INNOVATIVE IBCH PAS

ACHIEVEMENTS AND POTENTIAL

FOUNDATION OF IBCH PAS

IBCH PAS Foundation

Ministry of Science and Higher Education
Republic of Poland

Co-financed by the "Social Responsibility of Science" program of the Minister of Education and Science

Substantive study:
Artur Górski
Adam Wronkowski

Cover design, cover pages and typesetting:
Grzegorz Wójtowicz

Author's commentary:
Prof. Adam Kraszewski
Dr. habil. Marcin Chmielewski
Dr. habil. Anna Kurzyńska-Kokorniak
Dr.Lucyna Budźko
Dr.Agata Tyczewska

Substantive consultations:
Dr. habil. Eliza Wyszko
Dr.Luiza Handschuh
Dr. Łukasz Marczak
Dr. Magdalena Otrocka
Dr. Karol Pasternak
Dr. Anna Philips
Dr. Radosław Pilarski
Dr. Łukasz Przybył
Dr. Paweł Stróżcyki
Dr. Anna Urbanowicz

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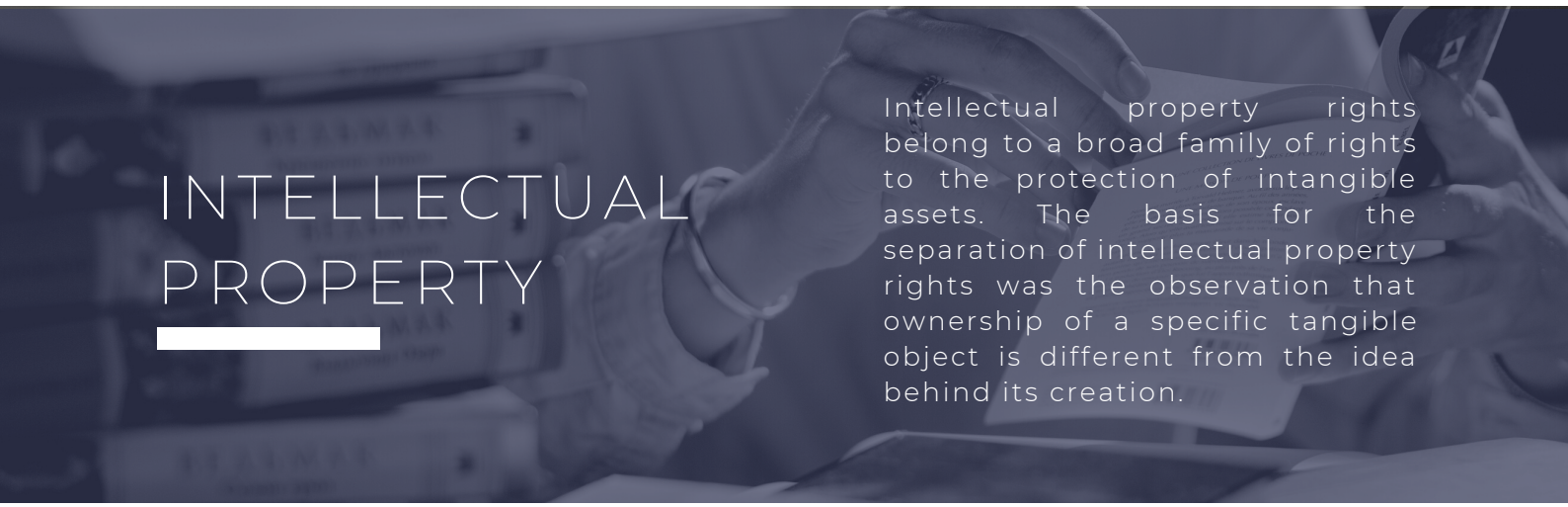
2020

TABLE OF CONTENTS



INTELLECTUAL PROPERTY

Intellectual property rights belong to a broad family of rights to the protection of intangible assets. The basis for the separation of intellectual property rights was the observation that ownership of a specific tangible object is different from the idea behind its creation.

From the entrepreneur's point of view, the key legal regulations in this area are contained in three pieces of Polish legislation: Act of 30 June 2000. – Industrial Property Law, Act of 4 February 1994 on Copyright and Related Rights and Act of 16 April 1993 on Combating Unfair Competition.

On the other hand, an invention is a technical solution that is aimed at satisfying practical needs by means of new ways of influencing the matter or using its properties, which provides, in a complete and comprehensive fashion, the rules of conduct guaranteeing the achievement of the intended result[1].

However, for an invention to be patentable, it must meet the following additional conditions: novelty, inventive step and industrial applicability. An invention is considered new if it does not form part of the state of the art (Article 25(1) of the IPL). An invention shall be considered as involving an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art (Article 26(1) IPL). An invention shall be considered as susceptible to industrial application, if by means of that invention a product may be produced or a process may be used, in a technical sense, in any kind of industry, including in agriculture (Article 27 of IPL)[2].

The mere acquisition of a patent for an invention is, in principle, an intermediate link, as the premise of industrial applicability already suggests that the target state is to implement it in production. On the one hand, obtaining a patent for an invention ensures the protection of the invention (an exclusive right for a period of up to 20 years) and, on the other hand, it causes the object of protection to be disclosed (for example, through publicly available registers) and to be transferred to the public domain after the expiry of protection. The patent protection is a costly process, the more so the greater the territorial scope of protection. The need to use the invention in business activities is, therefore, noticeable, which will make it possible to compensate for the expenditure in creating the invention and protecting it.

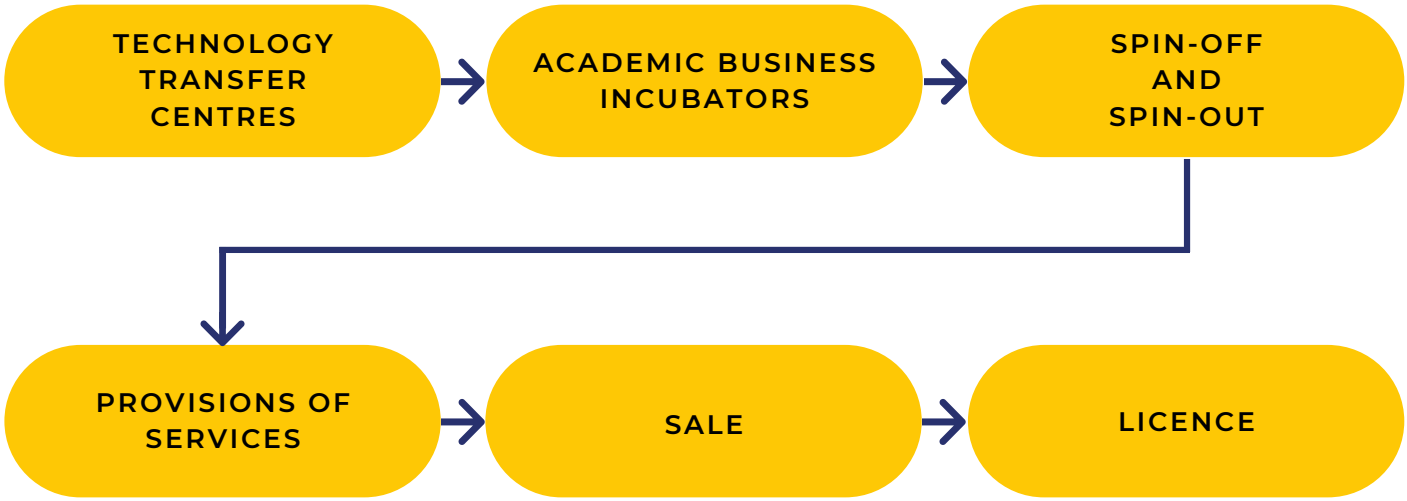
It is worth bearing in mind that, even if the solution does not meet any of the conditions necessary to obtain a patent (or is not patentable for other reasons), it does not mean that it cannot be legally protected. Such solutions may be know-how and protected by the provisions of the Act on Combating Unfair Competition.

[1] M. Rutkowska-Sowa, Prawo patentowe [in:] J. Sieńczyło-Chlabicz (ed.), Prawo własności Intelektualnej, Warszawa 2018, p. 562
[2] Act of 30 June 2000 - Industrial Property Law (Journal of Laws (Dz.U) of 2020, Item 286).

FROM IDEA TO PRODUCT

COMMERCIALISATION

Entities governed by Act of 20 July 2018 – Law on Higher Education and Science, implement the transfer of innovations into the business sector (commercialisation) in various ways.



Naturally, the above statement is only indicative and not exhaustive. The sale of the intellectual property rights is a solution that guarantees the broadest control of an invention for the buyer that is a business entity. However, it involves a greater risk as well as requires a proper valuation, which can be challenging. The new solution may be priced too high (profits from the sale will not even cover the costs of its acquisition and protection). Therefore, a licence agreement seems to be a safer solution, as it usually envisages a percentage of a cyclical licence fee (in relation to revenue or income). Spin-off entities are separate entities (e.g. special purpose vehicles), using the resources of the parent entity, differing primarily in the degree of association with the scientific or research institution[3].

[3] P. Malinowski, P. Stec, Organizacyjno-prawne aspekty komercjalizacji [in:] P. Stec (ed.), Komercjalizacja wyników badań naukowych, Warszawa 2017, p.248-254

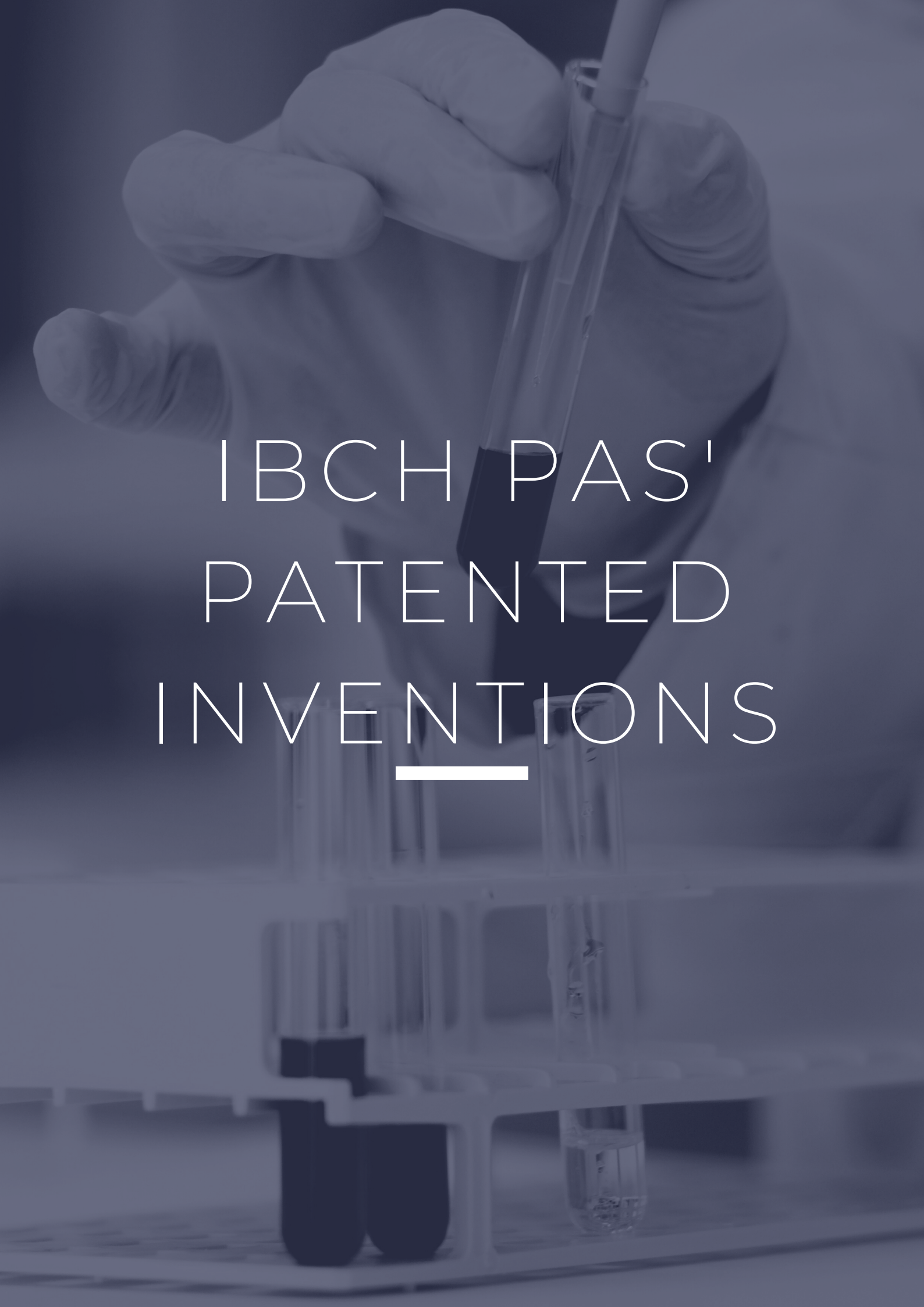
FROM IDEA TO PRODUCT

COMMERCIALISATION

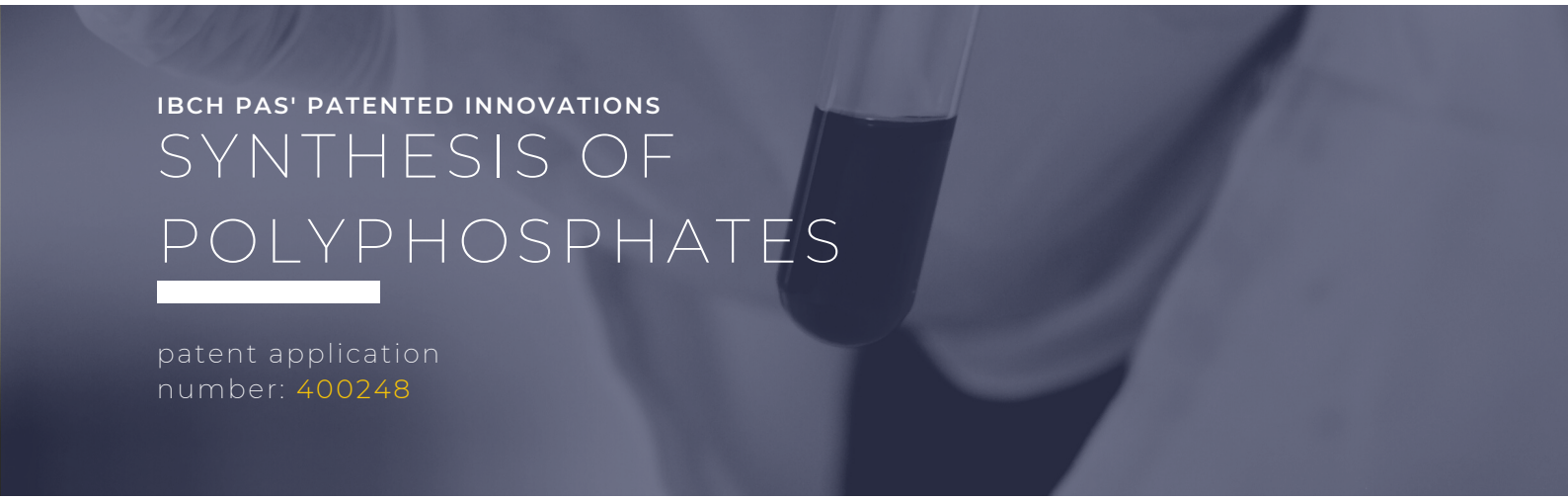
An increasingly popular form of obtaining funding for the implementation of innovative solutions is the so-called crowdinvesting. It is a related concept based on crowdfunding - one of the forms of the sharing economy which has been gaining significant popularity in recent years. Crowdinvesting consists of taking up shares in companies in exchange for financing – in fact, it helps to create or recapitalise them, often for specific benefits. It is, therefore, an instrument that supports, rather than eliminates, the traditional institutions, including in particular a stock exchange. In the broad terms, the following crowdinvestment models can be identified: equity (equity and stock) – based on the acquisition of shares in a company in exchange for the money invested in it; revenue-based – in which the investment entitles you to a percentage of the return on the sale over a given period; royalty-based (based on royalties and fees) – a twin of the above, focused mainly on creativity, i.e. music, books; real estate crowdfunding – investing in real estate, an alternative to the construction project financing systems; ICO (initial coin offering) – a way of making the company go public using cryptocurrency[4].

Regardless of the legal form of commercialisation, it should be pointed out that the possession of intellectual property rights in a company's assets has a significant effect on its market position. This phenomenon is a natural consequence of the requirements from the market. It places an emphasis on products and services that are increasingly technologically advanced. Moreover, the transformation of the economy to industry 4.0 will not succeed without the increasing intensity of cooperation between science and business.

[4] B. F. Malinowski, Crowdfunding udziałowy dla startupów (i nie tylko), https://wethecrowd.pl/ecf.



IBCH PAS' PATENTED INVENTIONS



IBCH PAS' PATENTED INNOVATIONS

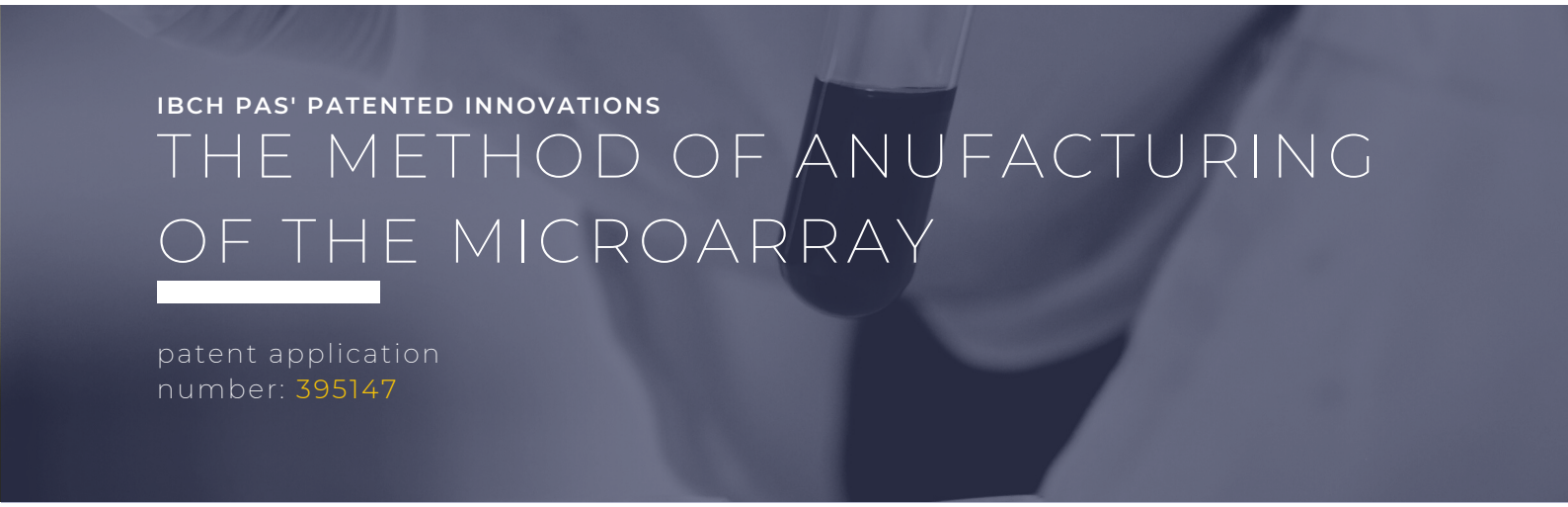
SYNTHESIS OF POLYPHOSPHATES

patent application number: 400248

The invention is used in the process of obtaining triphosphate analogues of many biologically important compounds, such as nucleosides or oligonucleotides. These compounds are subject to large-scale research and development activities, demonstrating the application potential for organic chemistry, molecular biology and biotechnology.

The polyphosphate analogues are highly biologically active compounds, which are responsible for the distribution and storage of energy in living organisms. Moreover, one of the most practical applications of the invention is the use of triphosphate analogues as substrates in the PCR reactions to multiply the DNA matrix by polymerase.

Currently, a growing interest in new effective methods of obtaining triphosphate nucleoside analogues can be observed. The most widely used biological search methods consist in the degradation of the native DNA. On the other hand, the alternative methods are highly time-consuming and expensive and the quality of their product is unsatisfactory. None of these disadvantages apply to the method developed by the IBCH PAS.



IBCH PAS' PATENTED INNOVATIONS

THE METHOD OF ANUFACTURING OF THE MICROARRAY

patent application number: 395147

This invention makes it possible to obtain microarrays that are particularly capable of binding oligonucleotides, proteins and other bio-particles, which are used, among other things, in basic research, diagnosis and the search for new medicines.

The microarray technology is a key tool used in the chemical combinatorial analysis of interactions between bio-particles, such as proteins or nucleic acids. It thus enables the rapid, easy and parallel detection of the addressed specific interactions between thousands of probes in a single experiment.

The advantage of the invention is the obtaining microarrays that are cheaper to manufacture thus allowing experiments to be carried out with more repetitions, which increases the accuracy, precision and efficiency of the experiments.

IBCH PAS' PATENTED INNOVATIONS

RIBONUCLEASE DICER INHIBITOR

patent application number: 384455

Ribonuclease Dicer belongs to endoribonucleases, which specifically cut the double-stranded RNA particles. MiRNAs play an extremely important role in regulating gene expression, especially in such processes as cell differentiation and proliferation, maturation, apoptosis or neoplastic transformation.

The aim of the invention was to select the RNA aptamers specifically binding human ribonuclease Dicer, which is one of the main enzymes involved in the biogenesis of the miRNAs, and then to select the molecule that affects the activity of the enzyme.

There are many examples showing that RNA aptamers can be successfully used as regulators of processes in living organisms. Some of them have already been introduced as medicines, for example in the treatment of the macular degeneration. Studies have found a reduction of Wilms' tumour (nephroblastoma) in mice.

IBCH PAS' PATENTED INNOVATIONS

PEPTIDE WITH THE ENZYMATIC ACTIVITY OF A DICER-LIKE PROTEIN AND ITS APPLICATION TO THE PRODUCTION OF THE SHORT RNA MOLECULES

patent application number: 395495

Eukaryotic organisms have the ability to generate short RNA molecules, which are involved in regulating the gene expression, which occurs in many important physiological processes, such as cell proliferation and differentiation as well as the programmed cell death. It is also present in pathological processes, such as carcinogenesis, viral infections and neurodegenerative processes.

In recent years, short RNA molecules have been used increasingly widely, both in biology and medicine. Techniques using these molecules are applied both for the cognitive purposes (to study the gene function) and the practical purposes (to obtain beneficial functional characteristics in plant and animal organisms).

The invention makes it possible to produce short RNA molecules much cheaper than using other solutions available on the market, since the relevant protein can be produced both in the eukaryotic system and in an extremely efficient prokaryotic system. This system also allows obtaining a preparation of unprecedented purity.

IBCH PAS' PATENTED INNOVATIONS

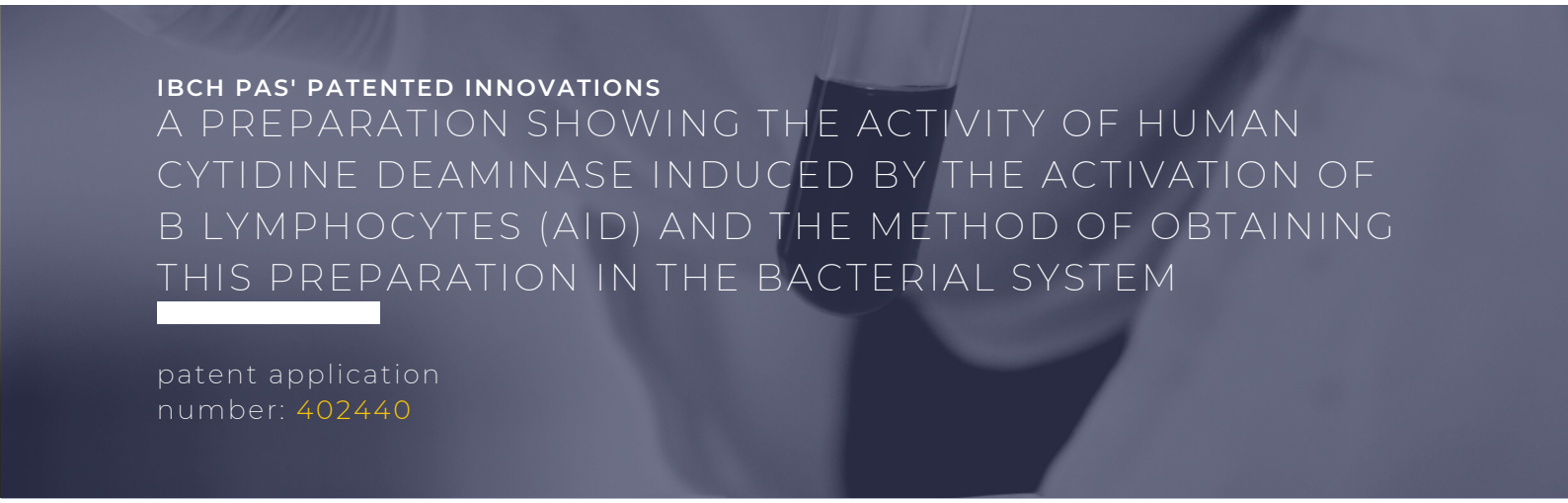
METHOD OF OBTAINING 3-(4-HYDROXYPHENYL) PROPANOIC ACID AMIDE

patent application number: 377747

The subject of the invention is a method of synthesis of 3-(4-hydroxyphenyl)propanoic acid amide, which can be used in the cosmetics and pharmaceutical industries. 3-(4-hydroxyphenyl)propanoic acid amide has a number of biological properties. Low-molecular compounds contained in plant juices are very important for the growth and development of plant shoots.

There is a constant need to obtain an optimal way of obtaining the described amide with the highest possible efficiency of the process.

The aim of this invention is to provide a method that can be used for the synthesis of 3-(4-hydroxyphenyl)propanoic acid amide, allowing its further use in the cosmetics and pharmaceutical industries.



IBCH PAS' PATENTED INNOVATIONS

A PREPARATION SHOWING THE ACTIVITY OF HUMAN CYTIDINE DEAMINASE INDUCED BY THE ACTIVATION OF B LYMPHOCYTES (AID) AND THE METHOD OF OBTAINING THIS PREPARATION IN THE BACTERIAL SYSTEM

patent application number: 402440

Cytidine deaminase induced by B lymphocyte activation (AID) is the key protein involved in the process of antibody differentiation. As a result of the activation of B lymphocytes in the presence of the antigen, a secondary differentiation of genes encoding immunoglobulins occurs. The role of AID in providing a correct autoimmune response is very important (there are serious immunological disorders with people with a mutated version of AID). The AID probably also takes part in genome demethylation.

The aim of the invention is to obtain a modified human AID gene, which enables the production of an active enzyme in the bacterial system. A unique element of the proposed solution is the modified human AID gene. The proposed solution will make it possible to develop specific AID inhibitors, which will be used in the treatment of diseases associated with increased levels of AID expression, such as certain cancers, hepatitis C virus or Epstein-Barr virus infections. Due to its high performance, the proposed method has a measurable commercial potential. No commercial products with such activity are currently available.

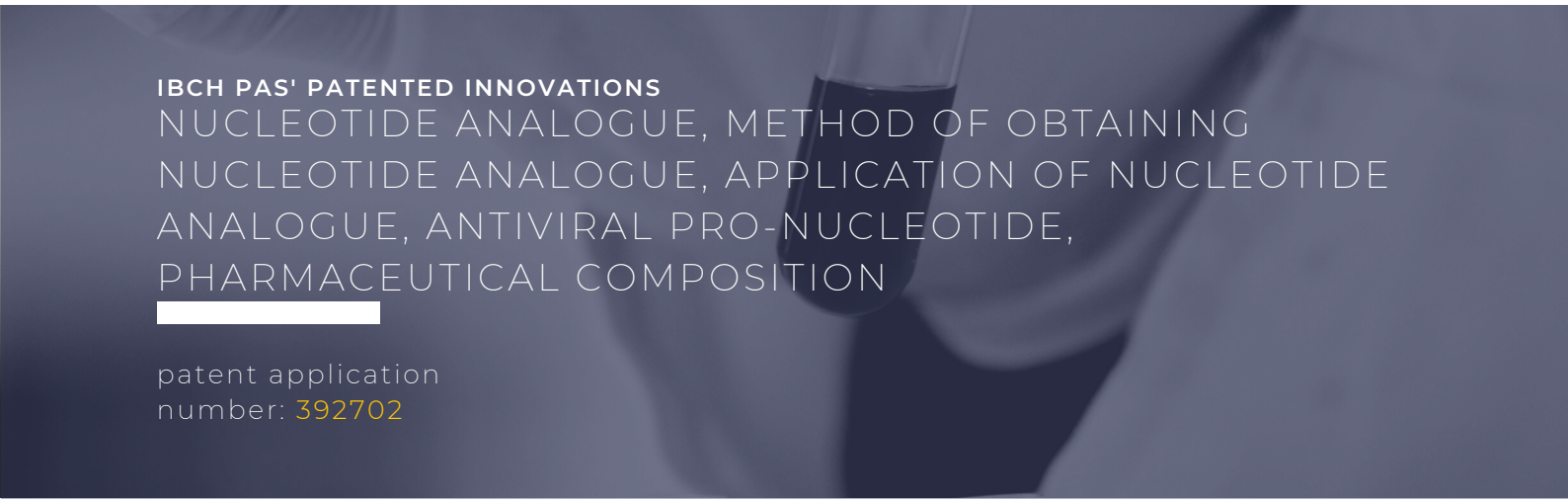
IBCH PAS' PATENTED INNOVATIONS

CYTOSINE ANALOGUE AND ITS APPLICATION IN THE TREATMENT OF DISEASES WITH THE UNDERLYING DNA METHYLATION DISORDERS

patent application number: 390769

Gene expression and genome stability are controlled by an epigenetic mechanism. One of its elements is a methylation pattern characteristic for a given organism, determined at the stage of embryonic development and unchanged during life. The accurate reproduction of this pattern during subsequent cell divisions is a condition for the proper development and functioning of the organism. Changes in the methylation pattern associated with lowering or increasing the methylation level are described for many cancers. The reversibility of the epimutations makes them an attractive therapeutic objective in the treatment of cancer.

There is a need to create effective DNA methylation modulators, which could be used in the prevention and treatment of diseases associated with disorders of the DNA methylation level, such as cancer or hematopoietic proliferative disease. The aim of this invention is to obtain various cytosine derivatives as therapists for treating cancer.



IBCH PAS' PATENTED INNOVATIONS

NUCLEOTIDE ANALOGUE, METHOD OF OBTAINING NUCLEOTIDE ANALOGUE, APPLICATION OF NUCLEOTIDE ANALOGUE, ANTIVIRAL PRO-NUCLEOTIDE, PHARMACEUTICAL COMPOSITION

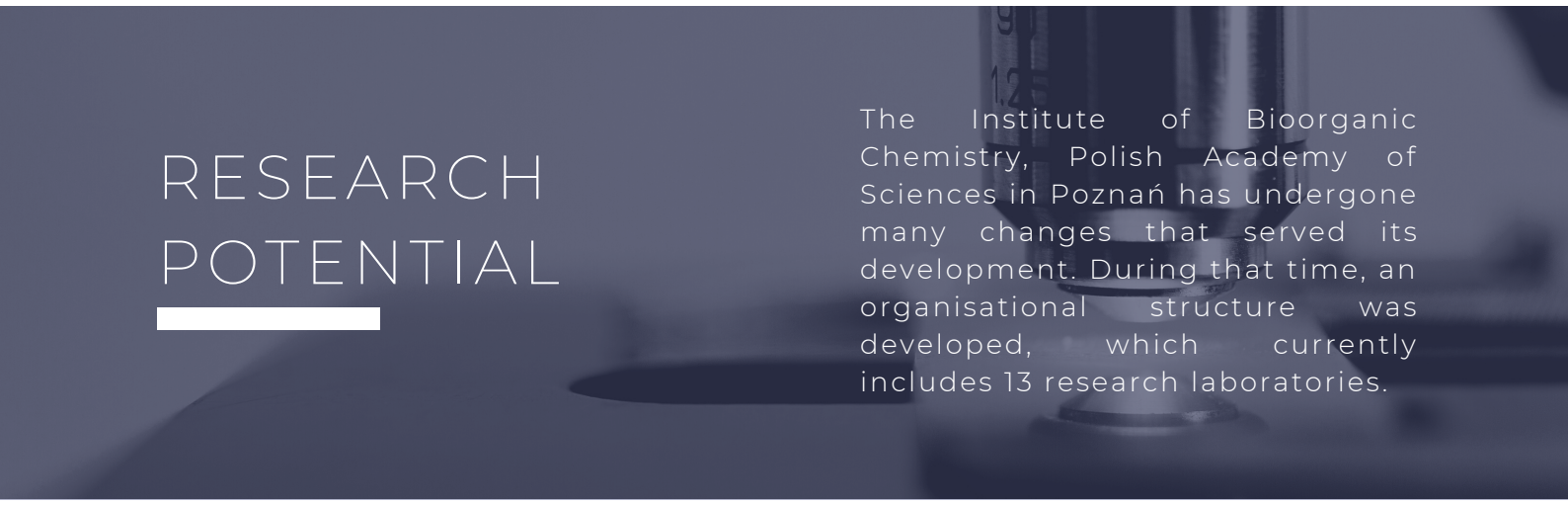
patent application number: 392702

The invention concerns a new group of nucleotide derivatives and their use in inhibiting, partially or completely, the multiplication of the human immunodeficiency virus (HIV). It has been proved that antiviral pro-nucleotides need not be amino acid derivatives. The derivative test for simple amines tested had the same or better pharmacokinetic parameters compared to the analogous amino acid derivative compounds.

Despite the many existing solutions using nucleotide derivatives as compounds for the treatment of viral diseases, there is a continuing need for an effective solution to create pharmaceutical compositions containing compounds that would be water-soluble, while exhibiting the same or higher activity compared to the baseline nucleoside, and at the same time have low toxicity. The aim of this invention is to find effective compounds which constitute a new group of nucleotide derivatives whose physicochemical properties and the anti-HIV pharmacokinetic parameters would be better in comparison with the nucleoside analogues from which they are derived. The invention concerns compounds which would be pro-nucleotides, containing no chiral centres of the phosphorus atom, on which the transformation of pro-nucleotide to the relevant nucleoside-5' phosphate could depend.

The compounds obtained by their developers constitute a new group of nucleotide derivatives whose cytotoxicity was superior to that of the AZT and ddU nucleosides (from which they originated) and whose anti-HIV activity was comparable to that of these nucleosides. They are certainly pronucleotides, i.e. they penetrate the cells as nucleotide derivatives, which have proved the activity of ddU derivatives. The latter fact, and their very good solubility in water, as well as their extremely low cytotoxicity with the antiretroviral activity retained, make these compounds more beneficial as potential HIV therapies compared to those used so far in AIDS therapy.

IBCH PAS' RESEARCH POTENTIAL



RESEARCH POTENTIAL

The Institute of Bioorganic Chemistry, Polish Academy of Sciences in Poznań has undergone many changes that served its development. During that time, an organisational structure was developed, which currently includes 13 research laboratories.

The laboratories are grouped into three centres:

The Structural Biology Centre:

- Laboratory of Subcellular Structures Analyses
- Laboratory of Protein Engineering
- Laboratory of Biomolecular NMR

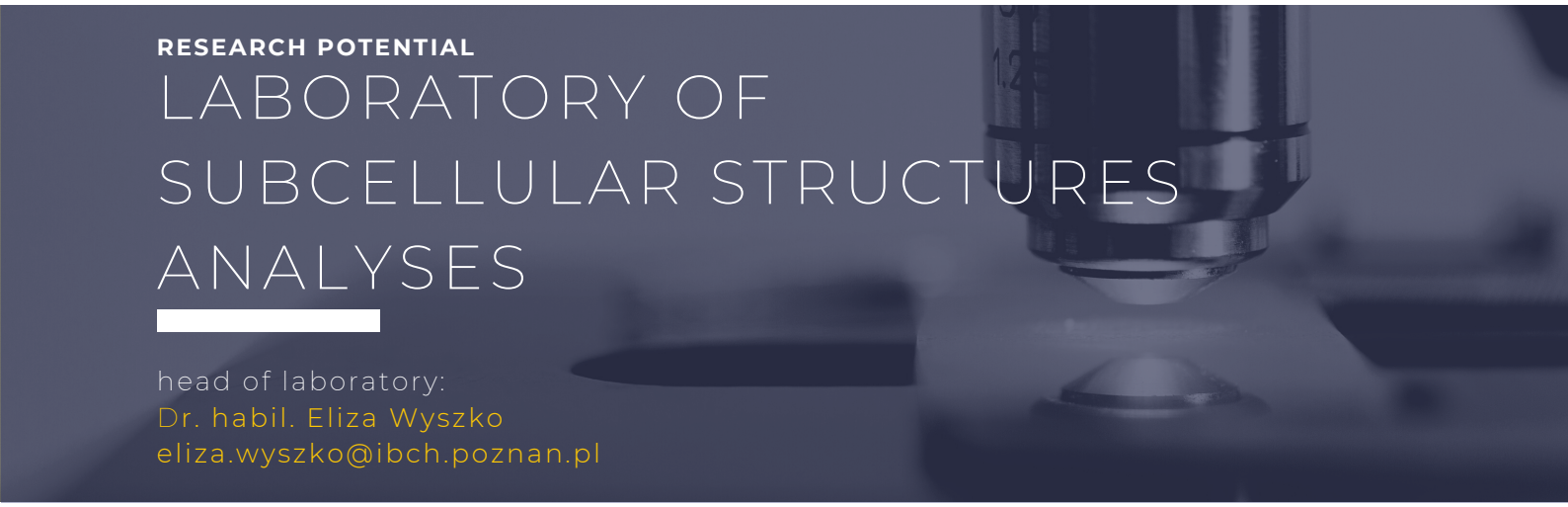
Multi-omics Centre:

- Laboratory of Genomics
- Cell and Tissue Culture Laboratory
- Laboratory of Animal Model Organisms
- Laboratory of Mass Spectrometry

High-throughput Screening Centre:

- High-throughput Screening Laboratory
- Nucleic Acid Derivative Synthesis Laboratory
- Laboratory of Molecular Assays
- Functional Transcriptomics Team

The laboratories have the appropriate equipment and specialised personnel at their disposal to support the scientific and research activities arising from the Institute's internal needs. The extensive apparatus facilities also allow for the provision of commercial services to the interested private entities. Both of the above-mentioned aspects make up the research potential of the Institute of Bioorganic Chemistry, Polish Academy of Sciences, which will be presented in this chapter on the basis of the equipment available to the laboratories together with the offer of its use as well as the scientific staff resource.



RESEARCH POTENTIAL

LABORATORY OF SUBCELLULAR STRUCTURES ANALYSES

head of laboratory:
Dr. habil. Eliza Wyszko
eliza.wyszko@ibch.poznan.pl

The Laboratory of Subcellular Structures Analyses offers a variety of services that can be grouped into 4 main categories: (1) confocal microscopy, (2) flow cytometry, (3) xCELLigence system and (4) high-performance liquid chromatography (HPLC). The first of them offers the services of the visualisation of fixed and intravital preparations (using the environmental chamber and with preservation of culture conditions), use of each type of fluorochrome from the excitation range 470-670 nm and 405 nm, 2D and 3D analysis of the preparations, fluorescence intensity analysis, colocalisation and the FRET and FRAP analyses. The second category includes the cell cycle, cell viability, immunofluorescence, oxidative stress and cell sorting analyses. The xCELLigence system enables, among other things, a real-time analysis of eukaryotic cell proliferation or migration, real-time PCR using the fluorescence probes, analysis of single mutation using HRM and the methylation and genotyping level analysis. Using High Performance Liquid Chromatography (HPLC), the laboratory can analyse the presence of the modified nucleic acid components in eukaryotic cells. Moreover, it is possible to carry out the whole research process from cell culture breeding to the use of specialist PASS apparatus. The Laboratory also provides consulting services and offers assistance in designing tests and selecting appropriate methods and procedures.

The above offer is based on sophisticated equipment infrastructure. The laboratory has, among others, confocal microscope Leica TCS SP5 II with a white laser and a life chamber, along with software LAS AF SP5, LAS X SP8 with a deconvolution module and 2D analysis, Leica DMI 4000B microscope with the fluorescence and the light field functions, and the Leica stereoscopic microscope, flow cytometers (BD FACS Calibur and BD Accuri C6), Perkin Elmer cell harvester (96 wells), Roche LightCycler 480 II quantitative PCR apparatus or xCELLigence chamber. Moreover, it is also worthwhile mentioning high-performance liquid chromatography (HPLC) with 3 detectors: UV with diode array (DAD), fluorescent (FLD) and electrochemical (ED) and mass (MSI).

The staff and infrastructural resources of the Laboratory are used for the purposes of 3 research projects conducted at the Institute of Bioorganic Chemistry, Polish Academy of Sciences:

- Kinetine riboside and its derivatives – analysis of apoptotic properties and the operation mechanism in brain tumourells. NCN – OPUS 7,
- Anti-ageing properties of 4-N-furfurfurylcytosine in age-differentiated eukaryotic cells, yeasts and the mouse ageing model. NCN - OPUS 13.
- Regulation of the level of neuroactive 13-carbolineum in a diet based on selected products. NCN - OPUS 10 (cooperation with the University of Life Sciences).

Keywords: low-molecular compounds, nucleosides, modifications and adducts in DNA and RNA, catalytic nucleic acids, gene expression, confocal microscopy, fluorescence microscopy, flow cytometry, LightCycler 480 thermocycler, xCELLigence chamber, CO2 incubators, laminar chamber, high-performance liquid chromatography, HPLC, MS

RESEARCH POTENTIAL

HIGH-THROUGHPUT SCREENING LABORATORY

head of laboratory:
Dr. Radosław Pilarski
rpilarski@ibch.poznan.pl

The High-Throughput Screening Laboratory offers services in the design of the reporter systems in human and plant cells, the transformation of human and plant cell lines, the banking of cells and tissues in liquid nitrogen, the creation and maintenance of chemical libraries for screening tests or screening of chemical libraries. In addition, the Laboratory also carries out a combinatorial optimisation of bio-processes using intelligent systems, production, purification and analysis of proteins, automation and increase in the capacity of biochemical experiments and analyses, culturing cells in bioreactors, assembling media and supplements for the culturing of cells, statistical analysis and the modelling of results.

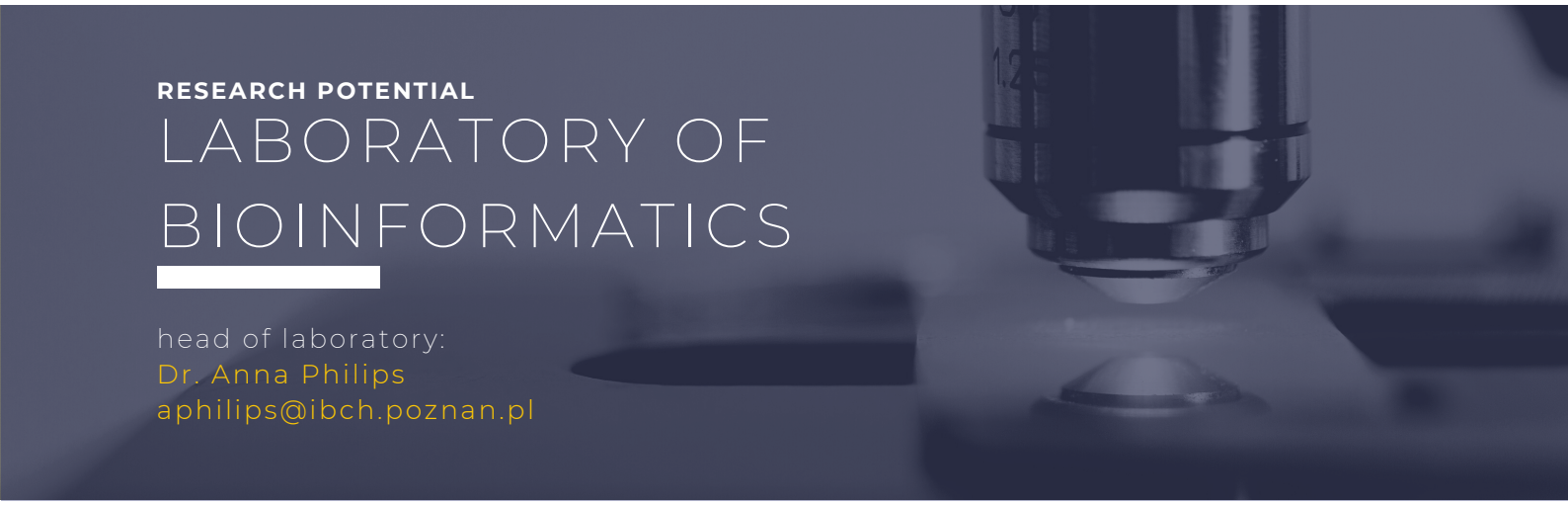
In its activities, the Laboratory is focused on the question of high throughput. Automation in combination with artificial intelligence based on the genetic algorithms allows to achieve a closed loop effect. Therefore, the Laboratory is a unique place on the national and global scale.

The Laboratory, together with its human resources and infrastructure, takes part in 4 research projects:

- Evolutionary modelling of the physiochemical conditions for the overexpression of viral replicons in liquid plant cultures (PLANTVIR)NCN - SONATA 5,
- Low molecular weight epigenetic modulators as the activators of cell pluripotency for regenerative medicine (EPICELL)NCBR - STARATEGMED,
- TMPRSS2 - potential target for new drugs and the COVID-19 course marker; NCN - COVID-19 fast pathway,
- Inhibition of biocalcification; EU - OPENSCREEN DRIVE.

The wide offer of services realised by the Laboratory is based on the sophisticated equipment. The Laboratory has, among other things, a six-axis industrial robot adapted to the pure zones with an arm reach of up to 1.5 m - Mitsubishi RV-7FLM, Agilent Bravo pipetting station with 96- and 384-well microtest plates, Formulatrix Tempest combinatorial dispenser with 12 independent channels (4 stations), Biotek Cytation 3 plate reader integrated with fluorescent microscope and light field, SBS Agilent vSpin automatic plate centrifuge, Agilent Microplate Labeler integrated with code reader, Agilent PlateLoc automatic plate sealer, Agilent vStack automatic plate punch, Agilent vStack automatic microtest plate feeders, Thermo Cytomat 6001 C4 automatic CO2 incubator for 184 96-well plates, Metler Toledo Quantos analytical weight d=0.01 mg and gravimetric system for precise preparation of solutions, Leica DM IL LED inverted fluorescent microscope, Sartorius AriumPro ultrapure water production system, Enbio Microjet handy microwave autoclave for liquid sterilization, Enbio SteamJet handy steam autoclave for instruments sterilization, Knauer K7400-S osmometer, Metler Toledo SevenExcellence multi-parameter pehameter and conductometer or Metler Toledo UV5Nano Excellence UV-Vis spectrophotometer.

Keywords: screening, screening test, screening, screening, high-throughput tests, automation, intelligent systems, cell cultures, cell banking, reporting systems



RESEARCH POTENTIAL

LABORATORY OF BIOINFORMATICS

head of laboratory:
Dr. Anna Philips
aphilips@ibch.poznan.pl

The offer of the Laboratory of Bioinformatics is based on two main groups of services. Firstly, the Laboratory provides a wide range of activities related to the Next Generation Sequencing, including analytical activities such as: differential gene expression analysis, differential transcript expression analysis (alternative splicing), non-coding RNA analysis, WGS analysis, analysis of exons (Exome-Seq) and of selected genes (targeted sequencing) and the metagenomic analysis. In addition, as part of the NGS, identification of SNP, CNV, new genes and of the splicing forms as well as of the miRNA target sequencing. In this field, the Laboratory's offer also includes the submission of ab initio (genome based) and de novo (no genome sequence) transcripts and their annotation and de novo genome submission and their annotation. The second main group of services is the structure modelling, including: 3D structures of proteins and nucleic acids with modifications, thermodynamic analyses, docking of low-molecular compounds to proteins/RNAs and prediction of RNA structure based on NGS data. The laboratory's offer also includes the processing of large-scale data, statistical analyses or analyses of biological data in Pythonand Bioconductor (R language).

In order to perform the above services, the Laboratory uses computer hardware with high computing power as well as computational clusters. An unquestionable advantage is also access to the Poznań Supercomputing and Networking Center as well as an interdisciplinary team with knowledge of microbiology, simulation of biological processes, structural biology or statistics.

Keywords: NGS, WGS, RNA-seq, DE, Metagenomics, Transcriptomics, SNP, CNV, PCA, Docking, Structure Modelling

RESEARCH POTENTIAL

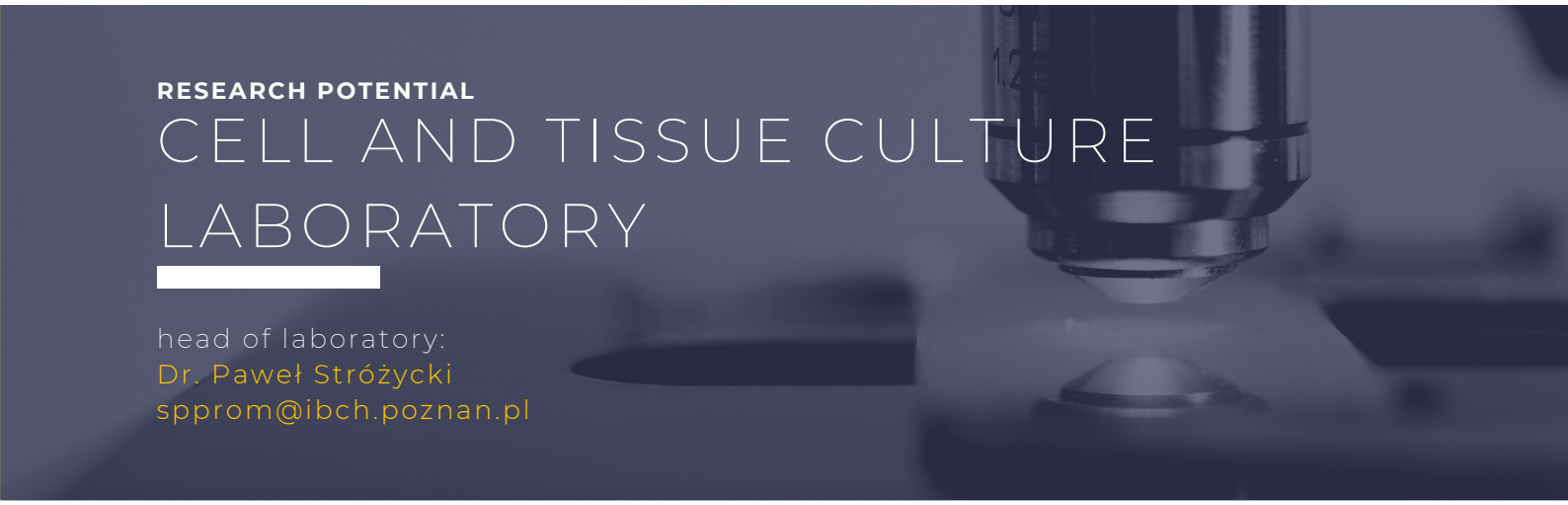
LABORATORY OF GENOMICS

head of laboratory:
Dr. Luiza Handschuh
luizahan@ibch.poznan.pl

Due to the profile of its activity, the Laboratory of Genomics provides services consisting in the support of the genomics research. The offer includes both microarray research, new generation sequencing (DNA and RNA-seq) and analysis of selected genes or transcripts using the quantitative PCR.

The Laboratory has a broad range of the apparatus facilities, including: BioRad for the quantitative PCR droplet (digital PCR QX200 droplet), Qiagen Rotor-Gene Q for the quantitative PCR, Agilent Bioanalyzer 2100 nucleic acid analyser, Telechem NanoPrint LM60 microarray printer, PerkinElmer SpotArray24 microarray printer, Tecan HS 4800 Pro microarray hybridisation station, Axon 4200AL microarray scanner from Molecular Devices, ScanArray Express microarray scanner from PerkinElmer, DNA CL E508 G crosslinker fromUvitec, Bioruptor NextGen sonicator from Diagenode, Nanodrop 2000 spectrophotometer from Thermo Scientific, Qubit fluorimeter from Invitrogen, Techne and BioRad thermocyclers and Quantum St4 gel documentation kit from Fisher Biotec.

Keywords: genomics, new generation sequencing, microarrays, gene expression analysis, computational biology



RESEARCH POTENTIAL

CELL AND TISSUE CULTURE LABORATORY

head of laboratory:
Dr. Paweł Stróżycki
spprom@ibch.poznan.pl

The Cell and Tissue Culture Laboratory offers a number of services in the field of broadly understood molecular biology, using the culturing of cell lines and tissues. The Laboratory also offers services in the field of experimental biology. In the Laboratory, after obtaining appropriate permission, it is possible to work with transgenic material. All activities are performed with the use of specialist equipment and under strictly defined conditions (e.g. sterility, controlled temperature and humidity). The Lab's infrastructure allows safe work with both animal and plant material (in compliance with the BSL2 safety standards). The Laboratory also has laboratories allowing working with viruses and planarians. It is noteworthy that all the rooms and equipment are subject to restrictive sterility rules (UV sterilisation systems, ozonisation, Vacusafe Integra waste protection system). The characteristics of the Laboratory also allow carrying out a full experimental cycle, i.e. from the replication of biological material through its use in experiments to obtaining material for further analyses outside the PHKiT complex.

The infrastructure resources of the Laboratory include: carbon dioxide controlled atmosphere incubators (Memmert), controlled oxygen concentration incubators (Thermo Scientific), rotary incubators (New Brunschwick, Innowa) and cooled incubators (Binder). In addition, the Laboratory has chambers with laminar airflow (Holten, Alpina), ultra centrifuges, preparation centrifuges, mini centrifuges and table centrifuges (Beckman/Eppendorf), water baths, containers for storing preparations in liquid nitrogen atmosphere, ballistic cellular transfusion apparatus (BioRad PDS-1000/He), Nanoject III microinjector (Drummond), cell complex for plant tissue cultures, Persival climatic chambers, phytotron complex and macro-photographic documentation kit. The Laboratory also has at its disposal microscopes equipped with specialised software for analysis and documentation with the possibility of photographic documentation – the inverted microscopes (Leica DM IL LED with fluorescence and CoolLED illuminator, Leica DM500) and stereoscopic microscopes (Leica M205 FA, Nikon SMZ1270, Nikon SMZ800N, Nikon SMZ-10, Motic SMZ-171).

Keywords: molecular biology, tissue cultures, cell cultures, model systems, Arabidopsis thaliana, Medicago truncatula, stem cells, influenza virus, planaria, transfusion, transformation, micro-injection, micro-injection

RESEARCH POTENTIAL

LABORATORY OF PROTEIN ENGINEERING

head of laboratory:
Dr. Anna Urbanowicz
aniau@ibch.poznan.pl

On the basis of its infrastructure resources, the Laboratory of Protein Engineering offers expert opinions on the preparation of expression vectors, production of recombinant proteins and their purification as well as the evaluation of the quality of protein preparations intended for functional and structural tests. Our experience and equipment enable the offering of physicochemical characteristics of interactions between proteins and other macromolecules. The measurement methods we apply allow, on the one hand, assessing the affinity and measure of the rate of association and dissociation constants and, on the other hand, determining the number of ligand binding sites or thermodynamic binding parameters such as enthalpy or entropy. The Laboratory also conducts high-throughput tests of the preliminary conditions for the crystallisation of biomolecules and the optimisation of the crystallisation process to obtain crystals for diffraction experiments. Moreover, we record the diffraction data of protein and nucleic acid crystals using a diffractometer equipped with a rotating copper anode.

The infrastructure and human resources also allow 3 research projects to be carried out with the help of the Laboratory:

- Structural and functional research of the key proteins for the interactions between the tick, mammal and pathogen.
- Obtaining isoforms of the PR-10 proteins from St. John's wort as potential receptors of melatonin and mediators of the hormonal signal transmission, and preliminary crystallographic characteristics of their complexes with natural ligands. NCN- MINIATURE 2
- Characteristics of virus-like particles based on virus capsaicin protein

The sophisticated equipment of the Laboratory includes a set of expressive vectors and the devices necessary for the cloning and production of proteins in the bacterial system, an incubator with the threshing and temperature control from 5°C to 50°C functions, a two-station sonicator with variable probes (depending on the sample volume), a preparation centrifuge (rotors): 8 x 50 ml and 6 x 500 ml), vacuum set for the affinity chromatography, FPLC ACTA Prime plus GE high-performance liquid chromatography set, and set of columns with the molecular filtration bed (SEC), Zetasizer gV Malvern gV analyser for dynamic and static light scattering measurements (DLS and SLS) to determine the size and molecular weight of proteins and polymers, Microcal iTC200 Malvern and Microcal PEAQ-ITC Malvern calorimeters to determine the ligand binding parameters by isothermal calorimetric titration (ITC), Monolith NT. 115 Nanotheper system to measure the strength of micromolecular impact using micro-thermophoresis (MST), Octet K2 ForteBio system for the layer interferometry (BLI), N60 Implen nanophotometer, Agilent 8453 UV-visible spectrometer for concentration and kinetics measurements, ARI Gryphon crystallisation robot and Hampton Research commercial reagent sets, MDL for identifying initial crystallisation conditions and optimising conditions by the vapour diffusion method, Rigaku XtaLAB Synergy-R diffractometer for crystal quality tests and, in many cases, recording high quality diffraction images to solve the structure of the biomolecule, and finally, the cold store (8°C) and crystallisation room (18°C).

Keywords: Cloning, mutagenesis, expressive plasmids, production of proteins in bacterial system, isothermal calorimetric titration (ITC), DLS, SLS, micro-thermophoresis (MST), layer interferometry (BLI), protein chromatography (FPLC), crystallisation of proteins and nucleic acids, measurements of X-ray diffraction, resolution of macromolecular structures, Ixodes and Borrelia tick and spinner proteins, complexes of plant proteins associated with pathogenesis PR-10, phytomelatonin, transcription factors WRKY, plant pyrophosphatase AtPPA1, folding of viral capsids, plant glutamate dehydrogenase.

RESEARCH POTENTIAL

LABORATORY OF ANIMAL MODEL ORGANISMS

head of laboratory:
Dr. Agata Tyczewska
agatat@ibch.poznan.pl

The Laboratory of Animal model Organisms offers services in the field of media sterilisation in a range from 1 to 10 litres, pouring sterile media on 35 mm, 60 mm and 90 mm Petri dishes (in each case up to 900 dishes/hour), preparation of microneedles for microinjection as well as microinjections (possibility to use for the C. elegans gonads, cellular nuclei or cytoplasm of the adherent cells, pronuclei of the fertilized mouse oocytes, Xenopus laevis oocytes and fish embryos at the early stages of development).

The Laboratory is equipped with devices such as: Integra mediaclave 10, MediaJet vario, with Ø35 mm, Ø60 mm, Ø90 mm dish carousels from Integra, PC-100 from Narishige, Axio Vert.A1 from Zeiss on which the Eppendorf microinjection kit is mounted: InjectMan 4 micromanipulator with dynamic motion control and programmable FemtoJet 4i microinjector with integrated pressure supply and Tissue Lyser, 2 x 24 (for 2 ml tubes) and 2 x 10 ml.

Keywords: Caenorhabditis elegans, C. elegans, micro-injection, MediaJet, Mediaclave, Tissue Lyser

RESEARCH POTENTIAL

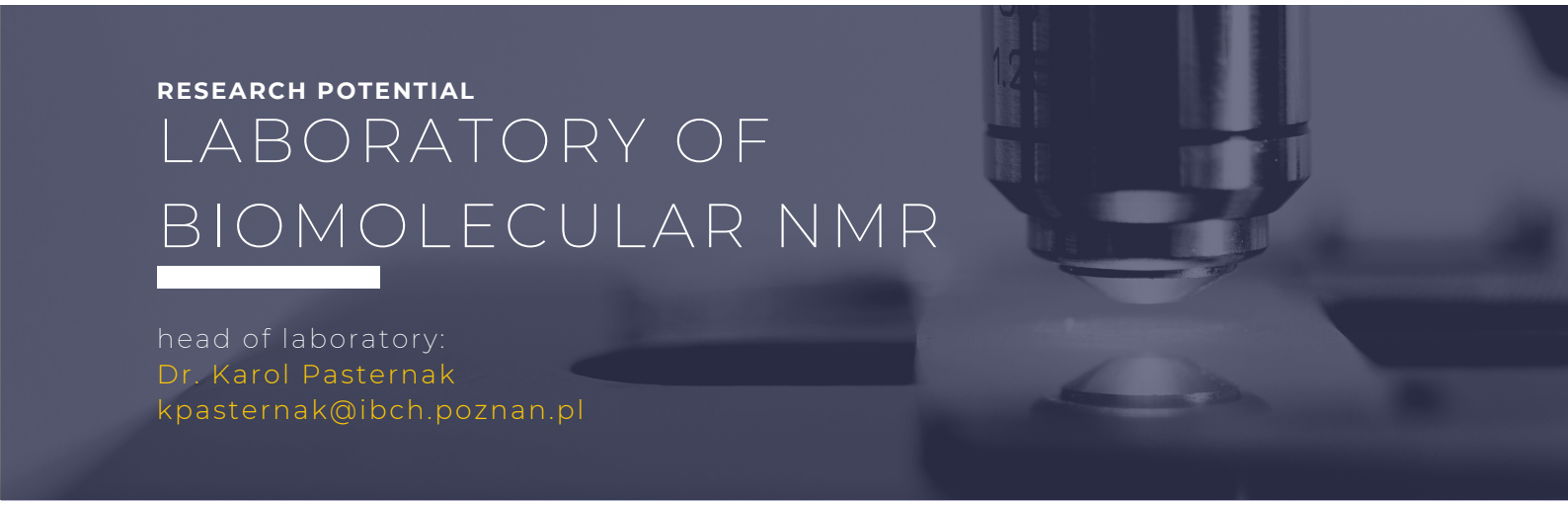
LABORATORY OF MAMMALIAN MODEL ORGANISMS

head of laboratory:
Dr. Łukasz Przybył
lprzybyl@ibch.poznan.pl

The Laboratory of Mammalian Model Organisms focuses its activities on complex animal experiments. The Laboratory's offer includes the services of expense planning for grant applications, designing experiments and appropriate experimental groups in accordance with the 3R and ARRIVE principle, obtaining appropriate approvals from the Local Ethics Committee, Ministry of Climate and Environment, the Chief Veterinary Inspectorate, organising the transport of the experimental animals, obtaining appropriate approvals for using the Animals, conducting training on the basic techniques of work with animals, breeding a colony of transgenic or wild-type mice, acquisition of embryonic material at appropriate stages of development, intramuscular, intraperitoneal, subcutaneous and intracerebral injections, microsurgery, mouse perfusions, organ weighing and blood and tissue collection, maintenance of the mouse colony database, maintenance of experience logs, basic behavioural observations and postoperative care, digitisation of data, creation of graphs and statistical analysis of data obtained during the experiment and in-depth analysis of the mouse immunophenotype by flow cytometry. It is also possible to organise the incorporation, into the experiments, of the infrastructure of the UAM CZT Animal Facilities, which includes a computer tomograph, the PhotonImager in-vivo visualisation system, the IntelliCage and PhenoMaster ActiMot2 cognitive and motor skills, haematological and biochemical tests from blood, metabolic cages.

The laboratory participates in the NCN - MINIATURE 3 research project entitled: “The influence of normal and mutated attack 3 on the immune system in the context of pathogenesis of cerebrospinal-spinal ataxia type 3."

Keywords: in vivo, mouse, rat, model organisms, culture, phenotype, surgery, immunity



RESEARCH POTENTIAL

LABORATORY OF BIOMOLECULAR NMR

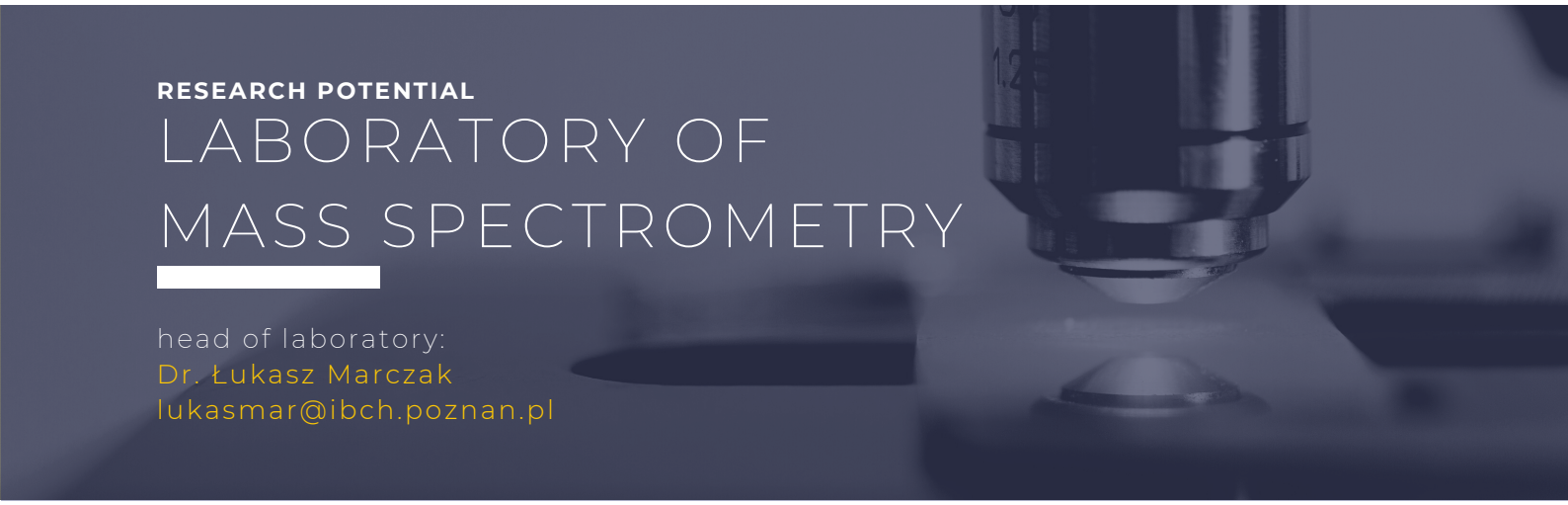
head of laboratory:
Dr. Karol Pasternak
kpasternak@ibch.poznan.pl

The Laboratory of Biomolecular NMR focuses on the registration and analysis of high-resolution NRM spectra, determination of the conformation of organic compounds of natural or synthetic origin, the studies of intramolecular and intermolecular interactions, the studies of interactions with ligands, high-throughput and automated registration of the 1D and 2D NMR spectra (e.g. COSY, HSQC, HMBC, NOESY, TOSCY), use of NMR, UV-VIS, CD spectral methods for the structural studies of nucleic acids and proteins as well as the comprehensive analysis of assessment of the purity of the RNA/DNA based on NMR, UV and CD spectra. The laboratory also provides expert services in the interpretation of the NMR spectra and solving structural problems.

The Laboratory stands out among other entities of this type in Poland by its technical and non-technical knowledge (know-how) as well as the strong links with the NMR Biomolecular Laboratory of IChB PAN. The use of bio-particles at work is also unique for the Laboratory's activity.

The NMR Laboratory is in particular equipped with the NMR 700 MHz (16.44 T) AVANCE III Bruker NMR spectrometer as well as the NMR 400 MHz (9.39 T) AVANCE II Bruker NMR spectrometer, the NMR 500 MHz (11.74 T) AVANCE III Bruker NMR spectrometer, the Circular Dichroism Spectrometer (CD) Jasco J-815, the UV VIS Jasco V-650 spectrophotometer and the Agilent Tech 1260 Infinity High Performance Liquid Chromatograph.

Keywords: high-resolution NMR spectroscopy, nuclei 1H, 13C, 31P, 19F, 29Si, mono- and multidimensional (correlation) spectra, homo- and hetero-nucleolar spectra, temperature measurements, automatic spectrum registration, material identification, structure and dynamics of nucleic acids, CD and UV-Vis spectroscopy, HPLC



RESEARCH POTENTIAL

LABORATORY OF MASS SPECTROMETRY

head of laboratory:
Dr. Łukasz Marczak
lukasmar@ibch.poznan.pl

The Laboratory of Mass Spectrometry offers services in the field of protein identification using the MS methods, de novo analysis of peptide and protein sequences (MALDI, ISD-MALDI), analysis of posttranslational modifications of proteins by MS methods, quantitative analysis of proteins by electrophoretic and MS methods, determination of the weight of the low-molecular monoisotopic compounds using the HR- MS methods, structural analysis of the low-molecular weight compounds by tandem mass spectrometry, quantitative analysis of low-molecular weight compounds by MS methods, analysis of volatile compounds by GC-MSn methods.

The resources of the Laboratory include a 2D electrophoresis kit - GE Healthcare IPGphor + EttanDalt six, an independent ion source with a fraction collector - Advion NanoMate TriVersa and MALDI-TOF spectrometer – Bruker Autoflex. Moreover, the laboratory is equipped with these systems: HPLC-MS (Q-TOF) – Bruker micrOTOF-q, GC-MS (TOF) – Waters GCT Premier, nanoLC-MS (offline MALDI-TOF/TOF) – Proxeon nanoLC + Bruker UltrafleXtreme, nanoLC-MS (ion trap) – Waters nanoAcquity + Bruker Amazon SL, nano/micro LC-MS (OrbiTrap) – Dionex RSLC nano 3000 + Thermo QExactive, GC x GC – MS (TOF) – Leco Pegasus 4D and GC-MS (TripleQuad) – Thermo TSQ8000.

Keywords: mass spectrometry, liquid chromatography, gas chromatography, electrophoresis, proteomics, metabolomics, lipidomics, qualitative analysis, atherosclerosis, cancer, blood, plasma, hyperhomocysteinaemia, homocysteine of proteins, exosomes, biomarkers

RESEARCH POTENTIAL

LABORATORY OF MOLECULAR ASSAYS

head of laboratory:
Dr. Magdalena Otrocka
motrocka@ibch.poznan.pl

The Laboratory of Molecular Assays is a part of the High-Throughput Screening Centre (CWBP) located in the Wielkopolska Centre of Advanced Technologies that offers know-how and practical assistance in the development of molecular tests of a commercial standard as well as the conducting of the screening campaigns. The laboratory carries out projects based on biochemical tests and cellular technologies, including phenotypic screening, high-throughput microscopy and image analysis. It should be emphasised here that CWBP is Poland's only, among the academic and commercial laboratories, centre with the appropriate experience and equipment to carry out screening tests with the capacity of hundreds of thousands of compounds over days.

Together with the CWBP, the Laboratory has a fluorescent high-throughput microscope coupled with software allowing for image analysis and obtaining information at the level of a single cell – Opera Phenix (Perkin Elmer) High Content Screening System, CLARIOstar Plus (BMGLabtech) multimode plate reader – enabling the detection of absorbance, fluorescence and luminescence and derivatives, FRET, BRET, AlphaScreen as well as Liquid handling – enabling precise transfer of fluids in small (nanolith) volumes and full automation of processes. Moreover, the resources of the Laboratory include Bravo Pipetting station (Agilent), Tempest liquid handlers (Formulatrix) and Robotic arm (Mitsubishi).

The resources of the Laboratory are used in two projects:

- "TMPRSS2 – potential target for new drugs and COVID-19 mileage determinant" - NCN COVID-19 Fast Track
- "Inhibition of biocalcification" - EU/OPENSCREEN DRIVE

Keywords: molecular test development, miniaturisation, high-throughput screening, high-throughput microscopy, phenotypic screening, biochemical test, image analysis, data analysis, chemical compounds library