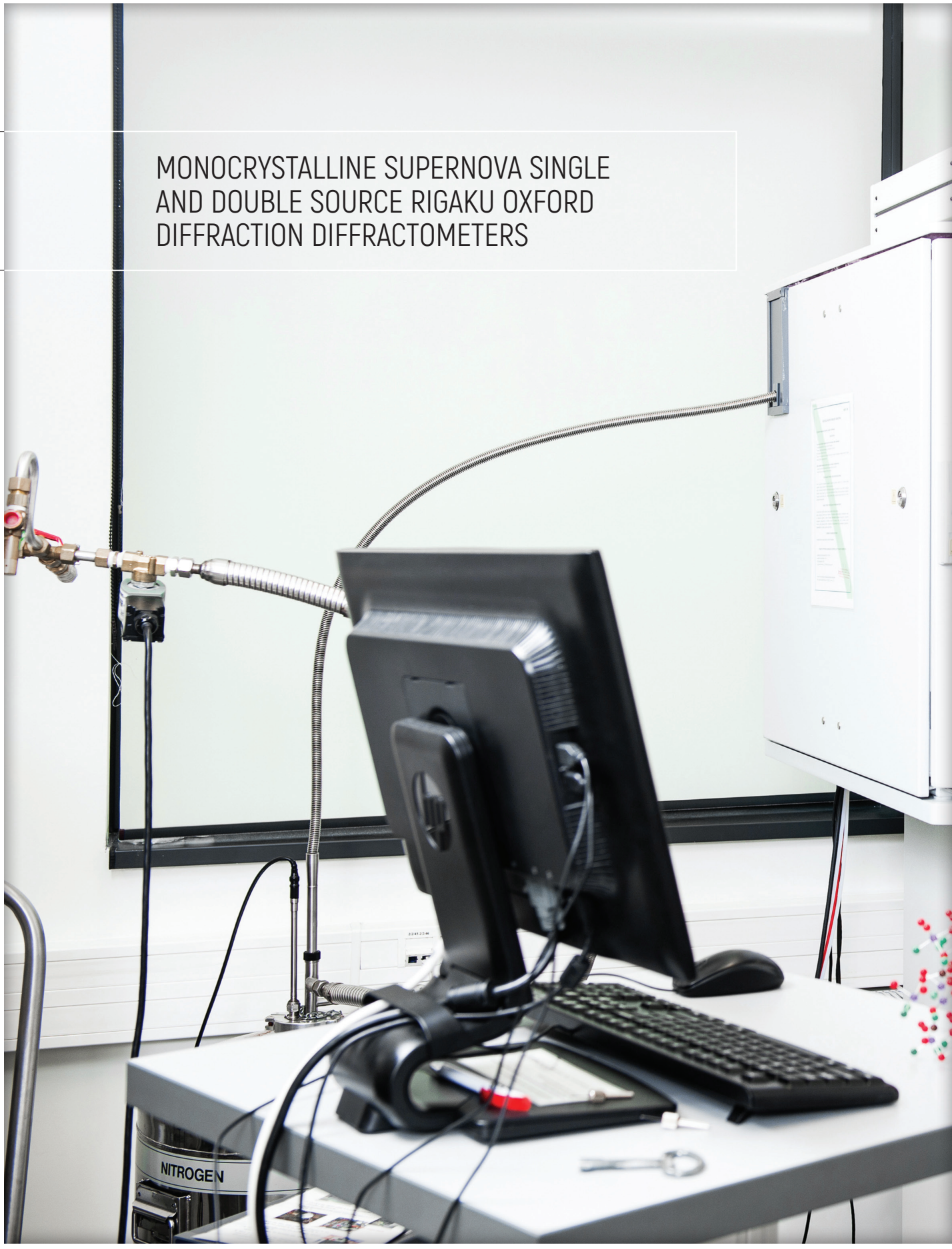
As a result of a TEAM-TECH Core Facility grant obtained in February 2018' from the Foundation for Polish Science (www.fnp.org.pl), "Core Facility for crystallographic and biophysical research to support the development of medicinal products" (CFCB, https://cfcb.uw.edu.pl) has been established at the Biological and Chemical Research Centre under supervision of Professor Krzysztof Woźniak (Head) and Jan Kutner, Ph.D. (Deputy Manager). The mission of the new Facility is focused on analysis of proteins and small chemical compounds (molecules) leading to crystallization trials for academic and commercial users. The project enables the studies of challenging biochemical and pharmaceutical problems, with emphasis on drug development and collaboration with the local research groups.

As a special achievement of the last a few years, we consider demonstration that Hirshfeld Atom Refinement utilizing aspherical atomic scattering factors and based on X-ray diffraction data only allows for precise and accurate localization of positions of hydrogen atoms in crystals even in the case of close proximity of heavy atoms. (Woińska et al. Sci. Adv. 2016; 2 : e1600192).



- Determination of structure and experimental electron densities of crystals of organic and inorganic compounds,
- Crystallization of proteins and their complexes, studies of the strength and character of their interactions
- Determination of crystal structures under high pressure.
- Crystallization of small molecule crystals and studies of polymorphism and phase transitions in crystals
- Crystallization of proteins
- Biochemical and biophysical analysis
- Ligand or Protein Binding Assays
- Quality Check and Optimization
- Preliminary Diffraction Data Collection (in house)

MONOCRYSTALLINE SUPERNOVA SINGLE AND DOUBLE SOURCE RIGAKU OXFORD DIFFRACTION DIFFRACTOMETERS



TEST APPARATUS

- Equipped with different sources of X-rays (Mo, Cu, Ag);
- Structuring and experimental study of the electron density of organic crystals, organometallic and inorganic low molecular weight chemicals, including pressure tests and temperature tests

MYCOLOGICAL LABORATORY

Marta Wrzosek

Ph.D., D.Sc.

Julia Pawłowska

Ph.D.

Marta Wrzosek: author or co-author of several articles and chapters on the diversity, evolution and ecology of fungi; in 2012-2016 President and presently spokesperson for the Polish Mycological Society; author of numerous publications and programs popularizing knowledge about fungi; leader and co- ivestigator of the National Science Centre grants.

Julia Pawłowska: author or co-author of several articles and chapters on the diversity, evolution, phylogeny and taxonomy of fungi; Secretary of the Polish Mycological Society; leader and co-investigator in grants of the National Science Centre; cooperates with teams from Germany, Finland and Iran.

We deal with the ecology and evolution of various groups of fungi. The number of fungal species is estimated at up to 1 million, which is four times higher than the number of described plant species. Although many new and valuable substances used by humans are isolated from fungi and their ecological role cannot be overestimated, they still constitute a relatively little known group of organisms. Our investigations focus primarily on analysis their phylogeny and understanding the relationship between fungi and various other groups of organisms.

We are currently working on the following research topics:

1. Effect of soil contamination on the occurrence and diversity of Mucoromycota and their bacterial endosymbionts
2. Mortierellomycotina fungi as symbiotic organisms from oligotrophic habitats
3. Evolution of carbon assimilation abilities within Mucorales representatives
4. Evolution and taxonomy of Laboulbeniomycetes (Laboulbeniales)
5. The phylogeny and diversity of black yeast isolated from oil-contaminated soils
6. Investigating the diversity of microscopic fungi in soil from the Antarctic and the Arctic
7. Research on fungal diversity in burial soil from barrows
8. Investigating the diversity of ants – related fungi
9. Analysis of the spread of Aureoboletus projectellus in Europe

OFFER

Aureoboletus projectellus is a species of mushroom from North America, which reached Europe at the end of the 20th century. Although it initially appeared only on the south coast of the Baltic Sea, we have recently demonstrated its spread in Europe and the mass occurrences of fruiting bodies. The fungus forms mycorrhizal association with native pine species, which may pose a potential threat to native species of mushrooms.

- Molecular identification of fungi (both microscopic and mushrooms) – the sample is either a fruitbody or a fungal culture on a Petridish
- Morphological identification of fungi based on microscopic characteristics (both microscopic and macroscopic fungi) – the sample is either a fruitbody or a fungal culture on a Petridish
- Inventories of mushrooms for environmental studies
- Preparation of mycological expert opinions
- Mycological expertise for the judiciary and the police
- Consultation on edible and poisonous mushrooms
- Organisation of courses on the molecular identification of fungi

EUKARYOTIC MICROORGANISMS

TEAM LEADER

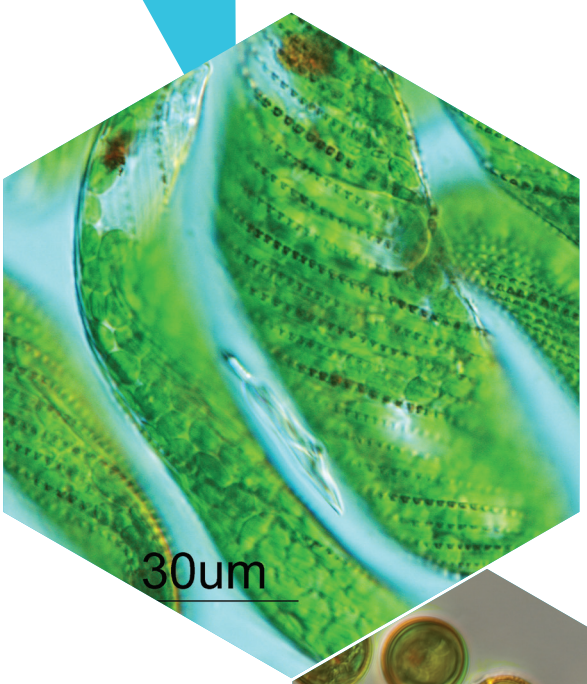
Professor Bożena Zakryś

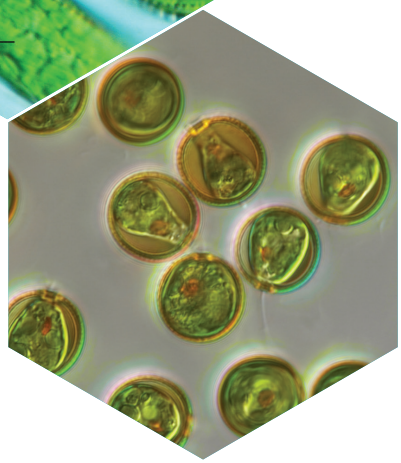
Author or co-author of nearly 50 scientific articles and chapters in books on taxonomy, phylogeny and evolution of green euglenids. Since 2000 Head of the Department of Molecular Phylogenetics and Evolution (until 2015 named the Department of Plant Systhematics and Geography); winner of many individual and team awards from the Rector of the University of Warsaw for her scientific achievements; awarded the Silver Cross of Merit for her teaching achievements and organizational activity at the University of Warsaw; manager and contractor of many Polish (KNB, MNiSW, NCN), American and Spanish research projects.

- Systematics, phylogeny and evolution of green euglenids. We try both to get to know the diversity of these organisms by isolating new species from the environment, microscopic observation and molecular studies, and to reconstruct the affinity relations between them by construction a reliable phylogenetic tree with as many taxa as possible. So far, only 10% of species are represented on phylogenetic trees, which is why the relationship between taxa is poorly known.
- Molecular identification. We have developed a universal, rapid and accurate method of molecular identification of taxa (DNA barcodes). This will make it possible to monitor water bodies for the biodiversity of euglenids, including species capable of generating toxic blooms.
- Origin and evolution of unconventional introns. In the euglenid nuclear genes, in addition to conventional spliceosomal introns present in most eukaryota, there are unconventional introns, removed regardless of the spliceosome. We study origin, mechanism of removal from original transcripts and mechanisms for placing unconventional introns in new positions in nuclear genes.
- Origin, evolution and loss of function in secondary chloroplasts in euglenids and Dictyochophyceae. Using genomic and transcriptomic data we examine the origin of secondary chloroplasts, first stages of endosymbiosis, evolution of chloroplast genome structure and evolutionary changes associated with loss of photosynthesis.
- Genomics of anaerobic eukaryotic microorganisms of the Metamonada and Acetosporea groups.
- Biological treatment of water contaminated by industrial wastewater. Green euglenids do not only tolerate well the presence of high concentrations of heavy metals and various toxic substances in the environment, but are also capable of accumulating them. We are carrying out research into the treatment of mining waters contaminated with arsenic compounds using euglenids.

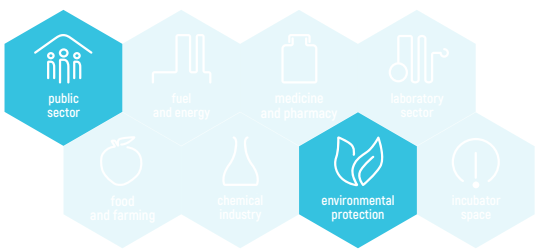
OFFER

Morphological, molecular and environmental studies made it possible to reconstruct the phylogeny, reconstruct the evolution of morphological features and numerous taxonomic changes in the group of autotrophic euglenids; the result was a modern system of their classification. A method of molecular identification (DNA barcode) of this group of organisms in the environment was also developed.





- Identification of toxic euglenid species in farm fishponds
- Environmental expertise, in particular algae in industrial wastewater (sugar, dairy, heavy metal-polluted).
- Algae consultations on the conservation of monuments and construction (complexes of algae developing on plasters, roof slates, sandstone elevations and other building materials).
- Consultations on de novo sequencing, combining and annotations of organellar genomes and nuclear genomes of eukaryotic microorganisms.
- Consultation on phylogenetic and phylogenomic analyses.



TEST EQUIPMENTS

The scientific potential of the University of Warsaw Biological and Chemical Research Centre combines specialized scientific staff and high class measuring equipment.

NAME	APPLICATION
Light isotope analyser (IRMS) DELTA V Plus	Determination of isotopic ratios: H/D, 13C/12C, 15N/14N, 18O/16O, 34S/32S in solid and liquid samples
Flow Analyzer (CFA) model SAN++	Flow analyzer for simultaneous analysis of ammonium nitrogen, nitrates, nitrites and phosphates in water
DMA-80 Mercury analyzer	Direct measurement of mercury, without mineralization using acids, in solid and liquid samples
Organic carbon analyser TOC/TN multi N/C 3100	Analysis of total organic carbon and total nitrogen in waters and total organic carbon in solid samples
Soxtec extraction apparatus 2055	Solvent extraction using a modified Soxhlet extraction technique, determination of soluble substances, inter alia, in soil and food
Automatic peptide synthesizer Activo-P1	Peptide synthesis in a wide range of synthesis scales, choice of purity degree. Synthesis of linear and cyclic, modified peptides. Syntheses of peptidomimetics. Synthesis of peptides together with the characteristics of the final product. Scale: from 0.05 to 2.0 mmol
Liquid chromatograph with mass detector Q-TOF 1260/6540, HPLC-QTOF MS/MS	Qualitative and quantitative analysis of complex mixtures of chemical compounds
Clarus 680 gas chromatograph model SQ8C with flame-ionization detector (FID) with auto-sampler	Qualitative determination of volatile organic substances. Clarus 680 gas chromatograph model SQ8C with flame -ionization detector (FID) with auto-sampler. The apparatus is equipped with an autosampler for 108 vials. Possibility of operation in split-splitless and on-column mode. The EI spectra recorded can be compared with spectra library NIST 2012. The instrument is used for routine GC/MS analysis. Spectrometer mass detection range: up to 1200 Da, maximum furnace temperature: 450 °C. Attachments: chiral column and column used for the analysis of high-polarity organic compounds
Gas chromatograph for separation and detection of alcohol oxidizing products in the fuel cell 7890A	Analysis of alcohols, organic acids and aldehydes. Equipped with FID and TCD detectors. In combination with a fuel cell test kit for quantitative analysis of alcohol oxidation products in the fuel cell depending on the catalyst used and operating conditions of the cell. Enables automatic analysis of gas products electrochemical reactions
Gas chromatograph combined with high resolution mass spectrometer with GC Q-TOF MS/MS flight time analyzer	Qualitative and quantitative determination of volatile organic substances. Separation of volatile components of liquid samples, recording of the high resolution mass spectra of the components. Execution of MS/MS spectra - information about the structure of compounds.

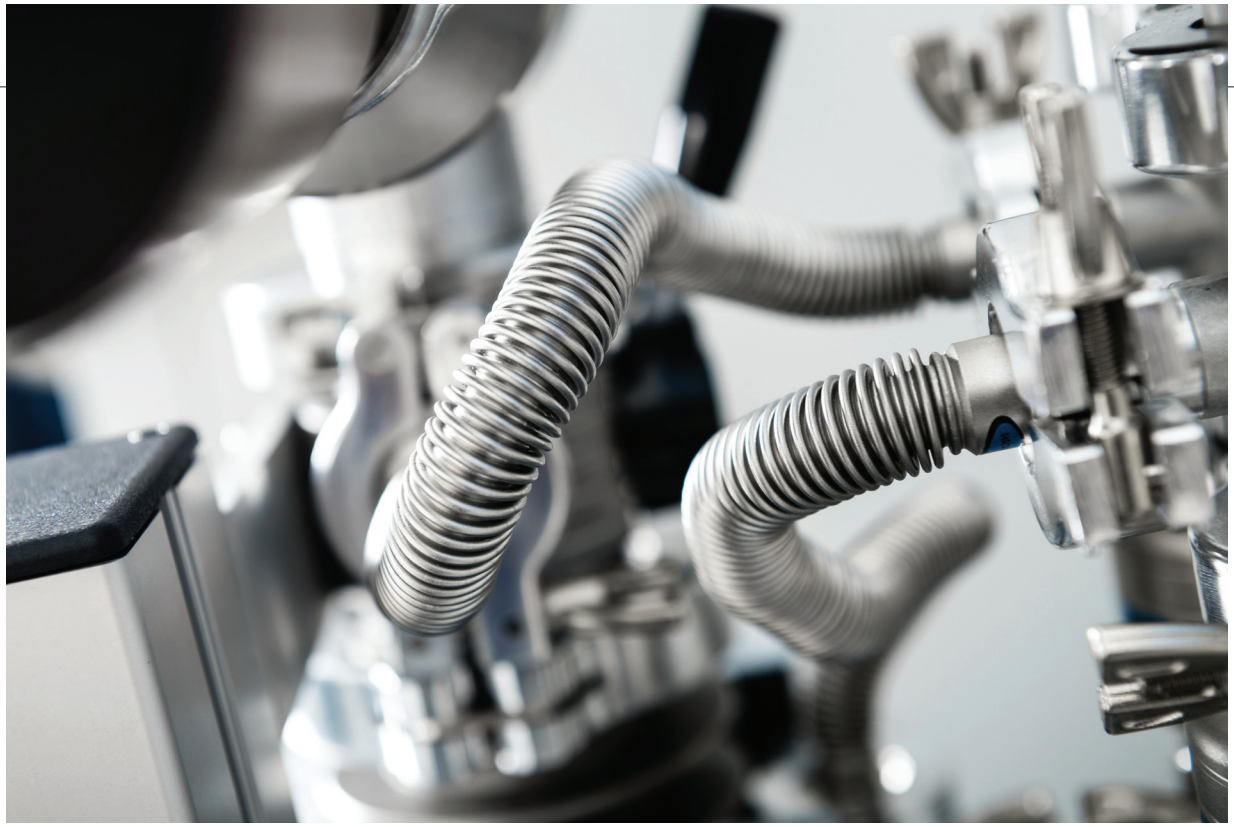
The commissioned studies are handled by:

Research and Development Office of the CNBCh UW
e-mail: wspolpraca@cnbc.uw.edu.pl
tel.: +48 22 55 26 711, +48 22 55 26 535

Gas chromatograph with mass detector GC EI Q-TOF MS 7890B/ 5977A / CTC	Qualitative and quantitative analysis of complex mixtures of chemical compounds
Kjeltec 8200 Distillator with mineralization block and Titrator Nitrogen apparatus	Kjeldahl nitrogen and protein apparatus. After prior mineralization, Kjeldahl nitrogen is determined in solid and liquid samples
SuperNova Single and Double Source Rigaku Oxford Diffraction monocrystalline diffractometers	Equipped with various X-ray sources (Mo, Cu, Ag). Structuring and experimental study of the electron density of organic and inorganic crystals of low molecular weight chemical compounds, including pressure and temperature tests
Capillary electrophoresis 7100 with mass spectrometry QqQ MS/MS 6460	Separation of the components of chemical mixtures. Examination of biological, medical and food samples. Analysis of liquid samples. Separation of the mixtures of chemical compounds. Identification of the constituents of liquid samples, determination of the exact molecular weight of the analysed substances, info. on a molecular structure (MS/MS spectra). Quantitative and qualitative analysis of forms of a given element. Attachments - Syringe pump and liquid chromatograph
Incubators, chambers and boxes for breeding	Cultivation in strictly controlled conditions. Studies and tests requiring constant temperature, humidity and illumination
VIGOcam thermal imaging camera v640	Thermographic images (photograph, film) with the possibility of obtaining an absolute temperature measurement for each pixel of the image
Computing Cluster	High-performance computing cluster and parallel programming-based algorithms significantly reduce the time required for calculations in biomodeling, bioinformatics, biochemistry and molecular biology
HPGe Coaxial Semiconductor Detector	Detection of ionising radiation
Quadrupole mass spectrometer with ionisation in inductively coupled plasma ICP-MS NexION 300D	Determination of the total content of selected elements in liquid and solid samples (after mineralisation). Multi-elemental analysis of traces of selected elements in samples of various origins. ICPMS tests allow simultaneous multi-elemental and/or isotopic analyses at different concentration levels with high precision and accuracy.
Lyophilizers	Lyophilisation of unstable aqueous solution compounds
Scanning microcalorimeter SN 20131, SN 20132	Module 1: Measurement of mixing , dilution, dissolution enthalpy and equilibrium constants. Module 2: Measurement of Cv and phase shifts in fixed volume liquid systems, measurement of Cp and phase shifts under constant pressure, measurement of thermal expansion coefficient of liquid systems

TEST EQUIPMENTS

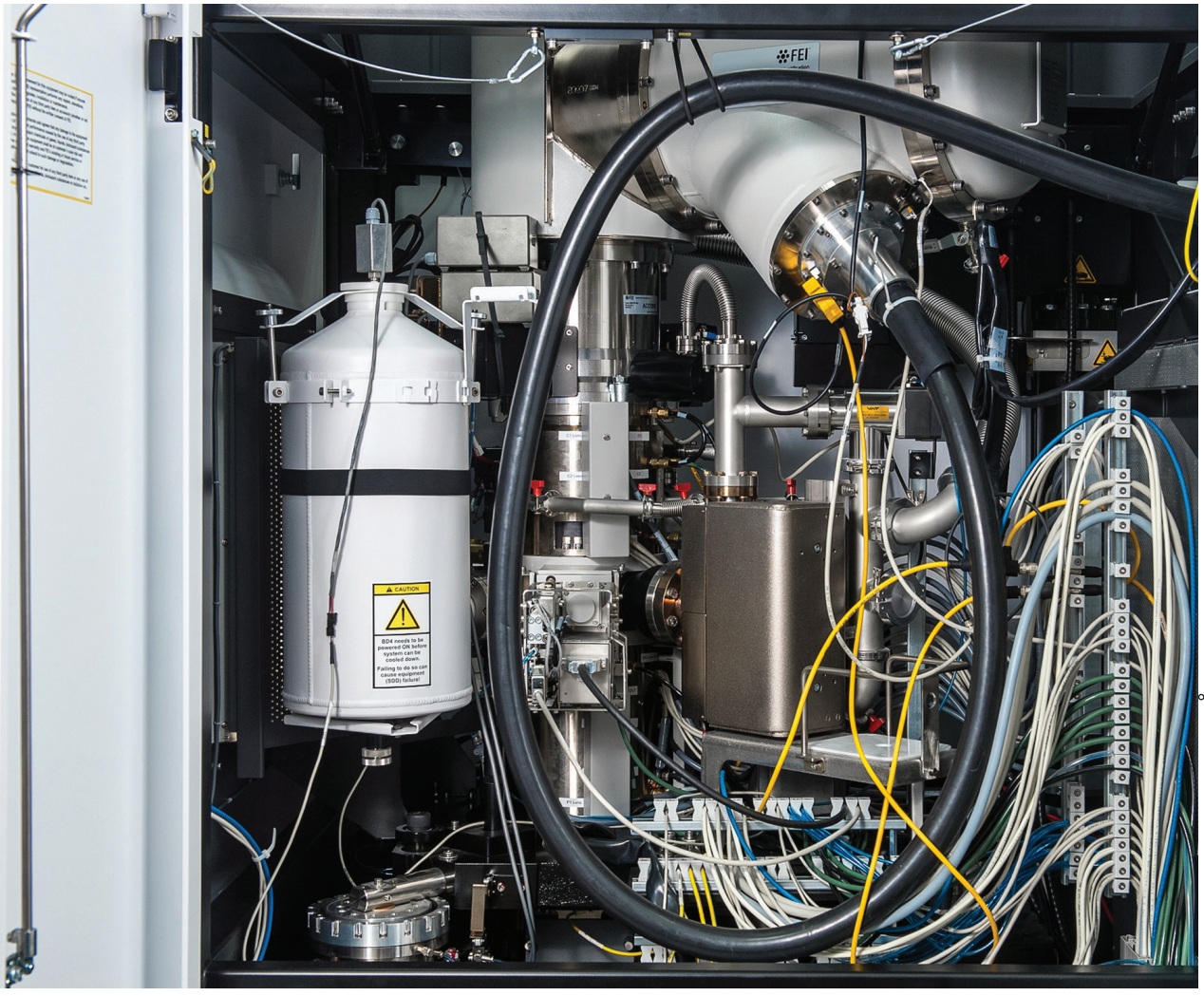
Atomic Force Microscope (AFM) Dimension Icon	Surface imaging of soft and hard solids (inorganic and organic layers). Surface topography tested in air and liquids. Information about the topography of the tested surface, mechanical, electrical and magnetic properties
Optical microscopes	Observation of objects in zoom
Mineralogical Electromagnetic Separator Frantz Isodynamic L-1	Separation of fine particles with different magnetic potential
Ionising radiation radiometer RKP-100	Measurement of the activity of ionising radiation
X-ray photoelectron spectrometer (AXIS Supra)	Integrated with the secondary ion mass spectrometer (TOF.SIMS 5). The set is dedicated to research aimed at determining the qualitative and quantitative composition of the tested materials.
Scanning electron microscope FIB SEM	Observation of surfaces of various materials with resolution up to 0.7 nm in STEM and 0.9 nm SEM mode
Spectrofluorometer	Registration of emission and excitation spectra
Spectrophotometer for measuring DNA, RNA, proteins with microscope	Spectrophotometric measurement of DNA, RNA and proteins
LAMBDA UV-VIS spectrophotometer 650	Analysis of transition metal ion solutions and organic compounds in liquid samples. Recording of UV VIS spectra of chemical substances. Qualitative and quantitative determination of elements in liquid samples
UV-VIS spectrophotometer Specord 200 PLUS	Determination of chemical compounds in the test sample
UV-VIS-NIR 3600 spectrophotometer	Transmission and reflection spectra of liquid and solid samples. Equipment of the device in the integration sphere enables the examination of powder samples and layers with high surface roughness deposited on solid media. Measurement of spectra in the transmission and reflective mode in the wavelength range 190 nm-3300 nm. Reflecting attachment and integration sphere
Atomic absorption spectrometer AAS contrAA 700	Quantitative analysis of the elemental composition in liquid samples. Determination of elements in liquid and solid samples (after mineralisation). Two excitation sources: graphite furnace and flame, concentration determination from several mg/L
Nuclear magnetic resonance spectrometer NMR 400-MR	Measurement of NMR spectra in isotropic liquid systems. 400 MHz nuclear magnetic resonance spectrometer (NMR) for self-service measurements with "OneNMR" probe (channels: 1H/19F, 15N-31P + 2H broadband) with AS-7600 auto-sampler. Self-service mode with queuing of measurements (max 50 samples). Measurement results in the form of *.fid files for processing. In automatic mode, the following can be programmed independently for each sample: routine 1H and 13C NMR spectra, 13C DEPT, 11B, 19F, 31P spectra, correlation two-dimensional H-H and C-H spectra, tests of NOE effects and spin-spin couplings.



Nuclear magnetic resonance spectrometer NMR Agilent 600 MHz DDR2	NMR spectroscopy of proteins and nucleic acids in solutions, highly complex organic samples
Nuclear magnetic resonance spectrometer NMR Agilent 800 MHz DDR2	NMR spectroscopy of proteins and nucleic acids in solutions and solid phase
Infrared spectrometer with Fourier transformation FTIR	Infrared spectroscopy with Fourier transformation and spectrum library (FT-IR)
RAMAN spectrometer with microscope	Analytical and physico-chemical tests
UV/VIS spectrometer with DNA concentration measurement capability	Analysis of transition metal ion solutions and organic compounds
Spectroscopic imaging ellipsometer EP3-Nanofilm	Studies of interactions of various substances with model biological membranes, measurements of changes in surface tension under the influence of various compounds, imaging and measurements of layer thickness, electrochemical analysis of electroactive substances of biological and medical significance.
UV/VIS fluorescence spectroscope with video monitor	Measurement of ellipsometric parameters, thickness, refraction index and absorption of thin layers.
System for filmless autoradiography Rnplus	Autoradiography

TEST EQUIPMENTS

Two glove chamber system UNIlab 9113 and UNIlab 9111 with setfor drying and distillation of solvents MB SPS-800 UNIlab 1950/780	Working with substances sensitive to moisture or air in a controlled inert gas atmosphere. Glove chamber with solvent drying and distillation kit, MB--SPS-manual-5 model Unilab 1950/780. Equipped with a programmable autocleaning system with regeneration of the deposit. The operating temperature between +10 and -35 °C. Achievable purity of the working atmosphere inside ≤1 ppm H_2O/O_2 in a closed dynamic system. Solvent purification system in manual intake version. System with 5 solvent lines (methylene chloride, toluene, n-hexane, THF and diethyl ether) in argon atmosphere (99.999%) with working pressure of 345 mbar allowing to obtain solvents containing up to 1 ppm of oxygen and water.
Molecular imaging system of small animals Albira PET/SPECT/CT	Molecular imaging of small animals
Molecular imaging system of small animals In-Vivo MS FX PRO	Molecular imaging of small animals



Unmanned helicopter (rotorcraft) Versa X6 Optima Plus	Studies using unmanned airborne platforms with a lifting capacity up to 1 kg. Creation of orthophotomosaics, videofilming, atmospheric parameter measurements
Transmission electron microscope TALOS F200X (HR TEM)	Determination of morphology, surface structure, crystalline structure, spatial structure (tomography), defects of the crystalline network, structure of inter-phase boundaries and chemical composition of materials. The change in acceleration tension makes the microscope a research device for characterising biological materials and at the border of material engineering.
Ultra high-performance liquid chromatograph (Agilent) coupled to the spectrometer Orbitrap type detector – UHPLC-ESI-Orbitrap-MS/MS (Orbitrap Fusion Thermo)	A coupled system to analyze organic compounds and organometallic connections in biological samples. Identification of proteins.
Ultra high-performance chromatographer HPLC-2D 1260/1290 coupled with high resolution mass spectrometer and Orbitrap Fusion analyzer	Speciation analysis of selected metals in plant, pharmaceutical and food samples. Separation and identification of the components of liquid samples. Identification of biologically active compounds of selected elements extracted from plant material. Recording of high-resolution mass spectra of liquid sample components and substance masses after chromatographic separation. Execution of MS/MS spectra – information about the structure of compounds
Multisensor mass spectrometer for measuring isotope ratios (Multicollector)	Analysis of isotopic composition changes resulting from fractioning in natural systems. Application mainly in geology (e.g. determining the geological history of waters, minerals, etc.), in environmental protection (e.g. tracing/determining sources of pollution), and in studying metabolic changes in organisms.
High-performance liquid chromatograph HPLC 1260	Separation of the components of chemical mixtures. Speciation analysis of selected metals in plant, pharmaceutical and food samples. Separation and identification of the components of liquid samples. Identification of biologically active compounds extracted from plant material.
NAP Surface Analysis Kit XPS	Analysis of the composition and surface properties of materials using X-ray and UV-impact electron spectroscopy methods (XPS and UPS), with particular emphasis on testing of catalysts and nanomaterials, including testing under high pressure.
Set of hot chambers for radiochemical syntheses	Carrying out radiochemical syntheses and portioning of radiopharmaceuticals
Scribner Associates Fuel Cell Testing Kit 850e	The device is designed for complex single cell and small fuel cell stacks testing (low temperature, i.e. PEM and AFC), both hydrogen-oxygen and liquid-fuelled. It enables the determination of current and voltage characteristics, power as a function of current, direct current tests, direct voltage tests, automatic durability tests, crossover phenomenon, resistance of the cell/ stack, etc.

Computing Cluster

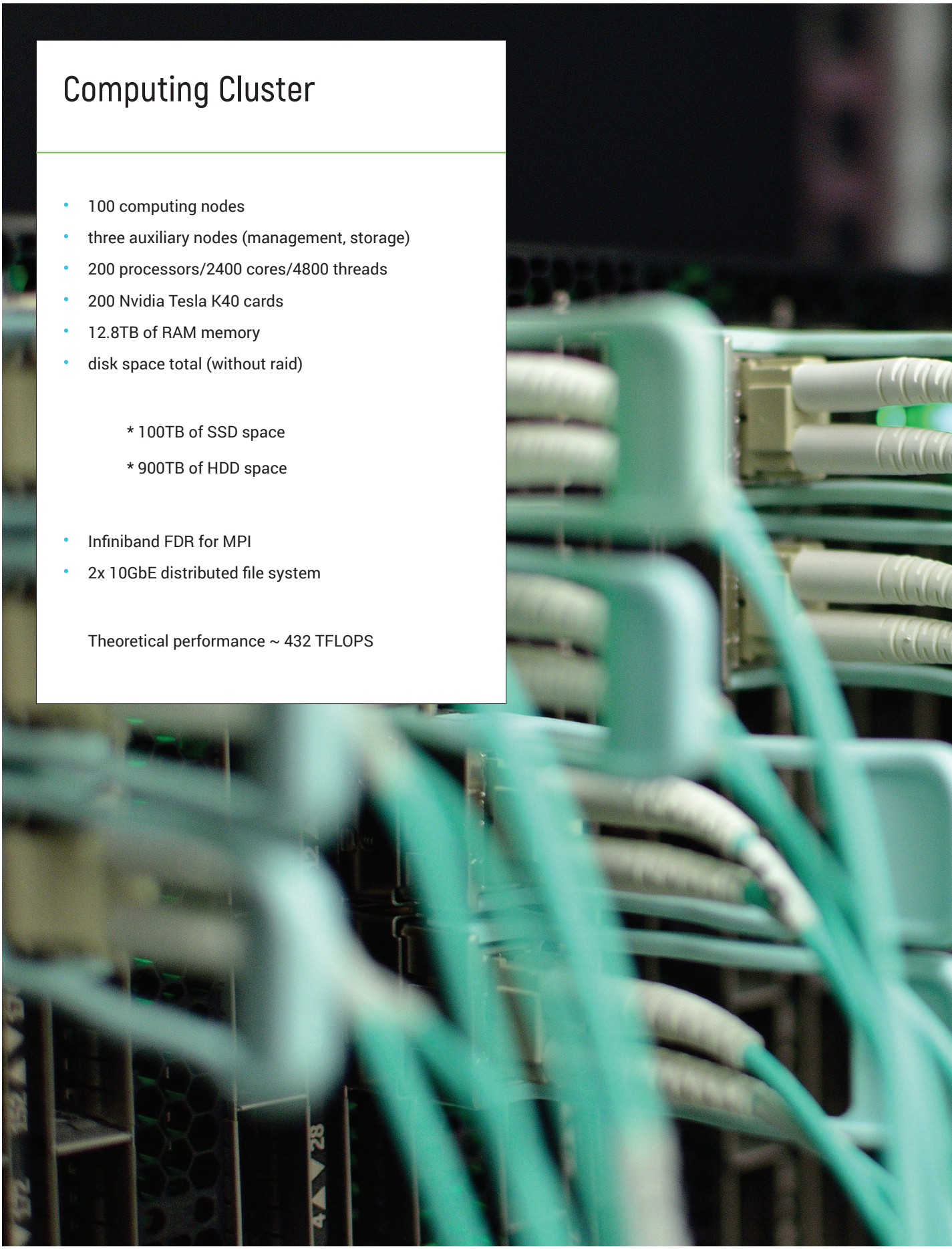
- 100 computing nodes
- three auxiliary nodes (management, storage)
- 200 processors/2400 cores/4800 threads
- 200 Nvidia Tesla K40 cards
- 12.8TB of RAM memory
- disk space total (without raid)

  * 100TB of SSD space

  * 900TB of HDD space

- Infiniband FDR for MPI
- 2x 10GbE distributed file system

Theoretical performance ~ 432 TFLOPS



Metrological laboratory

EQUIPMENT:

MICROSCALES
model: MYA 11.4Y

SCALES AND DRYER
model: MA 50.X2

LIQUID AND SOLID DENSITY KIT
model: PS 1200.X2

A COMPREHENSIVE CALIBRATION STATION
FOR PISTON PIPETTES: MICROSCALES
model: MYA 21.4Y.P
RADWAG PIPETTES – 10 µL,
20-200 µL, 250 µL, 500-5000 µL

ANALYTICAL SCALES
model: AS 220.X2

ANALYTICAL SCALES
model: XA 52.4Y

CLASS E2 MASS STANDARDS
1 mg – 200 g

CLASS F1 MASS STANDARDS
1 mg – 500 g

SPECTROPHOTOMETER
UV/VIS LAMBDA 650

room
no. 2.40

Technical supervision over the scales is exercised by RADWAG.

Contact:

Research and Development Office of the CNBCh UW.

e-mail: wspolpraca@cnbc.uw.edu.pl
tel.: +48 22 55 26 711, +48 22 55 26 535

A place of good meetings

An ideal place for scientific, business meetings, gatherings and videoconferences.

- conference table/comfortable chairs
- projector/screen
- videoconferencing infrastructure
- retractable roller blinds
- kitchenette


room
no. 0.36

Conference space

Thanks to the modern conference facilities we organize both intimate business meetings and large conferences and scientific symposiums. The CNBCh UW is a place of good meetings between science and business.

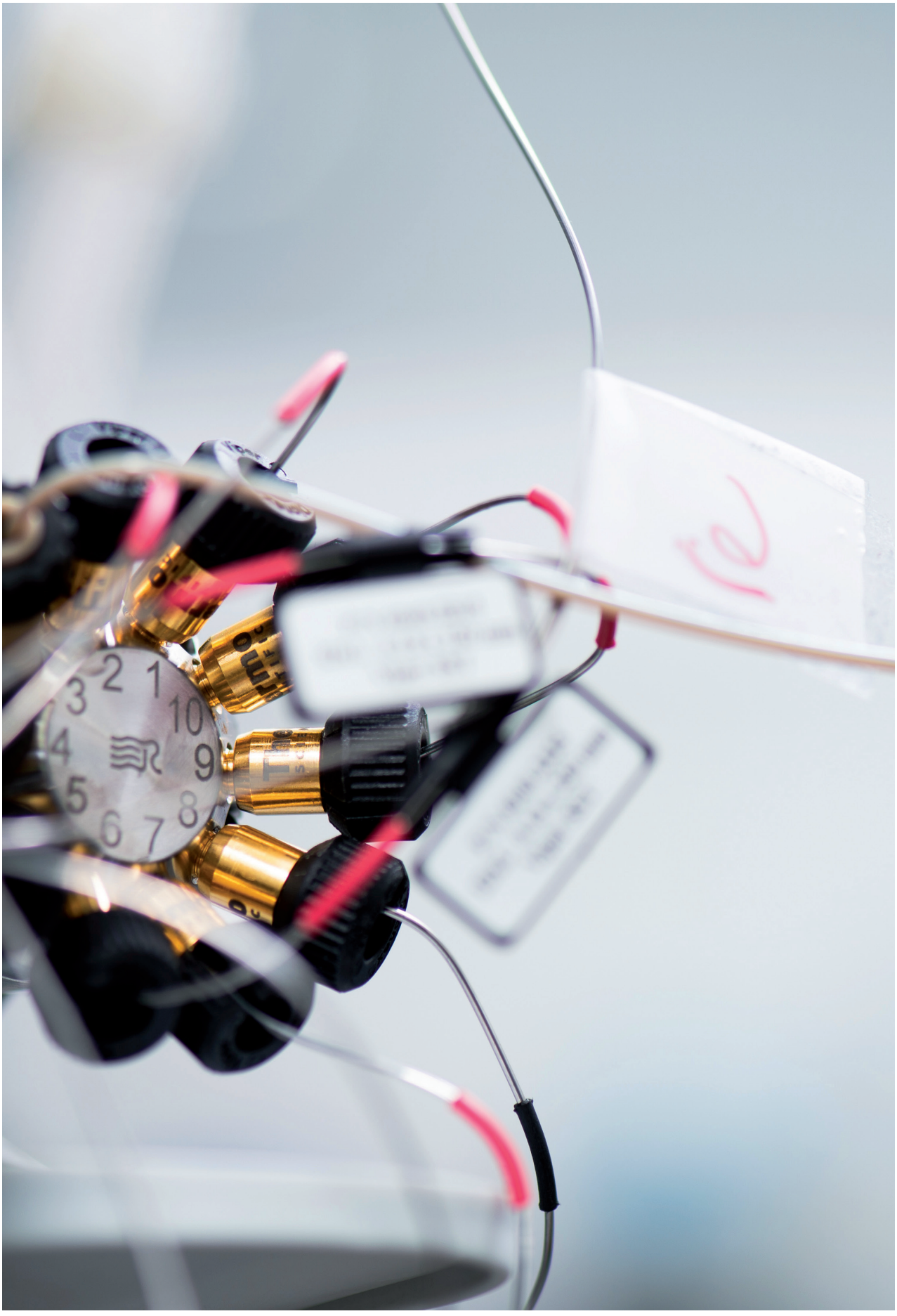
Seminar rooms

0.03	up to 40 people
0.37	up to 30 people
0.38	up to 45 people
0.109	up to 20 people
0.117	up to 20 people
2.101	up to 30 people
2.32	up to 40 people
3.29	up to 20 people
4.148	up to 30 people
4.31	up to 30 people

Lecture halls

A	112 seats
B	82 seats
C	105 seats

INDEX OF GROUPS



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Editor: Jakub Socha
Design: Anna Zagrajek
Photographs from own resources of scientists and CNBCh UW
Execution: DRUKARNIA WŁODARSKI
Warsaw 2018.