FNP International Research Agendas

INTERNATIONAL RESEARCH AGENDAS PROGRAMME

INFORMATION BROCHURE

INTERNATIONAL RESEARCH AGENDAS PROGRAMME

14 research centers based in Poland

International Research Agendas – 14 research centers based in Poland. All are specialized, world-leading scientific institutions, which adopt the best world practices in the fields of:

- identification of research programs and topics
- personnel policy
- management of R&D activities
- commercialization of results of R&D activities

PLN 35–45 million

5 years

Each International Research Agenda received PLN 35–45 million for a period of five years. The project is financed by the EU's Intelligent Development Operational Programme (IDOP). The International Research Agendas Programme – together with its extended module International Research Agendas PLUS – also supports projects carried out within the Teaming of Excellence Programme, a competition launched under the Horizon 2020 Programme.

"The International Research Agendas Programme provides special conditions to work in Poland for the best scientist, both Polish and international. We guarantee freedom of science and freedom to employ people selected through competitions. We offer decent salary and the opportunity to purchase modern, unique equipment. Most of these centers have already proved successful and won considerable reputation on an international scale," says Prof. Maciej Żylicz, President of the Foundation for Polish Science.

#WeSupportTheBest #WeKnowHow

IRAP IS ABUT:

- Research and development
- Innovation
- Competitive workplaces
- Scientific authorities
- Polish and international scientific partners
- Highest standards of research
- Modern equipment
- Scientific freedom
- Cooperation with business

European Funds Smart Growth
Republic of Poland
European Union
European Regional Development Fund

AstroCeNT

Discovering the Invisible Universe

The centre is implementing a project entitled: „Particle Astrophysics Science and Technology Centre." AstroCeNT conducts R&D work into the development of technologies, e.g., for research on detecting gravitational waves and dark matter, and detecting signals and hidden information from the universe. These issues are fundamental and, at the same time, the most exciting areas of particle physics and astrophysics, and over the last few decades there has been an unprecedented advancement in knowledge about them, and in applying the technologies developed during their study.

AstroCeNT – Particle Astrophysics Science and Technology Centre

Prof. Leszek Roszkowski and Prof. Tomasz Bulik

Silicon photo multipliers, seismic sensors, data mining, information technology

Creating and developing technologies for detecting weak signals and hidden information in physics, to apply these in universe research and in many other fields

FNP International Research Agendas

AstroCeNT is really doing some amazing things. I am glad that it joined the international scientific community whose goal is to detect first dark matter particles. I have accepted an invitation to the international conference on particle astrophysics, organised in Poland by AstroCeNT already for the fourth time. I just had to be here - **Prof. Arthur B. McDonald.***

From „The scent of matter", an interview for Polityka (Issue 25/2019) by Przemysław Berg.

*Prof. Arthur B. McDonald, Canadian physicist, 2015 Nobel Prize laureate in Physics, studies neutrinos, i.e. elementary particles, attended AstroCeNT conference in May 2019.

The universe is continuously sending us some very interesting information. But to be able to read it, we need to create some extremely sensitive equipment, and to develop methods for capturing the signals we are looking for from the vast sea of all sorts of background noise and data – **Prof. Leszek Roszkowski**.

Prof. Tomasz Bulik, PhD Hab. – astronomer, graduated in Physics from the University of Warsaw, received PhD in Astrophysics from the Penn State University, and did his post-graduate studies at the Nicolaus Copernicus Astronomical Center of the Polish Academy of Sciences (PAN), and also worked at the University of Chicago. Deputy head for science affairs of the Astronomical Observatory, University of Warsaw. Member of VIRGO-POLGRAW, a team searching for gravitational waves as part of LIGO and VIRGO experiments, also involved in the HESS/CTA observatory projects. Together with LIGO and VIRGO groups, he received the 2016 Breakthrough Prize; an active promoter of astronomy.

Prof. Leszek Roszkowski, PhD Hab. – physicist, graduated in Physics from the University of Warsaw, received his PhD from the University of California, Davis, and did his post-graduate studies at the Jagiellonian University. He returned to Poland in 2011 as the laureate of FNP's Welcome programme. He had previously worked, e.g., at the Department of Physics and Astronomy, University of Sheffield, UK. Initiator and head of the international conference series COSMO, member of international advisory boards for COSMO, IDM, and DARK, and member of the editorial team for the scientific journal *Reports on Progress in Physics*. Chairman of the National Board for Particle Astrophysics. Representative of Poland to APPEC.

Interesting facts

Breakthrough Prize, of which Professor Tomasz Bulik, one of AstroCeNT founders, is a laureate, is renowned as the „Oscars of Science." The Prize has been awarded since 2012. Its founders include Sergey Brin, co-founder of Google, Mark Zuckerberg, founder of Facebook, and Chinese investors, such as Jack Ma, CEO of Alibaba Group, and Pony Ma, founder of Tencent.

International Strategic Partner:
Astroparticle and Cosmology Laboratory (APC), Paris, France

Other foreign partners:
DarkSide group at the Princeton University, USA, Gran Sasso Science Institute, Italy, SNOLab, and the McDonald Institute, Canada

Polish Partners:
National Centre for Nuclear Research, Warsaw University of Technology

www.astrocent.camk.edu.pl

facebook.com/AstrocentAstrophysics

4 Rektorska St., 00-614, Warsaw

BRAINCITY

Uncovering the secrets of a healthy and diseased brain and mind

The centre is implementing the project: „Nencki-EMBL Center of Excellence for Neural Plasticity and Brain Disorders: BRAINCITY". It conducts research into a comprehensive understanding of how the human brain, and its product - the mind, operate. The researchers hope to use this knowledge to develop innovative solutions which improve the prevention, diagnosis, monitoring and treatment of brain diseases. This includes mental illnesses such as depression and schizophrenia, addictions, as well as neurodegenerative diseases such as Alzheimer's or Parkinson's.

BRAINCITY – Centre of Excellence for Research on Neural Plasticity and Brain Disease

Prof. Leszek Kaczmarek, PhD and Associate Prof. Ewelina Knapska, PhD

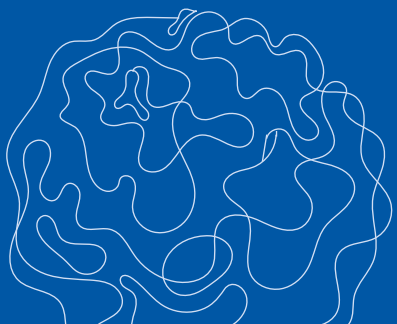
Brain disorders; synaptic plasticity; stem cells, optical imaging; neuromedicine

Comprehensive research into the complex mechanisms of brain plasticity

Quotes

Annual medical and social costs of brain diseases in the EU exceed EUR 800 billion. This is more than the costs associated with cancer, cardiovascular diseases and diabetes combined – **Prof. Leszek Kaczmarek, PhD**

To understand such a complex and intriguing organ as the brain, it is necessary to conduct research at several levels of organisation. Therefore, in BRAINCITY we will combine, among others, genome editing technologies and gene-protein manipulation, methods for precise visualisation of both: single synapses and entire neuronal networks, organoid research, animal behaviour research and bioinformatics techniques – **Ewelina Knapska, PhD.**



Prof. Leszek Kaczmarek, PhD – Head of the Neurobiology Laboratory at the Nencki Institute of Experimental Biology, Polish Academy of Sciences, Warsaw. He is a Member of the Polish Academy of Sciences, the European Molecular Biology Organization (EMBO) and Academia Europaea. He was Principal Investigator on more than 50 national and international research projects funded, among others, by the EU, NATO and the Wellcome Trust. He has worked as Contract Professor at the University of Catania (Italy) and as Visiting Professor at McGill University in Montreal (Canada), the University of California in Los Angeles and the Institute of Optics and Photonics in Castelldefels (Spain). Prof. Kaczmarek was awarded Foundation for Polish Science Prize in the field of natural and medical sciences for his research on the influence of various stimuli on gene expression in the mammalian brain. He also received the Prime Minister's Award for lifetime achievements in science.

Ewelina Knapska, PhD – Professor at the Nencki Institute, Head of the Laboratory of Neurobiology of Emotion at the M. Nencki Institute of Experimental Biology of the Polish Academy of Sciences in Warsaw. She graduated from the University of Warsaw with a master's degree in biology and psychology, and obtained her PhD in neurobiology from the M. Nencki Institute of Experimental Biology of the Polish Academy of Sciences. She completed a two-year fellowship at the University of Michigan, USA. She received her PhD Hab. degree in 2013. She received grants from the Foundation for Polish Science, the Minister of Education and Higher Education, National Science Center in Poland. In 2016, she was awarded the prestigious European Research Council Starting Grant. In 2018 she became a member of the FENS-Kavli Network of Excellence, a prestigious organisation for young brain scientists sponsored by The Federation of European Neuroscience Societies (FENS) and The Kavli Foundation.

Interesting facts

Miniature brain-like structures, or brain organoids, are the innovative research models used in BRAINCITY. Brain organoids are grown from stem cells obtained from peripheral blood or skin cells. These organoids provide insights into the mechanisms underlying neural and psychiatric disorders, and enable the testing of potential diagnostic and therapeutic methodologies.

One of the brain properties studied in BRAINCITY is neuroplasticity. This is the ability to reorganise the network of nerve cells in response to various stimuli. When we meet new people, gain new experiences or learn something, the number and distribution of synapses, i.e., connections between neurons, changes. Neuroplasticity is essential for maintaining brain health.

International strategic partner:
European Molecular Biology Laboratory (EMBL)

www.braincity.nencki.gov.pl

facebook.com/ibdnencki

Nencki Institute of Experimental Biology, Polish Academy of Sciences
3 Pasteur St., 02-093 Warsaw

CENTERA

Analysis of basic characteristics and applications of terahertz radiation

The Centre is implementing a project entitled: „Center for Terahertz Research and Applications (CENTERA)". It was created to develop breakthrough technologies that use terahertz radiation (THz), such as rapid scanners and chemical composition analysers, which can be applied in various sectors of the economy and safety oversight. Practical application of THz radiation has not been previously possible because of the high costs and large size and energy consumption of existing THz transmiters and detectors. In order to introduce THz technology to the general market, CENTERA is conducting interdisciplinary research on possible ways of generating, emitting, processing, and receiving THz waves by systems based on well-known and cheap technologies for semiconductor equipment (transistors, integrated circuits).

Center for Terahertz Research and Applications

Prof. Wojciech Knap, PhD Hab. and Prof. Thomas Skotnicki, PhD Hab. Eng

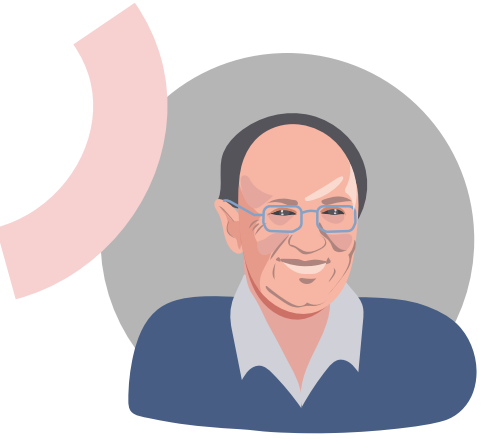
Terahertz radiation, Dirac matter, terahertz vision, terahertz antennas, terahertz safety scanners and demonstrators

To study the basic and applied characteristics of terahertz radiation. To develop innovative terahertz equipment and technologies, and to generate interest among commercial partners in Poland and abroad

Quotes

THz waves have several very interesting characteristics, e.g. they easily penetrate most non-metal materials, such as plastic, paper, clothing, and wood, which makes them suitable for use in the analysis of the internal structures or composition of such items. Unlike X-rays and UV radiation, THz radiation is not dangerous for people or animals, and it propagates through the air, providing visibility under difficult weather conditions or communicating huge amounts of information. Therefore, in many scenarios it can replace X-rays or lead to some completely new applications – **Prof. Wojciech Knap, PhD Hab.**

We expect THz waves to have many exciting applications, e.g. in communication (to increase data transfer speed), in industry (for process monitoring and/or quality control), in safety (in visual systems for working in difficult weather conditions), and in security (for detecting potentially dangerous parcels) – **Prof. Wojciech Knap, PhD Hab.**



Prof. Wojciech Knap, PhD Hab. – graduated from the Faculty of Physics, University of Warsaw. For many years he has been associated with the University of Montpellier and the National Centre for Scientific Research (CNRS) in France. As part of the LIA-TERAMIR International Lab he has coordinated the activities of Terahertz Radiation Lab (TeraGaN) at the Institute of High Pressure Physics, Polish Academy of Sciences in Warsaw. He is the author and co-author of more than 200 articles in the international scientific journals, and author of several patents. Prof. Knap's scientific pursuits cover numerous fields, including the absorption and emission of terahertz light by free and trapped carriers in shallow dopant states, heterostructures involving GaN/AlGaN nitrides, plasma excitation in nanotransistors, and terahertz radiation of plasmonic structures.

Prof. Thomas Skotnicki, PhD Hab. Eng – he graduated from the Faculty of Electronics, Warsaw University of Technology, and teaches there. He obtained his PhD degree at the Institute of Electron Technology in Warsaw and postdoctoral degree at INPG (Grenoble). He is a world-class specialist in semiconductor devices and advanced microelectronic technologies. He has long-standing experience both as a scientist and as an entrepreneur. He has worked in the famous CNET research labs in France, and was the lecturer at the Ecole Polytechnique Federale in Lausanne (Switzerland), Institut Polytechnique de Grenoble (France), and SUPELEC in Rennes (France). He spent 19 years at Europe's leading electronics manufacturing company, STMicroelectronics, where he was Vice-President and Director for the Advanced Devices and Technologies Programme. He developed UTBB FDSOI, a leading CMOS technology at STMicroelectronics, implemented in Globalfoundries Dresden and in SAMSUNG. Author and co-author of 350 scientific articles, holder of over 85 patents. He is an IEEE Fellow and an STMicroelectronics Company Fellow.

Interesting facts

Terahertz waves have previously been used mainly by astronomers to observe distant parts of the Universe. But terahertz radiation can also be used to scan materials, such as plastic, paper, and fabrics, and to communicate information faster than the current 4G. Future 5G and 6G wireless communication will use terahertz waves as information media.

THz waves were first used for biological object imaging 25 years ago. The scanned object was a leaf, and the image showed its veins for transporting water, and the process of water loss/absorption during drying/watering. Today we know that THz waves can be used, e.g., to see how fat tissue levels change, and to distinguish between the normal and abnormal ones.

Project partners:
Goethe University Frankfurt (GUF, Germany), Institute of Electronics, Microelectronics and Nanotechnology (IEMN, France), Terahertz Centre Regensburg, KTH Royal Institute of Technology Stockholm; University of California, Riverside; ITMO University in Petersburg, Charles Coulomb Laboratory and the University of Montpellier (France), RIKEN THz Center (Japan), Tohoku University in Sendai (Japan), Osaka University (Japan)

www.centera.eu

pl.linkedin.com/company/centera

29/37 Sokolowska St.
01 – 142 Warsaw

ENSEMBLE^3

From Czochralski to Metamaterials

The centre is implementing the project: „Centre of excellence for nanophotonics, advanced materials and novel crystal growth-based technologies". The ENSEMBLE^3 Centre of Excellence, or e3 for short, will combine crystal growth methods with the latest material concepts in nanophotonics, such as metamaterials, plasmonic materials and more.

ENSEMBLE^3 – Centre of excellence for nanophotonics, advanced materials and novel crystal growth-based technologies

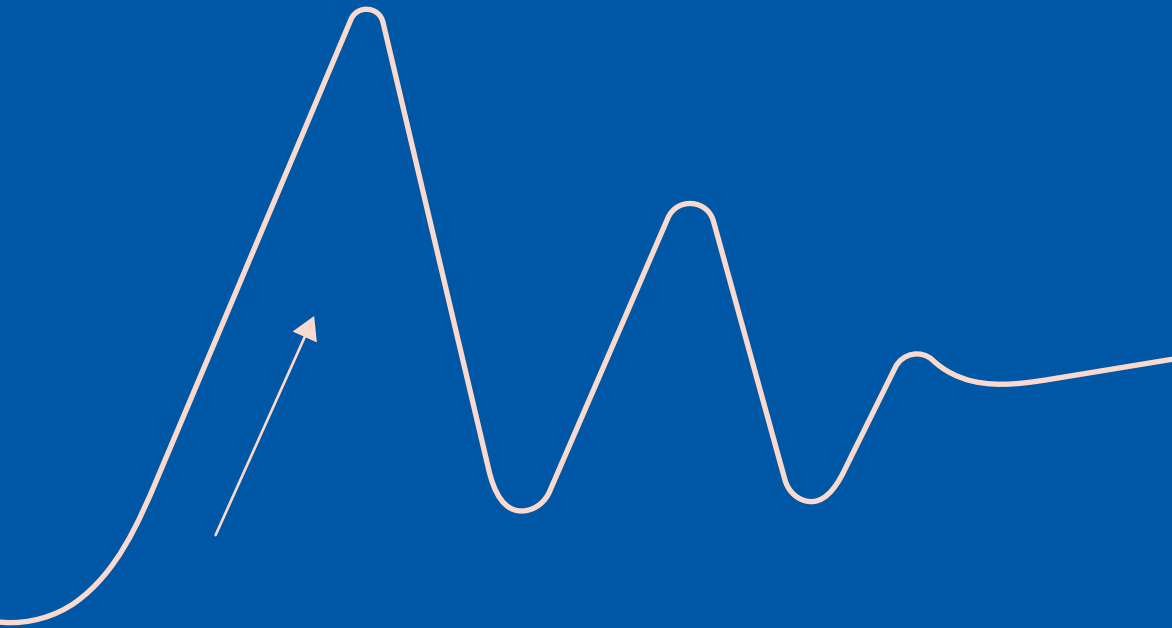
Prof. Dorota A. Pawlak

Crystal growth, advanced materials, nanophotonics, innovative technologies, materials science, bottom-up material technologies, self-organized materials, plasmonics, metamaterials

To develop new technologies and produce advanced photonic materials for applications in such fields as: optoelectronics, medicine, telecommunications, IT or energy conversion. ENSEMBLE^3 will produce novel materials allowing new functionalities in these applications

Materials are the basis of any technology - silicon has been the foundation of electronics for many years, and there are new hopes for two-dimensional materials such as graphene, while the new photonic materials we are developing, such as metamaterials, will ensure the future development of many photonics-based fields – **Prof. Dorota A. Pawlak**.

Quotes



Dorota A. Pawlak (DAP), PhD DSc – Professor at the University of Warsaw; she graduated from the Faculty of Chemistry of the University of Warsaw. She worked at Tohoku University in Japan. For many years she has been with the Institute of Electronic Technology in Warsaw. Currently, she manages the Functional Materials Department in the Institute of Microelectronics and Photonics of the Łukasiewicz Research Network. She also heads the Materials Technology Laboratory at the Faculty of Chemistry, University of Warsaw. She is known for combining crystal growth methods with modern material concepts in photonics such as metamaterials or plasmonics. She was the coordinator of the first Polish project in the field of nanomaterials within the 7th Framework Programme of the European Union (2008-2012). She is a two-time winner of the TEAM programme of the Foundation for Polish Science. She is currently coordinating a project implemented as part of the EU's Teaming for Excellence (2019-2026). President of the Polish Society for Crystal Growth (2013-2016).

Every computer, mobile phone or other electronic device contains a piece of crystal in it. Most of these crystals were grown using a method developed in 1916 by Polish chemist Professor Jan Czochralski. Even today, it is the world's most widely used technique for producing semiconductor single crystals, especially silicon, to manufacture electronic devices. ENSEMBLE^3, relying on this strength of Polish science and technology, intends to develop crystal growth methods and apply them for the development of new photonic materials.

Interesting facts

Foreign partners:
Sapienza University of Rome (Italy), Karlsruhe Institute of Technology (Germany) and Cooperative Research Center nanoGUNE Consolider (Spain)

Polish partners:
Łukasiewicz Institute of Microelectronics and Photonics (former Institute of Electronic Materials Technology), University of Warsaw, National Centre for Research and Development

www.ensemble3.eu

linkedin.com/company/ensemble3
facebook.com/fmlaboratory

133 Wolczynska St., 01-919 Warsaw

ICCVS

In search of cancer vaccines

The Centre is implementing a project entitled “International Centre for Cancer Vaccine Science”. Its activities are focused on personalised cancer immunotherapy. This approach is based on appropriate stimulation of a patient’s immune system to respond against cancer.

International Centre for Cancer Vaccine Science

Prof. Natalia Marek-Trzonkowska

Cancer, antigen presentation, immunotherapy, immunopeptidome, flow cytometry, mass spectrometry, interferons, genome sequencing, RNA editing and splicing, structural biology, mass spectrometry, computational science, virology, therapeutic antibodies

Immunology, molecular biology and proteomics in search for new anti-cancer therapies

Quotes

Cancer cells are generated in the human body every single day. The immune system is generally able to quickly recognise a mutated cell and to eliminate it. However, sometimes the cancer cells escape from immune surveillance, and start to proliferate. The growing cancer applies a range of strategies to avoid recognition and activation of immune cells. In our studies we try to restore effective immune surveillance – **Prof. Natalia Marek-Trzonkowska**.

A personalised anti-cancer vaccines matched for the patient HLA are focused precisely on the cancer and thus don't affect other tissues and organs. For that reason properly designed immunotherapy may be free of severe adverse reactions which are observed when standard cancer treatment is applied – **Prof. Natalia Marek-Trzonkowska**.

Prof. Natalia Marek-Trzonkowska – from 01.06.2021 prof. Natalia Marek-Trzonkowska is Acting Director of ICCVS. She leads the Cancer Immunology Group. Her research concerns clinical applications of cells of the immune system. Currently, she has been working on T cell based therapy for non-small cell lung cancer. She did her postdoctoral training at the University of Chicago, where she worked on pancreatic islet transplantation and conducted research on new methods for induction of immune tolerance. Awarded by numerous national and international boards, e.g. two Scientific Awards for research on the clinical application of regulatory T cells awarded by the European Federation of Immunological Societies (EFIS; Vienna and Glasgow), Polish-American Medical Society Award (PAMS; Chicago) and the Young Investigator Award granted by the International Society for Pediatric and Adolescent Diabetes (Istanbul), two scientific prizes awarded by the International Pancreas and Islet Transplant Association (IPITA; Praga) and Scholarship of the Minister of Science and Higher Education for Outstanding Young Scientists.

The founders of the ICCVS were initially Prof. Theodore Hupp and Prof. Robin Fahraeus. From June 1st, 2021, Prof. Hupp stepped down as the ICCVS director and group leader, while Prof. Fahraeus resigned from his position of group leader within the ICCVS from August 1st, 2021. Currently, Prof. Trzonkowska continues the work on the project.

Interesting facts

Cancer immunotherapy, developed at the ICCVS, is one of the greatest revolutions in medicine, compared with the introduction of antibiotics or protective vaccinations against infectious diseases. The Nobel Prize was awarded for advancements in immunotherapy in 2018.

Strategic partner:
University of Edinburgh

www.iccvs.ug.edu.pl

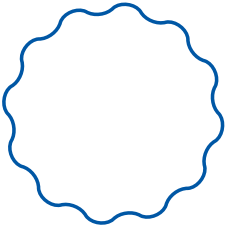
twitter.com/ic2_vs
linkedin.com/company/international-centre-for-cancer-vaccine-science

University of Gdańsk, 24 Kładki St., 80-822 Gdańsk

ICRI-BioM

Polymer and bioparticle research supported by advanced computational methods

The centre is implementing a project entitled: „International Centre for Research on Innovative Bio-based Materials." Supported by advanced computer calculations, it discovers and develops new biomaterials, such as biocompatible polymers, biocatalysts, and bioparticles with transport or regulatory functions in organisms. In the next step the researchers synthesise these and propose their practical applications. This will be achieved through the synergy of computational chemistry, polymer chemistry, biochemistry, and biotechnology.



ICRI BioM – International Centre for Research on Innovative Bio-based Materials (IRAP Plus).

Prof. Piotr Paneth and Prof. Klaus Müllen

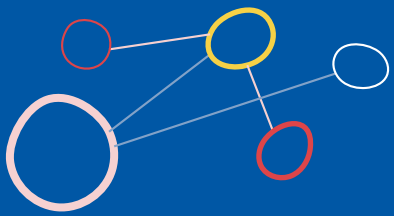
Biotechnology, biochemistry, polymers, proteins, nucleic acids, molecular complexes, organic functional materials, bio-materials, natural materials, nanomaterials, organic electornics, biosensors

To study polymers and bioparticles using experimental and theoretical methods to discover new materials

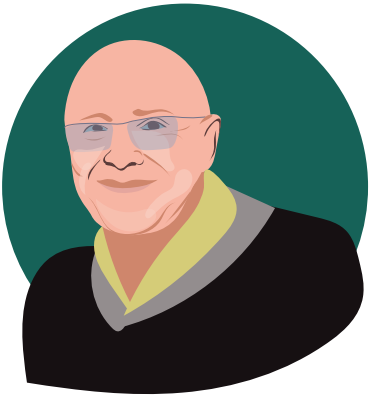
Quotes

Biomaterials are materials obtained from renewable or biocompatible materials, or new materials inspired by nature. These are applied in such fields as medicine, agriculture, environmental protection, and electronics – **Prof. Piotr Paneth**.

Biomaterials can include natural substances, such as proteins, peptides, and polysaccharides, or synthetic products, such as polymers, ceramics and composite ceramic materials. The range of potential applications of biomaterials is extensive – **Prof. Piotr Paneth**.



Prof. Klaus Müllen – served as Director at Max Planck Institute for Polymer Research, and continues his research at the Heidelberg and Cologne Universities. His broad research interest include new polymer creation reactions, chemistry and physics of individual particles, and graphene, dendrimers, and biosynthetic hybrids. He has published about 2,000 articles. He received multiple awards, honorary degrees and professor titles; he is a member of Polish and international academies. In 2008-2009, he was the President of the German Chemical Society (GDCh). In 2013-2014, he served as the President of the German Association for the Advancement of Science and Medicine. In 2010, he was granted a ERBN scholarship for advanced scholars for his work on nanographens. He is editor of the Journal of the American Chemical Society.



Prof. Piotr Paneth – formerly the Dean of the Faculty of Chemistry and Vice Rector for Science at the Lodz University of Technology, and President of the Łódź branch of the Polish Chemical Society. Now he serves as Director for Science Organisation at ICRI-BioM, and Deputy President of the Scientific Board, Centre of Molecular and Macromolecular Studies, Polish Academy of Sciences (PAN). Member of the Scientific Board, Polish Mother's Memorial Hospital Research Institute (ICZMP), and Chemistry Committee, Polish Academy of Sciences. His main research interests focus around the study of mechanisms of chemical and biochemical reactions using isotope effects, computational chemistry, chemometrics, and bioinformatics. He has published about 200 scientific articles and monograph chapters.

Usually associated with medical applications, such as scaffolds for tissue or organ cultures, artificial tendons or ligaments, bone cements, heart valves or by-passes, biomaterials can also be successfully used in environmental protection, e.g. as biosorbents for efficient absorption of toxic substances from water or soil, or easily biodegradable polymers. Such applications of biomaterials are the focus of researchers at ICRI-BioM.

Interesting facts

International Strategic Partner:
Max Planck Institute for Polymer Research in Mainz

Scientific Partner:
University of Łódź, Medical University of Łódź, Centre of Molecular and Macromolecular Studies, PAN, and Bionanopark

Other Partners:
Adamed Pharma S.A., Grupa Maspex, Grupa Pietrucha

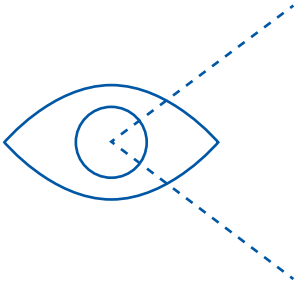
www.icri-biom.p.lodz.pl

Lodz University of Technology, 116 Zeromski St., 90-924 Lodz

ICTER

Revolution in the diagnostics and treatment of eye diseases

The Center is implementing the project called: “International Centre for translational Eye Research” (ICTER). The research will develop groundbreaking instruments for retinal cell imaging. These devices will be used to test new therapies for, among others, patients with diabetic retinopathy, which is the leading cause of vision loss in productive-age individuals, or with age-related macular degeneration (AMD) – the most common cause of blindness among people aged over 50 in developed countries.



The International Centre for Translational Eye Research

Prof. Maciej Wojtkowski, Dsc. Hab., and Prof. Krzysztof Palczewski, Dsc. Hab.

Vision science, optical imaging, ophthalmic diagnostics, pharmacology of retinal diseases, medical instrumentation, drug delivery

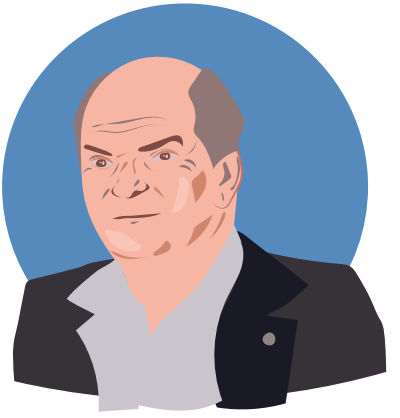
Research on human eye dynamics and plasticity, and the development of new therapies and diagnostic tools to help treat and diagnose a range of vision dysfunctions

FNP International Research Agendas

Quotes

Vision is a complicated multi-stage process, and while we already know very much about it, the exact course of many retinal diseases remains a mystery. In order to get closer to solving this mystery, it is necessary to develop more precise methods for retinal microstructure visualisation in patients. We need to learn more details at the cellular level. From among several thousands of cells, our aim is to identify a single cell and obtain its high-resolution image – **Professor Maciej Wojtkowski**.

Our tools will allow the assessment of not only the structure of the individual layers of the retina, but also their function. This will play a critical role in choosing the right pharmacotherapeutic solutions for degenerative changes in the retina and other retinal pathologies. Also, we will be able to monitor changes in the eye in response to pharmacotherapy or surgical procedures, or age-related changes – **Professor Maciej Wojtkowski**.



Prof. Maciej Wojtkowski, Dsc. Hab. – he started his research career at the Nicolaus Copernicus University in Toruń, where he earned his Master's degree, and later doctoral degree and habilitation (at the Institute of Physics, Faculty of Physics, Astronomy and Informatics). He was a research fellow at the University of Vienna in Austria and the Massachusetts Institute of Technology in Cambridge, USA. Prof. Wojtkowski heads the Department of Physical Chemistry of Biological Systems at the Institute of Physical Chemistry of the Polish Academy of Sciences in Warsaw. Professor Wojtkowski has authored more than 160 research publications and dozen-odd patents and patent applications. He has designed the tomography scanner used for the non-invasive and contactless examination of the inside of the eye, for which he received the Foundation for Polish Science Award in the field of mathematical, physical and engineering sciences. The scanner prototypes developed by Professor Wojtkowski became a blueprint for many devices currently used in ophthalmology clinics across the world.

Prof. Krzysztof Palczewski, Dsc. Hab. – he earned his Master's degree in Chemistry at the University of Wrocław, and his doctoral degree at the Wrocław University of Technology. He is an internationally renowned authority on the biochemistry of vision. Professor Palczewski worked at the University of Florida in Gainesville, USA, and the Oregon Health Sciences University in Portland, USA, where he established his own laboratory. He spent 13 years as a researcher at the University of Washington in Seattle, USA, where he also served in managerial roles. Professor Palczewski was the head of the Department of Pharmacology at the Case Western Reserve University in Cleveland, USA. He is currently employed with the University of California Medical School in Irivine, USA. His most notable accomplishments include the crystalisation and description of rhodopsin structure and function, and the discovery of the mechanisms underlying retinal degeneration and the associated loss of vision, for which he received the Foundation for Polish Science Award in the field of life and Earth sciences. Prof. Palczewski is a foreign member of the Polish Academy of Learning.

Interesting facts

Professor Krzysztof Palczewski, one of the founders of ICTER center of excellence, was able to restore vision in animals with the same mutations as those found in patients suffering from retinitis pigmentosa and other congenital mutations leading to blindness. Blindness reversal could be achieved through the simultaneous intervention in several stages of the vision cycle.

Professor Maciej Wojtkowski, one of the founders of ICTER, has invented the advanced spectral optical coherence tomography (SOCT) scanner for retinal imaging – a device which could provide eye images of much superior quality compared to its predecessors. The SOCT scanner has revolutionised ophthalmological examinations and is currently used by ophthalmologists across the world. According to the Ministry of the Economy, the SOCT scanner is one of the three, alongside graphene and infrared photodetectors, "Polish photonic products to have achieved a world-class level and global commercial success".

International partners:
UCL Institute of Ophthalmology - IoO, London, UK
UC Irvine's Gavin Herbert Eye Institute, California, USA

Research partner from Poland:
Institute of Physical Chemistry, Polish Academy of Sciences

linkedin.com/International Centre for Translational Eye Research
Twitter: @ICTER_PL

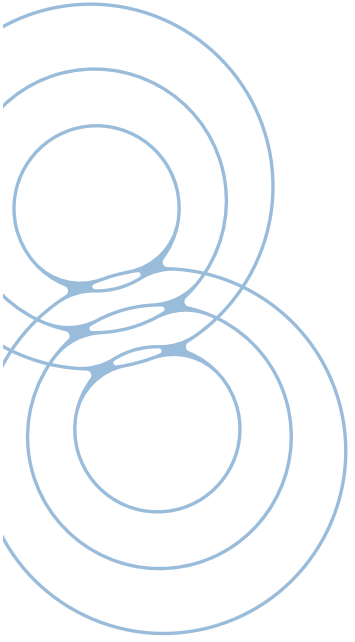
www.icter.pl

10A Skierniewicka St., 01-230 Warsaw

ICTQT

See Quantum

The centre is implementing a project entitled: “International Centre for Theory of Quantum Technologies.” In its operations, ICTQT focuses on research related to cutting-edge quantum technologies, and especially on quantum communications and information, and also quantum theory. In the context of practical solutions, this research concentrates on robust systems for ensuring absolute cybersecurity of data (including quantum, self-testing cryptography), quantum communication protocols, and conceptual work on algorithms for quantum computers.



ICTQT - International Centre for Theory of Quantum Technologies

Prof. Marek Żukowski PhD Hab. and Prof. Paweł Horodecki PhD Hab.

Cybersecurity, quantum optics, quantum information, quantum physics, quantum r&d, quantum thermodynamics, quantum technologies, photonics

In its research, ICTQT explores such fields as quantum communication, quantum algorithms, and quantum networks, and also quantum Internet. These efforts are undertaken in collaboration with some experimental centres

Quotes

Poland has a great scientific potential in quantum mechanics, but to be able to play an important role in the European Quantum Technologies Flagship initiative, it needs new research facilities, focusing on quantum technologies, with sufficient funds and capable of attracting top international talent. And the International Centre for Theory of Quantum Technologies is exactly such a facility. – **prof. Marek Żukowski**.

The problems addressed by quantum physics and quantum technologies are among the key challenges of contemporary science. This is a very good time for research initiatives like this, as quantum technologies are now the interest of not only scientists but also governments and large corporations, such as IBM, Google, and Microsoft. In the near future, this research could generate enormous economic benefits. – **prof. Paweł Horodecki**.

$$i\hbar \frac{\partial}{\partial t} \Psi = \hat{H} \Psi$$

Prof. Marek Żukowski PhD Hab. – Director of ICTQT, Full Professor at the University of Gdańsk, Correspondent Member of the Polish Academy of Sciences (PAN), expert in quantum mechanics and quantum interferometry, author of more than 160 research works, published in the world's leading journals. Member of the scientific boards of several institutions, such as the Quantum Information Center in Gdańsk and EU's QUANT-ERA. Winner of the 2013 FNP Award in Mathematical, Physical and Engineering Sciences „for research on multi-photon entangled states, which led to the formulation of information causality as a principle of physics." Former member of the National Science Centre's board, and former Associate Editor of Physical Review. The results of Professor Żukowski's research on multi-photon entangled states have not only theoretical implications. They have contributed to the development of multi-photon interferometry, which is the basis for experimental implementations of the prototypes of future quantum information technologies, such as quantum teleportation and quantum cryptography.

Prof. Paweł Horodecki PhD Hab. – theoretical physicist, graduate of the University of Gdańsk, he works at the Gdańsk University of Technology and is now in charge of the ICTQT team, member of the Scientific Board at the Quantum Information Center (KCIK). Author and co-author of more than 150 articles in quantum information theory and fundamentals of quantum mechanics. Professor Horodecki is the co-founder of the Quantum Information Center and currently a member of its Scientific Board. He is one of the creators of the Horodecki criterion (1996) for determining if a quantum state is entangled (and the article with this criterion is the most widely cited original scientific paper in the history of the University of Gdańsk). He was also among those who discovered what is known as *bound entanglement* (Physical Review Letters; 1998), and many fundamental laws of quantum information.

Interesting facts

Quantum cryptography offers unconditional security, which means that for the first time in history we can encrypt information and have a mathematical proof that it is only the designated receiver who can decrypt it. ICTQT currently works on it's even stronger variant. In, so-called, self testing protocols the users are protected even from backdoors that could be introduced by a malevolent producer of their devices.

The European Quantum Technologies Flagship initiative is expected to result in „game changing" impacts that benefit economy and society and pave the way to the technological and industrial leadership of the EU. Quantum Technologies Flagship seek to unlock the full potential of quantum technologies and accelerate their development and take-up into commercial products in Europe.

Foreign partner:
Institute for Quantum Optics and Quantum Information (IQOQI) of the Austrian Academy of Sciences in Vienna

Polish partner:
University of Gdańsk

twitter.com/ictqt

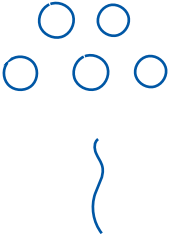
www.ictqt.ug.edu.pl

University of Gdansk, 63 Wit Stwosz St., 80-308 Gdansk

3P Medicine Laboratory

How gene mutations acquired throughout life affect the development of cancer and other diseases

The centre is implementing a project entitled: „Mutations acquired during lifetime that lead to increased risk for human disease, with focus on cancer." Researchers at the 3P Medicine Laboratory are focusing especially on the development of breast cancer in women, prostate cancer in men, and colon and bladder cancers in both genders, and also Alzheimer's disease in men related to their loss of chromosome Y in leucocytes. Results of this research could lead to the identification of new cancer risk biomarkers and help better understand early stages of Alzheimer's disease.



3P (Preventive, Personalized, Precision) Medicine Laboratory

Prof. Jan Dumanski and Prof. Arkadiusz Piotrowski

Somatic mosaicism, structural rearrangements, mutations, aneuploidy, loss of chromosome Y (LOY), cancer, genetics, genomics, diagnostics, Alzheimer's disease

Research into genetic anomalies developed throughout life as risk factors for cancer and other diseases

We plan to describe mutations that take place during human life and which contribute to cancer, and then to use this knowledge to diagnose cancer early, before any symptoms are displayed. Since in the vast majority of cases, early diagnosis determines the chances of successful treatment, our research can have an impact on reducing mortality among cancer patients – **prof. Jan Dumanski**.

It seems that the loss of chromosome Y (LOY) in leucocytes in men causes the impairment of immune surveillance. Healthy leucocytes eliminate all cells other than normal, but following the loss of chromosome Y this process becomes less efficient. If our research confirms this hypothesis, the analysis of LOY in the blood of geriatric males could become a new biomarker for several common diseases – **prof. Jan Dumanski**.

Prof. Jan Dumanski – He studied medicine at the Jagiellonian University in Krakow, Poland. Began research in 1986 at the Karolinska Institutet in Stockholm, Sweden. There he obtained his doctorate and in 2000 received the title of professor at Uppsala University in Sweden, in the field of Experimental Pathology, at the Department of Immunology, Genetics and Pathology. He was also a professor at the University of Alabama in Birmingham, USA, where he headed the Howell and Elizabeth Heflin Center for Human Genetics. He participated in many international research projects on cancer genetics, the molecular basis of metastasis, or the mechanisms behind cancer predisposition. One of his current main research interests is the loss of the Y chromosome (LOY) in male leukocytes and contributing to the development of many diseases, including cancer and Alzheimer's disease.

Prof. Arkadiusz Piotrowski – graduate of the Intercollegiate Faculty of Biotechnology, University of Gdańsk, and the Medical University of Gdańsk (GUMed). He earned his PhD in Pharmacy from the Faculty of Pharmacy and Department of Laboratory Medicine at GUMed. Following his doctorate, he worked at the Department of Immunology, Genetics and Pathology, Uppsala University, Sweden, and at the Department of Genetics, University of Alabama, Birmingham, USA. He continues to be affiliated with UAB as Adjunct Professor, and also carries out international research projects (including a grant from the US Department of Defense). His principal field of research is somatic mosaicism and structural rearrangements of the genome in the context of cancers and rare genetic diseases.

Interesting facts

Post-zygotic mutations are changes in the genome occurring during the course of one's lifetime and can be caused, e.g., by smoking, poor diet, viral infections, or simply cellular ageing. These mutations are so frequent that probably in an entire organism there are no two cells that are genetically identical. Such mutations make even identical twins, who develop from a single zygote, differ genetically. These mutations are also responsible for many diseases. Their identification and functional assessment are the main research focus for the researchers at the 3P Medicine Laboratory.

7-9 years is the difference between the average lifespan for men and women in Poland (Statistics Poland data for 2018). Perhaps this higher mortality among men is due to the loss of chromosome Y, as found over age in men and contributing to the development of many diseases, including cancer, Alzheimer's and atherosclerosis. This mechanism is being studied by the 3P Medicine Laboratory team, and in 2019 their findings were published in *Nature*.

Foreign partners:
Uppsala University (Sweden)

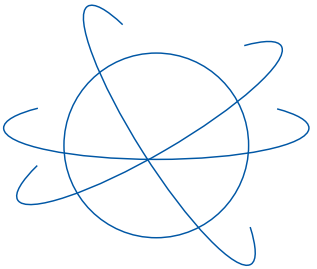
www.mab3p.gumed.edu.pl

Medical University of Gdańsk, Marii Skłodowskiej Curie 3a St., 80-210 Gdansk

MagTop

Materials for green electronics and quantum information technology

The Centre is implementing a project entitled: ”International Centre for Interfacing Magnetism and Superconductivity with Topological Matter”. MagTop is conducting interdisciplinary research into materials science, nanotechnology, semiconductor physics, magnetism and superconductivity. This way the scientists want to contribute to the development of new topological materials whose electronic states are resistant to disruptions. Such materials are regarded as the future of, i.a., energy-saving electronics or quantum information technology.



MagTop - International Centre for Interfacing Magnetism and Superconductivity with Topological Matter

Prof. Tomasz Dietl and Prof. Tomasz Wojtowicz

Semiconductors, magnetism, superconductors, topological matter, epitaxy, nanotechnology

Interdisciplinary research in the field of materials science, nanotechnology and semiconductor physics, as well as research into magnetism and superconductivity, which should contribute to the development of new topological materials.

Quotes

An outstanding feature of the materials we are testing is the fact that new electronic states exist on their edges or surface, with a size several dozen thousand times smaller than the diameter of a human hair, and their properties, for example electrical conductivity, are resistant to deformations. This differentiates them from such nanostructures as graphene which would lose numerous of its properties if, for instance, it was crumpled – **Prof. Tomasz Dietl**.

These new topological materials may find extraordinary applications. There are high expectations related to their use in the production of, e.g., high-performance biological or chemical sensors, devices transforming heat into electric energy, or components allowing the development of spintronics, a new branch of electronics, facilitating a faster and more efficient data recording and processing
– **Prof. Tomasz Dietl**.

Prof. Tomasz Dietl (MagTop, Institute of Physics at the Polish Academy of Sciences (PAN), Advanced Institute for Materials Research, Tohoku University, Japan) – has won recognition for his pioneering research into ferromagnetic semiconductors and the development of methods for magnetic ordering and quantum location of carriers. This paved the way for the creation of a new area of science - semiconductor spintronics. Winner of the Humboldt Research Award, the Agilent Europhysics Prize, and the Foundation for Polish Science Prize for the development of the theory of diluted ferromagnetic semiconductors, and for the demonstration of new methods for controlling magnetization. Director of numerous research projects, including the ERC Advanced Grant. Member of the Polish Academy of Sciences, Polish Academy of Arts and Sciences (PAU), Warsaw Science Society (TNW), and Academia Europaea. Fellow of the Institute of Physics, UK, the American Physical Society, and the Japanese Society of Applied Physics.

Prof. Tomasz Wojtowicz (MagTop, Institute of Physics PAN) – specialising in the growth of nanostructures using the molecular beam epitaxy method (MBE). Together with his colleagues, he demonstrated the action of a new type of a spin transistor whose operation is based on the use of the internal momentum (spin) of electrons, and not their electrical charge as is the case in transistors which are currently in use. Prof. Wojtowicz greatly contributed to the study of diluted magnetic semiconductors and semiconductor nanowires. Winner of the Minister of Science Award (2013) for outstanding research achievements, "for the fundamental contribution into the development of molecular beam epitaxy and research into unique quantum structures with programmable spin properties." He was the leader of the prestigious Maestro Project at the National Science Centre. A Fulbright Alumnus.

Interesting facts

The application of topology methods to the study of unusual states and phases of matter were awarded the Nobel Prize in Physics in 2016. Scholars are testing the possibilities of utilising the phenomena, and the ground-breaking papers on the issues, co-authored by MagTop researchers were published in prestigious journals, i.a. in *Physical Review Letters* (2017) and *Nature Physics* (2018).

Timo Hyart from MagTop took part in the interpretation of experiments on the so called “magic-angle” graphene, called the physical breakthrough of 2018. It is obtained by twisting two sheets of the material, made of a single layer of atoms. The electric current can flow through the obtained structure with zero resistance. It has magnetic properties which have not been observed before.

International partners:
The University of Würzburg; Research Institute of Electrical Communication, Tohoku University, Sendai; Institute of Physics at the Chinese Academy of Sciences, Beijing.

Collaboration with enterprises:
VIGO System S.A. (infra-red detectors), PUREMAT Technologies Sp. z o.o. (ultra-pure elements), MeasLine Sp. z o.o. (measurement systems), KRIOSYSTEMEM Sp. z o.o. (cryogenic devices).

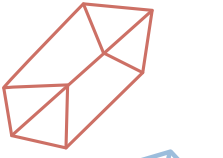
www.magtop.ifpan.edu.pl

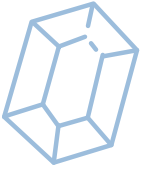
Institute of Physics, PAN. , 32/46 Lotnikow Av., 02-668 Warsaw

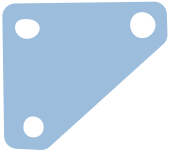
NOMATEN

Ultramodern materials for extreme conditions

The NOMATEN Centre of Excellence is strongly involved in investigating, designing and testing innovative multifunctional materials. Its scientists will focus on materials resistant to extremely high temperatures (above 500 degree C), corrosion and radiation, intended for industrial use (e.g. in energy and chemical technologies). NOMATEN will also investigate new types of radiopharmaceuticals for diagnostic and therapeutic purposes in nuclear medicine.







NOMATEN Centre of Excellence (IRAP Plus)

Prof. Mikko Alava and Prof. Paweł Sobkowicz

Material science, mechanical properties, radiopharmaceuticals, corrosion, molecular dynamics, structural analysis, functional properties, high temperature

To conduct research on materials resistant to extreme weather conditions (high temperature, corrosion, radiation – in particular neuron radiation) to be used in nuclear, energy, chemical and other industries, and to develop and produce new radiopharmaceuticals for medical use

Quotes

New materials resistant to extreme temperatures, radiation and corrosion will be used in advanced industrial processes such as nuclear and conventional energy, hydrogen production or chemical industry (e.g. for manufacturing artificial fertilisers). These activities – e.g. facilitating the energy-efficient production of hydrogen which is considered as a fuel of the future – can contribute to radically limiting greenhouse gas emissions – **Prof. Paweł Sobkowicz**.

New materials displaying increased resistance to negative environmental factors and research aimed at limiting the consequences of installation ageing provide a chance of improving the effectiveness and safety of those industrial installations that are already in operation – **Prof. Mikko Alava**.

Prof. Mikko Alava – Director of the NOMATEN Centre of Excellence, a world-class expert in the physical properties of materials and their dependence on structure, including transport properties. He has worked extensively on materials science data analysis and applications of modern machine learning approaches. He holds a PhD degree in nuclear engineering (Helsinki University of Technology) in fusion plasma physics, and a degree of full professor of physics at Aalto University, Finland. After a research direction change from thermonuclear reactions to materials science, Professor Alava has focused on statistical physics applications to the physics of materials and on challenging computational problems in understanding fracture, friction, plasticity and other complex properties, typical of functional materials and their dependence on structure. He held the position of Vice-Director of the Finnish Center of Excellence in Computational Nanoscience (COMP). He has uthored/co-authored over 250 scientific papers.

Prof. Paweł Sobkowicz – Scientific Operations Director of the NOMATEN Centre of Excellence in Multifunctional Materials for Industrial and Medical Applications. He holds a PhD degree in theoretical physics. Between 1982 and 1993 he worked at the Institute of Physics, PAS, and then he focused on management in international and Polish technological companies. In 2012 he joined the National Centre for Nuclear Research, with the task of managing the technology transfer processes and management of commercialization efforts, and in 2017 was appointed Deputy Director for Innovation and Commercialization. He has combined his scientific career with business experience and a knowledge of practising science, which is important in the context of efficient cooperation between the research communities and industry. His research has focused, i. a., on using tools of statistical physics to describe complex social phenomena. He has authored over 60 scientific papers cited over 500 times.

Radioisotopes are chemical compounds designed to accumulate in cancer cells. While used for diagnostic purposes, they enter the patient's body for a short period of time and facilitate the accurate imaging of the disease, without having any damaging effect. Another type of radioisotopes is used for therapeutic purposes. In order to eliminate cancer cells, emission of more destructive alpha or beta particles is required and they should last in the patient's body for a few days. Both types of radiopharmaceuticals (diagnostic and therapeutic) will be enhanced at NOMATEN. Poland is a significant producer of radiopharmaceuticals supplying products to 80 countries in the world. There is no other industrial sector in which Polish economy records such a high rate.

Interesting facts

Project partners:
National Centre for Nuclear Research, French Alternative Energies and Atomic Energy Commission (CEA), VTT Technical Research Centre of Finland

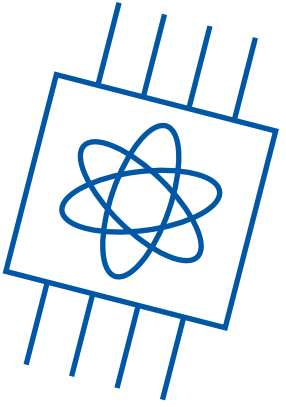
www.nomaten.ncbj.gov.pl

Narodowe Centrum Badań Jądrowych [National Centre for Nuclear Research]
7 A. Soltan St., 05-400 Otwock, Swierk

QOT

Quantum physics in new technologies

The centre is implementing a project entitled “Quantum Optical Technologies.” The Quantum Optical Technologies (QOT) unit has been created in cooperation with the University of Oxford to examine quantum phenomena, such as superpositions and entanglement, in various optical and optically controlled systems. In the long-term, the outcomes of this research are expected to be used in practice and translated, for example, into more sensitive sensors or safer communication methods.



QOT - Centre for Quantum Optical Technologies

Prof. Konrad Banaszek

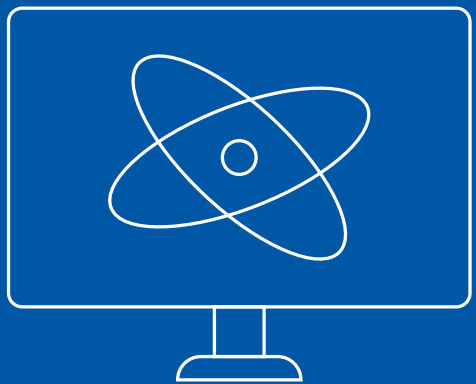
Quantum technologies, photonics, optical physics, quantum mechanics

Comprehensive study of optical systems at the quantum level to develop completely new communications, detection, metrology, imaging, and other practical solutions

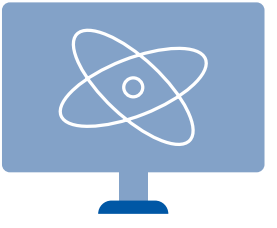
Quotes

The results of our research on quantum phenomena can find application, e.g., in communications (to improve data transmission security), geology (for accurate gravitational field measurements), ecology (to detect trace quantities of chemical substances in the environment), imaging and microscopy (to improve resolution), and fighting cybercrime (e.g. online identity theft) – **Professor Konrad Banaszek**.

The scenarios we explore include various physical structures that can be prepared, manipulated, and measured using light – **Professor Konrad Banaszek**.

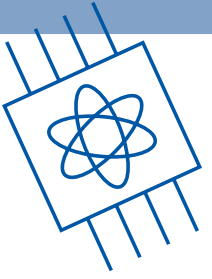


Prof. Konrad Banaszek, Dsc. Hab. – Head of the Centre for Quantum Optical Technologies, Head of the Quantum Technology Laboratory, Centre of New Technologies, University of Warsaw (UW), physicist, for many years involved with the Faculty of Physics at the University of Warsaw. Having received his PhD from UW, he completed international internships at the University of Rochester, USA, and the University of Oxford, UK. He has authored or co-authored more than a hundred scientific articles on quantum technology. Over the last decade, he has coordinated three projects financed from EU's 7th Framework Programme.



In addition to conducting research, Prof. Konrad Banaszek, Head of the QOT, is also the scientific coordinator of QuantERA, a network of 32 organisations supporting research in 26 countries. QuantERA supports international cooperation and research into quantum technologies, and closer collaboration between academia and industry. The programme is coordinated by the Polish National Science Centre (NCN). The programme has a budget of more than EUR 26 million, of which 11.5 million has been provided by the European Commission.

Interesting facts



Strategic Partner:
University of Oxford, UK

twitter.com/QOT_UW

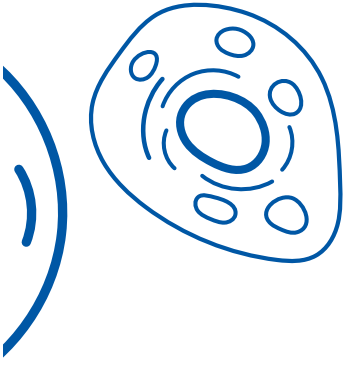
www.qot.uw.edu.pl

Centre of New Technologies, UW, ul. S. Banacha 2c, 02-097 Warszawa

ReMedy

Regenerative Mechanisms for Health

The centre is implementing the Project called „Regenerative Mechanisms for Health". ReMedy is engaged in comprehensive and complementary research on living organisms. This knowledge will be used to combat diseases in which cellular regenerative pathways are weakened (as in neurodegenerative diseases) or over-strengthened (as in cancer cells).

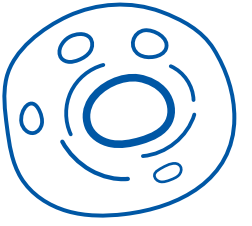


ReMedy - Regenerative Mechanisms for Health

Prof. Agnieszka Chacińska and Prof. Maria Magda Konarska

Stress, cellular adaptations, molecular defence responses, regeneration, pathology, neurodegeneration, cancer

To carry out research to understand the molecular and biochemical mechanisms involved in cellular adaptation to stressful situations, e.g. degradation and cessation of protein production in the cell in response to mitochondrial damage

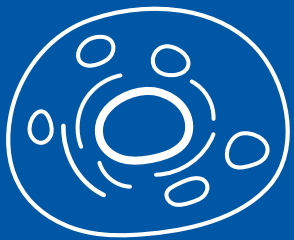


FNP International Research Agendas

Quotes

Cells exposed to severe stress die, while lighter stress triggers adaptive mechanisms that help the cell return to a state of equilibrium. These mechanisms have the potential to treat many of the diseases considered to be lifestyle-related – **Prof. Agnieszka Chacińska**.

In order to use the regenerative mechanisms of cells that have survived stress for future therapies, such as neurodegenerative diseases, we must first have a thorough understanding of these mechanisms. In ReMedy, we therefore study what happens in a cell in response to stress, such as the appearance of free radicals, high temperature, mutations or the presence of biologically active chemicals – **Prof. Maria Magda Konarska**.



Prof. Agnieszka Chacińska – Full Professor of Biology and Head of the Laboratory of Mitochondrial Biogenesis at the Center of New Technologies, University of Warsaw. She is the Director of The International Institute of Molecular Mechanisms and Machines, Polish Academy of Sciences (PAS). Her scientific interests focus on mitochondrial biogenesis and its role in health and disease at the cellular level. She completed her biology studies at the University of Warsaw with a specialization in molecular biology. She prepared her doctoral thesis and habilitation at the Institute of Biochemistry and Biophysics of the PAS. She worked, among others, at the University of Basel in Switzerland and the University of Freiburg in Germany. Until 2017, she was associated with the International Institute of Molecular and Cell Biology in Warsaw. Corresponding member of the PAS, laureate of the Prime Minister's Award, the Copernicus Award, the Award of the Minister of Science and Higher Education, the Award of the President of the PAS. Member of EMBO and Academia Europaea.

Prof. Maria Magda Konarska – Associate Professor at the University of Warsaw, since 2015 she heads the RNA Biology Laboratory at the New Technology Center at the University of Warsaw; Deputy Director for Science at the The International Institute of Molecular Mechanisms and Machines, Polish Academy of Sciences (PAS). Professor Emeritus at Rockefeller University in New York, where she headed the Laboratory of Molecular Biology and Biochemistry for 26 years. Her research interests include studies of RNA function in cellular processes, in particular the mechanism of pre-mRNA splicing. Graduated in genetics at the Univer sity of Warsaw, then obtained her PhD and postdoctoral degrees at the Institute of Biochemistry and Biophysics of the PAS. She was affiliated i.a., with the Center for Cancer Research at the MIT in Cambridge, USA, and Rockefeller University in New York. Corresponding member of the PAS, winner of numerous national and international fellowships, grants, and scientific awards. Member of EMBO and Academia Europaea.

Interesting facts

Published by Prof. Agnieszka Chacińska's team, the ground-breaking research on the cellular response to mitochondrial defects was conducted on the single-celled yeast Saccharomyces cerevisiae. These organisms have served science for decades to study vital processes at the molecular and cellular level. Their culture is not complicated, as they grow rapidly and are estimated to have 23% of the genome identical to humans.

The findings of Prof. Agnieszka Chacińska's team concerning changes in protein production in the cell in response to mitochondrial defects have been published in the most prestigious scientific journals: *Nature, PNAS, Nature Communications and EMBO Molecular Medicine*.

Project partners:
University Medical Center Göttingen (Germany)

CeNT – Centre of New Technologies, University of Warsaw, 2c Banacha St., 02-097 Warsaw.
At the end of 2020, the new International Institute of Molecular Mechanisms and Machines (IMol) of the Polish Academy of Sciences (PAN) was established to become the unit implementing the Remedy project

www.imol.institute

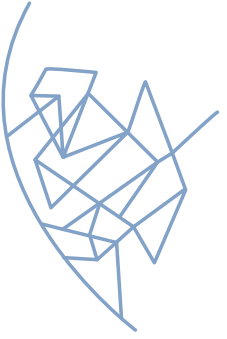
facebook.com/IMol.Institute
twitter.com/ReMedy_IRAP
linkedin.com/company/remedy-irap

2 Smetany St., 00-783 Warsaw

Sano

Computing Technologies for Modern Medicine

The centre is implementing the project: “Centre for New Methods in Computational Diagnostics and Personalised Therapy”. Researchers at Sano’s Centre of Excellence use artificial intelligence, advanced algorithms, computer modelling and simulation, as well as analyse extensive databases to support doctors in the diagnostic and treatment process. The modern computer technologies developed at Sano help to pick the most beneficial treatment for a given patient and accelerate the development of new pharmaceuticals and medical procedures.



Sano – Centre for Computational Personalised Medicine – International Research Foundation (IRAP Plus)

Prof. Marco Viceconti and Marian Bubak, PhD, Eng.

Simulation, in silico medicine, personalised healthcare, decision support, high performance computing (HPC)

To establish a centre for computational medicine with the primary objective of introducing innovative computational-based diagnostic and therapeutic solutions into everyday healthcare practice to improve individualised patient treatment

Quotes

Computational medicine – the purpose of Sano's existence – is the combination of medicine and computing, allowing the more effective prevention and the more accurate diagnosis and treatment of diseases, with less side effects – **Marian Bubak, PhD, Eng**.

Our project belongs to a branch of research called Virtual Physiological Human, whose aim is to build a computer model of a human being. Medicine is ceasing to be an art based on the experience of generations, and is increasingly moving into a field close to engineering, where it is important to measure patient parameters and predict how the body will behave after a specific treatment procedure has been applied – **Marian Bubak, PhD, Eng**.

Marian Bubak, PhD, Eng. – Chief Scientific Officer of Sano. Graduated in Technical Physics at the AGH University of Science and Technology, where he subsequently obtained a PhD in Computer Science. Alongside conducting research at Sano, he heads the Laboratory of Information Methods in Medicine of the Cyfronet AGH Academic Computer Centre. He is a member of the research and teaching personnel at the Institute of Computer Science, AGH, and Professor (Emeritus) of Distributed Systems Engineering at the Institute of Computer Science, University of Amsterdam. Co-editor of the journals: *FGCS, Bio-Algorithms and Med-Systems* as well as *The Computer Science Journal*. He has co-authored about 230 scientific publications and played crucial roles in 15 international research projects of the Framework Programmes of the European Commission. He was involved in the organisation of international conferences: ICCS, EuroPar, CCGrid, eScience.

Prof. Marco Viceconti – hailing from Italy, with a PhD from the University of Florence. He is Professor in Computational Biomechanics at the Department of Industrial Engineering, University of Bologna, Italy, and Visiting Professor at the Department of Mechanical Engineering, University of Sheffield, UK, where he founded the prestigious Insigneo: Institute for In Silico Medicine. He is an expert in the biomechanics of the neuromusculoskeletal system, particularly in the use of physical modelling for medical decision support. Prof. Viceconti is recognised as one of the greatest authorities in the international in silico medicine community. He is the President of the VPH Institute, an international non-profit organisation that coordinates this research community, and board member of the Avicenna Alliance, an organisation representing the interests of the biomedical industry in this area.

Interesting facts

Sano will use the fastest Polish supercomputers located at the Cyfronet AGH Academic Computer Centre in Kraków. The Prometheus currently in place has a computing power of over 50,000 high-end PCs, consists of 15 racks, each of which contains 144 servers and weighs over 30 tonnes. Between 2021 and 2022 a major extension of Cyfronet's computing power is planned, also to benefit Sano.

International partners:
University of Sheffield and Insigneo Institute, Forschungszentrum Jülich, Fraunhofer Institute for Systems and Innovation Research ISI, RWTH Aachen University, Sheffield Teaching Hospital

Polish partners:

Collegium Medicum of the Jagiellonian University and University Hospital in Kraków, Prof. Religa Foundation for Cardiac Surgery Development, AGH University of Science and Technology in Kraków and Cyfronet AGH Academic Computer Centre, LifeScience Kraków Cluster

www.sano.science

linkedin.com/Sano Centre for Computational Medicine

11 Nawojki St., 30-072 Cracow

International Research Agendas

www.fnp.org.pl

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