

Annual
ANNUAL REPORT

Report

2012

POLISH ACADEMY of SCIENCES

Contents

Address by PAS President Professor Michał Kleiber	3	Engineering Sciences	67
Presidium of the Polish Academy of Sciences.....	5	Medical Sciences	86
Members of the Polish Academy of Sciences.....	7	International Relations	96
Academy of Junior Scholars.....	13	Educational and Promotional Activity.....	99
Humanities and Social Sciences.....	15	The FNP Prizes for 2011	105
Biological and Agricultural Sciences	33	Selected Statistics.....	109
Mathematics, Physics, Chemistry, and Earth Sciences	50	Foreign Scientific Centers.....	111
		Research Units and Branches.....	112
		Scientific and Task Force Committees	119

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On the cover:

Top: neuronal cells derived from human cord blood stem cells. Immunofluorescent image. Red – Map-2 protein, characteristic for neurons. Blue – cell nuclei (I. Szablowska-Gadomska). Bottom: stem cells derived from Human Umbilical Cord Blood growing on a bioengineered surface. Scanning electron microscopy image (M. Zychowicz) – Stem Cell Bioengineering Laboratory, NeuroRepair Department, Mossakowski Medical Research Center, Polish Academy of Sciences.

Medical and Surgery Academy, Warsaw (now: the Polish Academy of Sciences, Staszic Palace) by F.H. Röber after L. Kapliński, woodcut engraving. Reproduction from the Archives of the Photographical Documentation Archives of the PAS Institute of Arts.

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Address by PAS President Professor Michał Kleiber

The year 2011 was a time of particularly intense efforts for the Academy, in connection with the relatively new “Act on the Polish Academy of Sciences” which came into force on 1 October 2010. Complying with the new regulations has been a particularly complex undertaking, both substantively and logistically, requiring both the Academy’s corporation (body of elected members) and the PAS organizational units to adapt to significant changes within a relatively short period of time, undergoing reorganization while at the same time maintaining their ongoing activity. This was, and still is, an undertaking of exceptional importance on the scale of the Academy’s entire 60-year history.

In particular, the year 2011 witnessed the transformation of the Academy’s core structure, giving rise to five new Divisions with altered profiles of activity. The program of restructuring the PAS research units was likewise continued, and work was initiated on reforming the Academy’s array of scientific committees and task-force committees. New statutory bodies of the Academy were established: an Academy of Junior Scholars, a Committee on Ethics in Science, and an Audit Committee. A self-governing association of PAS doctoral students was likewise set up. All of this took place in parallel and in connection with one of the most important tasks of all: launching debate on precisely how the Academy’s mission should be formulated and just what its strategic directions of development should be.

The issues involved in reforming, restructuring, and reshaping the organization of the Academy to comply with the new parliamentary act were the central topics of the 118th and 119th Sessions of the PAS General Assembly, which moreover adopted resolutions that addressed the issuing of opinions and recommendations concerning violations of research ethics, and also promoting standards of credibility in research. The debates at the General Assembly sessions also touched on regulations meant to boost the authoritative role played by scientists among society, the educational role of the PAS research units, the promotion of greater public scientific awareness, and efforts to make the economy more innovative, inspired by and pursued by the Academy.



K. Rainka

Two scientific sessions were also held in connection with the General Assembly gatherings: the first marking the International Year of Chemistry plus the 100-year anniversary of Maria Skłodowska-Curie’s Nobel Prize in the field of chemistry, the other dealing with energy sources of the future.

The most important research event of 2011 was indeed the year-long celebration of the 100th anniversary of Maria Skłodowska-Curie’s Nobel. The Academy was proud to be involved in the ceremony kicking off the International Year of Chemistry (under the patronage of the President of Poland) held at UNESCO headquarters in Paris, and also co-organized the opening and closing ceremonies for Maria Skłodowska-Curie’s Nobel jubilee. Many conferences and symposiums were hosted during the course of the year, drawing in outstanding scientists from around the world – including four modern-day Nobel laureates in chemistry. The year-long event also prompted a number of monographs, exhibitions, and films devoted to Maria Skłodowska-Curie, prepared through international cooperation and presented both in Poland and abroad. The clos-

ing ceremonies were held at the Royal Castle in Warsaw, with numerous prestigious representatives of the scientific and political world in Poland, France, and other countries in attendance, plus members of the Nobel laureate's family. The Presidents of France and Poland acted as the official patrons of the opening and closing ceremonies for the anniversary year.

Another important research event with an international dimension was the "Russian Science Days in Poland" (17-21 October), organized as a collaborative effort of the Polish Academy of Sciences and three Russian Academies (the Russian Academy of Sciences, the Russian Academy of Medical Sciences, and the Russian Academy of Agricultural Sciences). The agenda included numerous Polish-Russian research events, including a Polish-Russian seminar on nanotechnology, a session of the Commission of Historians of Poland and Russia, a session of the Polish-Russian Executive Workgroup in the field of basic space research, a research seminar on "Modern Soil-Science for Agriculture and the Environment," and a session of the Polish-Russian Commission of Economists together with a research conference. Also opened was an exhibition on "Women in Science" prepared through the efforts of the Polish and Russian Academies of Sciences.

The international conference Nanoethics 2011, organized by the Polish Academy of Sciences, was in turn one of the most important research events of the Polish Presidency of the EU. The objective was to present an overview of the most important issues involved in nanotechnology management and nanoethics. In particular, the gathering focused on the Code of Conduct for Responsible Nanosciences and Nanotechnologies Research, set forth in a European Commission recommendation on 7 February 2008.

All these events bear excellent testimony to the broad international research activity of the Academy,

which is a member of nearly 90 international research organizations; it greatly prioritizes Polish scholars' participation in research programs pursued under the framework of these organizations and Polish involvement in their management bodies. An important role in furthering bilateral and multilateral research cooperation and in popularizing and promoting Polish science abroad is also played by the PAS foreign centers, which in 2011 held numerous research meetings, exhibitions, and published numerous publications. An exciting new form of international activity of the Academy initiated during 2011 is the Polish-Chinese Center for Dialogue of Scientists and Engineers, which has the objective of broadening Polish-Chinese cooperation in various fields of scientific, social, and economic life.

The Polish Academy of Sciences was particularly honored to distinguish two outstanding foreign scholars with its high-ranking, prestigious awards: the Stefan Banach Metal was awarded to the British mathematician Prof. William T. Gowers, while the Medal of the Polish Academy of Sciences was given to Prof. Maria Siemionov, who specializes in difficult skin transplants.

Overall, the year 2011 was, as I have already stressed, a time of extraordinarily intensive activity in connection with the beginning of a new stage in the Academy's history. Yet irrespective of our research field or type of activity, all of us at the Academy have consistently sought to thoroughly and capably fulfill the Academy's overarching mission – which through the course various debates has come to be defined as the comprehensive pursuit of the advancement of science and scholarship, while unflinchingly adhering to the highest research quality standards and ethical standards.

Michał Kleiber

President of the Polish Academy of Sciences

Presidium of the Polish Academy of Sciences

M. Mlekicki



PAS Authorities (from left): Z. Hensel, A. Górski, M. Chmielewski, M. Marody, M. Kleiber

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- **Dr. Zdzisław Hensel**

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* Ryszard Górecki served as Vice-President of the Polish Academy of Sciences until 31 August 2012.

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Academy of Junior Scholars

The Academy of Junior Scholars was established by the “Act on the Polish Academy of Sciences” dated 30 April 2010, with the objective of promoting the research efforts and R&D work done by outstanding young representatives of Polish science. The members of this new body of young researchers are elected by the General Assembly of Academy members, and their number may not exceed 10% of the statutory number of national Academy members. They may not be more than 38 years old when elected and they must hold at least a PhD degree. They are appointed to the Academy of Junior Scholars for a single 5-year term, and may not be reelected.

The tasks of the Academy of Junior Scholars focus around efforts to stimulate the community of young researchers, predominantly including: putting forward opinions and agendas regarding scientific affairs; organizing debates, discussions, and research conferences to consider significant problems in a given discipline or set of related disciplines and popularizing the results of such gatherings; preparing opinions and scientific evaluations of a given discipline or set of related disciplines; and promoting standards of ethics among young researchers.



The first meeting of the Academy of Junior Scholars, 25 January 2012 (M. Mlekicki)

Leadership of the Academy of Junior Scholars

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Bartosz Karaszewski, PAS Division Five: Medical Sciences

Deputy Chairman:

Roman Szewczyk, PAS Division Four: Engineering Sciences

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Tomasz Guzik
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Łukasz Małek

Humanities and Social Sciences

Stanisław Filipowicz (born 15 February 1952),
Dean of PAS Division One: Humanities and Social
Sciences.

A historian of political thought, a graduate of the Faculty of Law and Administration at the University of Warsaw. His research focuses on the issue of different models of political rationality, liberal tradition, and transformations of political thinking patterns associated with the erosion of the tradition of the Enlightenment.

Corresponding Member of the Academy; Professor at the Faculty of Journalism and Political Science, University of Warsaw and the Institute of Political Studies, Polish Academy of Sciences; Director of the Institute of Political Science, University of Warsaw (in 1991-1999); Head of the Department of History of Thought and Social Movements, University of Warsaw; since 1995 Head of the Department of Political Philosophy at the Institute of Political Studies, Polish Academy of Sciences.



Jerzy M. Brzeziński (born 13 April 1947), Chair of the
Council of Provosts, PAS Division One: Humanities and Social
Sciences.

A graduate of the Department of Psychology at the Adam Mickiewicz University in Poznań; a specialist in psychological research methodology; Corresponding Member of the Academy (in 1998-2007), since 2007 Ordinary Member of the Academy; member of the PAS Presidium (since 2007); Vice-President (in 2007-2010) and member of the Presidium of the Poznań Branch, Polish Academy of Sciences (since 2011); since 2004 editor-in-chief of the *Nauka* quarterly.

Professor of the Institute of Psychology, Adam Mickiewicz University and University of Social Sciences and Humanities in Warsaw (SWPS Faculty in Wrocław); Dean of the Department of Social Sciences at the Adam Mickiewicz University (in 1981-85 and 1990-96); Director of the Institute of Psychology, Adam Mickiewicz University (1987-1990, and since 1999); since 1979 Head of the Department of Basic Psychological Research, Adam Mickiewicz University.

Member of the following organizations: l'Académie Européenne des Sciences, des Arts et des Lettres – AESAL (since 2011); the PAS Committee on Psychology (since 1981); the PAS Committee on Ethics in Science (since 2007); the PAS Committee on Science Studies (in 2007-2011).

Chair of the Human Sciences Research Committee (1997-2004); Chair of the Working Group (Social Sciences and Humanities) of the Research Council for the Development of Science, Ministry of Science and Higher Education (2008-2011).





editor-in-chief of the *Stylistyka* (Stylistics) magazine (since 1992).

Member of the Presidium of the International Committee of Slavists and since 2000 superintendent of the ICS commissions; *doctor honoris causa* at the Saints Cyril and Methodius University of Skopje (2005) and the Pedagogical University of Kraków (2010); member of the State Committee for Scientific Research (in 1997-2005).

Stanisław Gajda (born 3 October 1945), Deputy Chair of the Council of Provosts, PAS Division One: Humanities and Social Sciences.

A graduate of Opole University; an expert in Polish and Slavic linguistics; since 2010 Corresponding Member of the Academy; member (since 1990) and Chair (in 1977-2007) of the PAS Committee on Linguistics; since 2003 member of the PAS Committee on Slavic Studies; since 1996 member of the Council for the Polish Language.

Professor and Director of the Institute of Polish Philology at Opole University; founder and

As of the end of 2011, Division One: Humanities and Social Sciences had 48 national members (25 ordinary members and 23 corresponding members), plus 35 foreign members of the Academy. It is with deep sorrow that we note that the Academy's ordinary members Jan Baszkiewicz and Wincenty Okoń, corresponding member Alina Witkowska, and foreign members Joachim Herrmann and Jakub Goldberg passed away in 2011.

The Division held three plenary sessions in 2011. The first session, held on February 10, was devoted to organizational matters concerning the beginning of a new term of office. Participants accepted Stanisław Filipowicz, corresponding member of the Academy, as a candidate to become the Division's Dean in the 2011-2014 term and appointed him to represent Division One in the PAS Presidium. Wiesław Grudzewski, corresponding member of the Academy, was elected as Division One's candidate to sit on the PAS Audit Committee, while corresponding members Stanisław Gajda and Władysław Welfe were elected as the Division's representatives to sit on the PAS Science Promotion Council. A commission was established to evaluate the statutes of the research institutes within the Division, including Ewa Łętowska, ordinary member, and Karol Myśliwiec and Jan Woleński, corresponding members. A proposal from the scientific council and authorities of the Institute of the History of Science

to rename the Institute in honor of Ludwik and Aleksander Birkenmajer was accepted. The participants of this session furthermore decided not to divide the Division into sections.

During the second plenary session, held on May 12, a resolution was passed to grant Division One's annual awards in the 2011-2014 term and an Awards Commission was elected. Corresponding members of the Academy Jerzy Axer and Zbigniew Kwieciński were selected as the Division's representatives to serve on the Chapter of the Academy of Junior Scholars. A resolution was passed regarding the network of committees affiliated with Division (24 scientific and 3 task force committees) in the new term of office. In the second part of the session Jerzy Strzelczyk, corresponding member of the Academy, delivered a lecture on "Problems with the Middle Ages" that sparked a lively discussion.

During the third plenary session, held on November 17, the Division granted its research awards in the following fields: history, linguistics, literature and philology, political studies, and law studies. At the same session election rules were established, and elections to the Academy of Junior Scholars were held. None of the candidates gained the required minimum number of votes. Professor Jerzy Brzeziński, ordinary member of the Academy and Chair of the Division's Council of Provosts, gave a report on the activity of the Council of Provosts.

A candidate to sit on the Committee on Labor and Social Policy Sciences was chosen from among the set of individuals who had gained the same number of votes in direct elections. During the second part of the session Jan Woleński, corresponding member of the Academy, delivered a paper entitled “Law-Governed State,” which was followed by a discussion.

The Division granted its annual research awards to the following individuals: the Joachim Lelewel Award in history went to Prof. Wojciech Kriegseisen from the Tadeusz Manteuffel Institute of History, Polish Academy of Sciences, for the work *Stosunki wyznaniowe w relacjach państwo-kościół między reformacją a oświeceniem. (Rzesza Niemiecka – Niderlandy Północne – Rzeczpospolita polsko-litewska* [Religious Relations in State-Church Relations from the Protestant Reformation to the Enlightenment (German Empire – Northern Netherlands – Polish-Lithuanian Commonwealth)]; the Kazimierz Nitsch Award in linguistics to Prof. Jolanta Nocoń at Opole University for the work *Podręcznik szkolny w dyskursie dydaktycznym – tradycja i zmiana* [The School Textbook in Educational Discourse – Tradition and Change]; the Aleksander Brückner Award in literature and philology to Prof. Tadeusz Sucharski at the Pomeranian University in Słupsk for the work *Polskie poszukiwania „innej” Rosji. O nurcie rosyjskim, w literaturze Drugiej Emigracji* [The Polish Search for the “Other” Russia – The Russian Literary Mainstream in the Literature of the Second Emigration]; in political studies to Prof. Tomasz Żyro at Warsaw University for the work *Wola polityczna. Siedem prób filozofii praktycznej* [Political Will – Seven Attempts at Practical Philosophy]; the Leon Petrażycki Award in law studies to Dr. Marzena Laskowska from the Institute of Legal Studies, Polish Academy of Sciences, for the work *Dostosowanie prawa do Konstytucji Rzeczypospolitej Polskiej z 1997 roku* [Adjusting the Law to Comply with the 1997 Constitution of the Republic of Poland].

On October 17-21, 2011 the Ludwik and Aleksander Birkenmajer Institute of the History of Science, the Pultusk Academy of Humanities, and the Józef Mianowski Fund – A Foundation for the Promotion of Science organized a research conference of the Joint Commission of Historians of the Polish and Russian Academies of Sciences entitled “Polish and Russian Academies of Sciences, universities, higher education institutions, research units and learned societies – Polish-Russian scientific relations.”



The laureates of the Division One: Humanities and Social Sciences scientific awards. From left: Prof. Wojciech Kriegseisen, director of the PAS Tadeusz Manteuffel Institute of History (recipient of the Joachim Lelewel Award in history); Prof. Jolanta Nocoń from Opole University (recipient of the Kazimierz Nitsch Award in linguistics); Dr. Marzena Laskowska from the PAS Institute of Legal Studies (recipient of the Leon Petrażycki Award in law); wife of Prof. Tomasz Żyro (the Aleksander Brückner Award in literature and philology); Prof. Tadeusz Sucharski from Pomeranian University in Słupsk



Prof. Michał Kleiber, PAS president, and the laureates of the Division One awards

The Council of Provosts, at the beginning of the reporting period, consisted of 22 persons. It held one session, on 10 February 2011, during which the Bylaws of the Council of Provosts were laid out and the following individuals were elected: Chair of the Council – Jerzy Brzeziński, ordinary member of the Academy; Deputy Chair of the Council – Stanisław Gajda, corresponding member of the Academy; two representatives of national scientific communities – Prof. Joanna Kurczewska from the Institute of Philosophy and Sociology, Polish Academy of Sciences and Prof. Krystyna Skarżyńska from

the Institute of Psychology, Polish Academy of Sciences; and two representatives of international scientific communities – Prof. Gerd Hentschel at the Carl von Ossietzky University of Oldenburg (Germany) and Prof. Timothy Snyder at Yale University (USA).

Moreover, the Council of Provosts selected its representatives to serve on the Competition Commissions to fill the posts of directors at the following institutes: Institute of the History of Science (Henryk Olszewski and Janusz Tazbir, ordinary members of the Academy), Institute of Slavic Studies (Stanisław Gajda, corresponding member, and Franciszek Grucza, ordinary member), Institute of Art (Stanisław Mossakowski, ordinary member, and Andrzej Rottermund, corresponding member), and Institute of Mediterranean and Oriental Cultures (Henryk Samsonowicz, ordinary member, and Prof. Marek Mejor).

Out of all the statutory tasks of the Council of Provosts – which include evaluating the activity of the research institutes, scientific and task force committees affiliated with Division One; petitioning the PAS President to introduce structural changes at research institutes; and carrying out competitions to fill the posts of directors of the PAS research institutes – the Council dealt only with this last task in 2011. The members of the Council of Provosts, through e-voting, set up competition commissions to carry out 12 recruitment processes to fill the posts of directors at 11 research institutes. Seven such competitive processes ended with the appointment of the following individuals by the PAS President: Prof. Leszek Zasztowt – as director of the Aleksander and Ludwik Birkenmajer Institute of the History of Science for a 4-year term from 1 July 2011; Prof. Elżbieta Witkowska-Zarembina – as director of the Institute of Art for a 4-year term from 1 July 2011; Dr. Anna Engelking – as director of the Institute of Slavic Studies for a 4-year term from 1 August 2011; Prof. Karol Myśliwiec – as director of the Institute of Mediterranean and Oriental Cultures for a 4-year term from 1 September 2011; Prof. Wojciech Kriegseisen – as director of the Tadeusz Manteuffel Institute of History for a 4-year term from 1 January 2012; Prof. Władysław Czapliński – as director of the Institute of Legal Studies for a 4-year term from 1 March 2012; and Prof. Urszula Jakubowska – as director of the Institute of Psychology for a 4-year term from 15 March 2012. The competition for the post of director of the Institute of

Political Studies, held on November 2011, remained unresolved, as none of the candidates was admitted by the Competition Commission to the second stage of the competition.

Members of Division One received numerous awards and distinctions in 2011. Stanisław Filipowicz received the Award of the President of Warsaw University for the work *Prawda i wola złudzenia* [Truth and the Need for Illusions]; Stanisław Gajda received the Karol Miarka Award funded by the Marshals of the Silesian and Opole Regions; Michał Głowiński received the Władysław and Nelli Turzański Foundation Award for the book *Kręgi obcości* [Circles of Strangeness], which was also nominated for the Nike Literary Award and the Kazimierz Moczarski History Award; Wiesław M. Grudzewski was given the “100 Years of Technical Education in Lower Silesia” Medal, the “Szabla Kilińskiego” honorary badge by the Polish Craft Association, the Medal of the Wrocław University of Technology for his merits to the Faculty of Computer Science and Management, and the Best Paper Award for the article *Sustainable Enterprise – Enterprise of the Future – As the Response to the Economic Crisis* written for the 3rd Annual International Conference on Sustainable Enterprise of the Future; Jerzy Kmita was awarded the *Palmae Universitatis Studiorum*, the highest scientific distinction bestowed by the Adam Mickiewicz University in Poznań; Zbigniew Kwieciński received a *doctor honoris causa* degree from the University of Lower Silesia; Ewa Łętowska was decorated with the Commander’s Cross with Star of the Polonia Restituta Order; Mirosława Marody was decorated with Officer’s Cross of the Polonia Restituta Order; Stanisław Mossakowski was appointed as an active member of the Polish Academy of Arts and Sciences (PAU); Karol Modzelewski was distinguished by the Accademia dei Lincei by being elected its member; Karol Myśliwiec received the Polish Prime Minister’s Award for his lifetime achievements; Zbigniew Radwański was decorated with the Order of the White Eagle for his contribution to the development of contemporary Polish civil law; Andrzej Rottermund was distinguished with the Grand Cross of the Polonia Restituta Order and received the Józef Chełmoński Award for his outstanding achievements in artistic activity and culture promotion, as well as the annual Award of the Minister of Culture and National Heritage; Jerzy Strzelczyk received the

“*Lednicki Orzeł Piastowski*” honorary award bestowed by the Marshal of the Wielkopolska Region; Andrzej Walicki celebrated the republication of his doctorate at the University of Warsaw; Stanisław Waltoś received the title of *doctor honoris causa* from the University of Warsaw and was distinguished with the Commander’s Cross with Star of the Polonia Restituta Order; Aleksander Welfe was elected a member of the Academie Europeenne des Sciences, des Arts et des Lettres; Władysław Welfe won the Award of the President of the University of Lodz for the work *Zarys historii ekonometrycznego modelowania gospodarki narodowej* [An Outline of the History of Econometric Modeling of National Economy]; Jerzy Wilkin received the title of *doctor honoris causa* from the University of Białystok and was distinguished with the Knight’s Cross of the Polonia Restituta Order; Bogdan Wojciszke received a “Mistrz Programme” academic grant, awarded to professors by the Foundation for Polish Science. The Commander’s Cross of the Polonia Restituta Order was conferred upon the following individuals: Andrzej K. Koźmiński, Henryk Olszewski, Jan Strelau, and Jan Woleński.

In the first half of 2011, the Division embraced 25 scientific committees. By decision of the PAS Presidium, 24 scientific committees affiliated with Division One were set up for the 2011-2014 term. During their first sessions in the new term (November-December), 14 committees elected their chairs, deputy chairs, secretaries, and electoral committee and presidium members. The organizational matters concerning the activity of the committees in the 2011-2014 term were also discussed.

The Committee on the History of Science and Technology met at three plenary sessions. The first plenary session in the 2011-2014 term was held on 6 December 2011. Members of the Commission on the History of Siberia participated in the meeting of the Commission on History affiliated with the Polish and Russian Academies of Sciences. The Committee organized a scientific session on the activities of Polish chemists during World War II, which was held as part of the celebrations of the International Year of Chemistry. The Committee published a work by Kamil Kupliński, *Edwarda Janczewskiego studia nad porzeczkami. Karta z dziejów systematyki XIX–XX w.* [Edward Janczewski’s Studies on Currants – A Page from the History of 19th-20th Century Systematics], and the

tenth biographical volume from the series *Wybitni Polacy na Ziemi Lidzkiej* [Outstanding Poles from the Lida Region].

The Committee on Linguistics organized three plenary sessions, during which K. Kleszczowa delivered a paper entitled “Functional expressions in diachronic terms.” During sessions held by 9 different commissions more than 20 papers were delivered, including “Distinguishing morphology and phonetics on the maps of the Pan-Slavic Atlas” by J. Siatkowski. The first session of the Committee in the 2011-2014 term was held on 25 November 2011. The Committee co-organized two international conferences “*Nom Polakom tutaj pomnik trza wszystkim postawić, dlatego że jeszcze my jesteśmy, że jeszcze ktoś umi rozmawiać po polsku*. Polish linguistic heritage of the borderlands” and “Meaning, Context, and Cognition.”

The Committee on Demographic Studies held its first plenary session in the 2011-2014 term on 24 November 2011. The Section on Demographic Analyses co-organized a Young Demographers Conference entitled “Contemporary demographic problems in the times of globalization – Positive and negative aspects.” The Historical Demography Section met at three sessions during which M. Szoltysek delivered his paper “The dangers of pre-statistical exploitation of the census – A criticism of source in historical demography.” The Regional Demography Section co-organized a seminar on the National Census.

The Committee on Economic Sciences met at two sessions, during which two papers were delivered: “Present challenges to the development of the economy in Poland and the European Union” by J. Osiatyński and “Benefits from the mathematization of the economy” by M. Bochenek. The Committee co-organized the 21st Conference on “Challenges to Poland and Russia in the face of global changes in the economic model.” Six issues of *Ekonomista* [Economist] bimonthly magazine were published.

The Committee on Ethnological Sciences held one plenary session which was devoted to organizational matters. The Committee co-organized a conference entitled “Cultural dimensions of health, sickness and treatment – An interdisciplinary perspective.” The Commission on Eastern Research co-organized an international conference on “Himalayan meeting places: Trade, pilgrimage and cultural encounters.” The 95th volume of the *Lud* [People] magazine was issued.

The Committee on Philosophical Sciences met at three sessions. Together with the Committee on Pedagogical Sciences, Committee on Legal Studies and Committee on Psychology, it issued an appeal to the Ministry of National Education to maintain philosophy on the *matura* examination. The PAS authorities requested an expert report on the state of philosophy in Poland.

The Presidium meeting of the Committee on Historical Sciences was devoted to giving opinions on recommendations for the Polish Prime Minister's Award. The Commission on the History of Cities co-organized a conference entitled "Correspondence of the cities of the Republic of Poland, Silesia, and Pomerania from the Middle Ages to the 19th century."

Three plenary sessions were held by the Committee on Financial Sciences, during which T. Czerwińska delivered her paper on "Investment policy of insurance companies – The heart of the matter, determinants, and instruments." The first plenary session of the Committee in the 2011-2014 term was held on 15 November 2011. The Committee co-organized three scientific conferences, including "Present problems of the functioning of the banking sector in Poland, Russia, and Eastern European countries" and "Finance didactics in the finance and accounting field." The Committee's Award was bestowed to Irena Pyka for her outstanding scientific achievements in the field of finance.

Two plenary sessions were held by the Committee on Culture Studies. Mirosława Marody spoke at the plenary session held on 23 February about the changes resulting from the new Act on the Polish Academy of Sciences. The first session of the Committee in the new term was held on 1 December.

The Scientific Committee on Ancient Culture met at five plenary sessions, during which N. Richardson delivered his paper on "Constructing a Hymnic Narrative: Tradition and Innovation in the Longer Homeric Hymns." The first plenary session of the Committee in the new term was held on 25 November. The most active commissions in the reporting period were the Commission on Byzantine Studies, the Commission on Neo-Latin Studies, and the Commission on Ancient Law. Four issues of *Meander* magazine were published.

The Committee on Literature Studies held two plenary sessions. The first one was devoted to a paper presented by E. Krasowska on "National frames

of classification." The Committee co-organized two conferences, on "The *Northern side* of Czesław Miłosz" and "A century after Maria Skłodowska-Curie – The emancipation of women in Poland and France." The Committee and the University of Silesia jointly organized the 12th Convention of Polish Studies Specialists.

Three plenary sessions of the Committee on Labor and Social Policy Sciences were held. During the meeting on 22 April, M. Seweryński delivered his paper "Labor law codification problems in the transformation period" and the Committee conferred the W. Schubert Medals. The first session in the 2011-2014 term was held on 22 November. The Committee co-organized the 29th Polish Conference of Social Politicians entitled "Education problems and the employment market and social development." The research conducted by the Commission on Regional Social Policy focused on the problems of demographical factors influencing the development of Silesia through 2020.

During two plenary sessions of the Committee on Oriental Studies, the following papers were delivered: "*Rasik sampradāy* – Esoteric nature of the Rama cult in Northern India" by D. Stasik and "Protobulgarian Language in Danube Bulgaria (7th-9th centuries)" by A. Parzymies. *Rocznik Orientalistyczny* [Oriental Studies Yearbook] continued to be published. The Committee gave a positive opinion on the granting of the Polish Prime Minister's Award.

The Committee on Organizational and Management Sciences held two plenary sessions in the first half of the year. The Committee was a co-organizer of three scientific conferences, including "Breakthroughs in management" and "Management sciences vs. uncertainty and lack of continuity in the examined phenomena." Four issues of the quarterly *Organizacja i Kierowanie* [Organization and Management] and its special English version were published. The Tadeusz Kotarbiński Medal, awarded by the Committee, was conferred to B. Haus, S. Wiczorek, A. Dymna and the Radex SA corporation.

The Committee on Art met at three plenary sessions, during which two papers were delivered: "They walked screaming: *Poland, Poland* – Contemporary drama in the community/nation" by D. Kosiński and "Robert Browning – the Renaissance pictures in Victorian England." The first plenary session in the 2011-2014 term was held on 1 De-

cember. A one-day conference on “Polish sciences on art in the times of freedom” was held on 8 April.

The Committee on Pedagogical Sciences held four plenary sessions, with the first in the 2011-2014 term being held on 6 December. The Committee co-organized a conference on “Striving for mastery – Learning from the research techniques of major and minor researchers” and the 4th Ukrainian-Polish Forum on “Development of pedagogical sciences in Ukraine and Poland at the beginning of the 21st century.” The committee expressed its opinion on bills and directives from the Ministry of National Education, for the use of the Ministry and the Conference of Rectors of Academic Schools in Poland. The 24th volume of the *Rocznik Pedagogiczny* (Pedagogical Yearbook) was issued.

Three plenary sessions of the Committee on Political Sciences were held in 2011, with the first in the 2011-2014 term taking place on 22 November. The Committee co-organized a national scientific conference on “European Union – China: Present and future.” The book *Spory wokół teorii i praktyki państwa prawa* [Arguments on Theory and Practice of the Law-Governed State] edited by G. Ulicka and S. Wronkowska was published.

The Committee on Prehistoric and Protohistoric Sciences met at three plenary sessions, during which M. Parczewski delivered his paper on “New, early Slavic, open settlements on the loess Rzeszów Foothills.” The first session in the 2011-2014 was held on 2 December. The Commission on Medieval and Early Modern Period Archaeology organized a one-day conference on the “Archaeology of churches, monasteries, and cemeteries – Problems with methods, documentation, and interdisciplinary cooperation.” The Committee gave an opinion on four recommendations for the Polish Prime Minister’s Award.

The Committee on Legal Sciences met at two plenary sessions, with the first session in the 2011-2014 term being held on 13 December. The Committee dealt with two serious legal and social problems, namely the state of public finances and their reform and the procedure for the appointment of judges to the Constitutional Tribunal. The Committee and the Committee on Political Sciences jointly published a monograph *Spory wokół teorii i praktyki państwa prawa* [Disputed Issues in the Theory and Practice of the Law-Governed State] edited by G. Ulicka and S. Wronkowska.

The Committee on Theological Sciences held one plenary session during which A. Tronina presented his paper on “The Bible of Częstochowa and the new biblical commentary – Premises and perspectives.” During the same meeting the Committee dealt with the issue of publishing *Studia Nauk Teologicznych PAN* [Studies on Theological Sciences] and organizing cyclic scientific conferences on “Christianity’s contribution to Polish culture.”

The Committee on Psychology met at three plenary sessions. The first session in the 2011-2014 term was held on 15 November. The Committee co-organized the “20th Psychological Colloquia.” The Andrzej Malewski Award bestowed by the Committee went to P. Sorokowski. The Committee presented to the Minister of Science and Higher Education its opinion on the criteria and procedures for classifying the caliber of research at scientific units and for evaluating scientific journals published in Poland.

The Committee on Slavic Studies held three plenary sessions, during which J. Siatkowski presented his paper on “Distinguishing morphology and phonetics on the maps of the Panslavic Atlas.” The first session in the 2011-2014 term was held on 9 December. The Committee made an appeal to the director of the Institute of Bulgarian Language and the President of the Bulgarian Academy of Sciences in defense of the research teams from the Bulgarian Academy of Sciences that are in danger of being put into liquidation. Two motions to grant the Polish Prime Minister’s Award were passed. The journals *Slavia Orientalis*, *Pamiętnik Słowiański* [Slavic Chronicle], and *Rocznik Slawistyczny – Revue Slavistique* [Slavic Yearbook – Revue Slavistique] were published.

During the first plenary session of the Committee on Sociology, E. Rewers and T. Szlendak delivered their paper on “Culture and the city.” The Committee issued an opinion on one recommendation for the Polish Prime Minister’s Award. Four issues of the journals *Kultura i społeczeństwo* [Culture and Society] and *Studia Socjologiczne* [Sociological Studies] were published.

The Committee on Statistics and Econometrics met at two plenary sessions. The Committee co-organized four conferences, including the “36th Macromodels International Conference,” the 30th International Conference on “Multivariate Statistical Analysis,” and the 20th Conference on “Classification and data analysis – Theory and

applications.” A new section on “Didactics and Science” was introduced in the journal *Przegląd Statystyczny* [Statistical Overview]. The Committee provided its patronage for a few competitions on statistics, which were organized at high schools and higher education institutions.

In the first half of the reporting year there were not yet any functioning task-force committees affiliated with Division One. By a decision of the PAS Presidium, four task-force committees affiliated with Division One were set up for the 2011-2014 term in the second part of the year. The first plenary sessions in the new term were held on September and October, during which the committees elected their chairs, deputy chairs, secretaries, and presidium members.

The Research Committee on Human Migrations held its first plenary session in the 2011-2014 term. The Committee changed its name from the Committee on Human Migrations and the Polish Diaspora to the Research Committee on Human Migrations. The Committee created its website to promote its activity and initiated a publication called *Informator Migracyjny* [Migration Guide] to collect and transmit information on scientific events taking place within the community of Polish migration researchers.

The Committee on Agricultural Economy and Rural Development met at two plenary sessions, including its first session in the 2011-2014 term. Its December session was devoted to a celebration of the 90th birthday of E. Gorzelak – honorary member of the Committee.

The Committee on Ethics in Science held its first plenary session in the 2011-2014 term. The Committee held a joint meeting with the Commission for Ethics in Science and the Panel for Promoting Good Academic Practices on December 16, dealing with the competence and tasks of the three bodies, and the reform of disciplinary proceedings.

The Committee on Science Studies met at four plenary sessions, including its first session in the new term. Previously, the Committee functioned as a scientific committee affiliated with Division One. The Committee organized the following conferences: “The ethos of the researcher,” “Functions and aims of science,” and “The innovative character of science in Poland.” Under the supervision of the Committee a synthetic publication *Podstawy naukoznawstwa* [The Rudiments of Science Studies] was issued. The Committee published four issues of the quarterly *Zagadnienia Naukoznawstwa* [Problems of Science Studies].

Newly discovered sacrificial bog site from Late Antiquity near Czaszkowo in Masuria

T. Nowakiewicz | Institute of Archaeology | University of Warsaw

A. Rzeszotarska-Nowakiewicz | Institute of Archaeology and Ethnology | Polish Academy of Sciences

Site 1 at Czaszkowo, a unique sacrificial place from Late Antiquity, is located at the former Lake Nidajno in Piecki Commune, Mrągowski District, Poland. Excavations of the site are being organized by a research team from the Institute of Archaeology, University of Warsaw and the Institute of Archaeology and Ethnology, Polish Academy of Sciences. The project leaders are Tomasz Nowakiewicz, PhD (IA UW) and Aleksandra Rzeszotarska-Nowakiewicz, PhD (IAiE PAN), with the team of students from the Institute of Archaeology, University of Warsaw and prospectors. The first stage of discovery started with agricultural drainage, at first during the second half of the 19th century, then

during the 1960s through to the 1980s. It is from this time that we have the first, not easily verifiable information about a find which we can link with the lake deposit. The second stage of discovery began in the 1990s, when a quantity of iron objects were recovered there. A quite important development came in 2009 when the Mrągowo unit of the Warmia and Masuria Museum was approached with some finds recovered a few years earlier: two fragments of unique ornaments (fig. 1) and four spearheads. The latest stage of discovery has been the archaeological verification work undertaken by our team on the site in 2010. Just ten days’ work, carried out in September, was needed to make a map of the

horizontal stratigraphy of the surface finds and to start excavation in two test trenches.

Input gained at this time demonstrated the existence of a connection between the investigated location and the information about earlier discoveries. It also confirmed the potential the site might have for archaeology, although the extent of its erosion was not determined at the time. To answer this and many other questions, a wider-scale investigation was undertaken the following season, carried out during a four weeks' excavation campaign in July 2011. The area in which the work has so far been concentrated lies within the former western bay of the lake. This shallow fragment was permanently drained, the riverbed of the Dajna river being improved and transformed into a straight waterway. The archaeological excavation covered the dry area (north bank), wet area (south bank) and the completely wet area (the riverbed). Exploring the site we identified no relics typical for the stratigraphy of settlement or mortuary sites.

The culture component resting within this deposit consisted of organic and metal finds, the latter mainly iron, showing a substantial level of damage, caused by advanced corrosion. The situation was improved somewhat by the presence of wooden elements which tended to survive well in the acidic environment of the peat soil. The presence of numerous iron objects, most often heavily corroded, is one of the characteristic features of the Czaszkowo site. The spearheads, knives, and swords that dominate the series are identifiable thanks to their characteristic fragments of blades and sockets and blades respectively.

One truly unique find is a series of fragments of what was probably Roman chainmail. Another of the highlights of the deposit from Czaszkowo consists of brilliant elements of a richly decorated belt set. We can treat this group as belonging to one suite of belt ornaments (or of horse harness) comprising at least belt appliqué and a belt hanger. Each of these silver gilt ornaments is accentuated with niello. Another piece in a close relationship with the belt appliqué is a buckle plate and fragment of a buckle frame (fig. 2). One of the most unusual finds is a large strap appliqué with a palmetto terminal and a silver representation of a man-and-horse hybrid and the image of a hippocamp. Another object decorated with zoomorphic designs is a large silver mount with five gilt representations of the hybrids (fig. 3). The exceptional finds



Fig. 1. Silver, gilt and nielloed elements of a belt or harness (M. Osiadacz)



Fig. 2. Following elements of the belt or harness set: appliqué, hanger, and fragments of buckles (M. Osiadacz, J. Strobin)



Fig. 3. Large silver, gilt and nielloed appliqué and mount with representations of hybrids (J. Strobin)

further include a sword guard and upper scabbard mounts made of pure gold with a composition of zoomorphic and floral designs as well as gilt silver figurine of the vulture (fig. 4). There can be no doubt that the group of archaeological objects recorded at Czaszkowo was deposited deliberately in



Fig. 4. Gold mounts of the sword guard and upper scabbard and silver gilt figurine of the vulture (J. Strobin)

the waters of the now defunct Lake Nidajno. The quality of execution and style design of the gold sword mounts indicates that these objects originated in the sphere of Mediterranean civilization. Less easily resolved is the question of the provenance of the elite belt settings and figurine of the vulture, which display affinity with Roman artwork as well as with elite goods from Germanic, Sarmatian, and even Sassanid workshops. Similar complexity of

stylistic elements is indicative of cultural syncretism and could be the effect of coexistence of Germanic, nomad, and Iranian peoples in the contact zone with the Roman Empire. We are even much less clear about the circumstances of these exceptional objects' arrival in the Balt territories in Masuria. They could have been war booty, or alternately, a diplomatic gift to a local leader. The site should be preliminary dated to the period between the second half of the 3rd and the end of the 5th centuries. The sacred site on Lake Nidajno, the first archaeologically confirmed sacrificial bog site from the Roman Period and the Migration Period in Poland, definitely has much in common with similar sites known from southern Scandinavia. Research will continue in subsequent seasons, expected to bring a substantial increment of new and significant data.

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The Impact of EU Subsidies on the Innovativeness of Polish Enterprises

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High innovativeness is a key condition for participation in the global competitive rivalry. EU subsidies constitute a significant instrument for stimulating innovative activity on the part of Polish firms, including small and medium-sized enterprises. Hence, evaluating the impact of such subsidies on the transfer of knowledge from the research and development (R&D) sector to enterprises, and on the improvement of their capacity for innovation, has become an important research topic.

This analysis was carried out by adopting the perspectives of three main groups of knowledge-transfer participants: R&D institutions, intermediaries in the EU subsidy allocation process (i.e. local governments), and enterprises. The study of these groups involved evaluating the status and level of EU subsidy absorption, identifying major barriers encountered in the process, and recommending changes in the allocation system to improve its effectiveness.

The research showed that local governments, intermediating in the flow of EU funds to enterprises, did not manage to cope properly with their tasks. In specific, the process was found to be overly bureaucratized in terms of setting criteria for choosing projects to be supported with public funds and excessive formalization of the process of controlling their implementation. Moreover, the formal selection criteria were found to be accompanied by additional, informal ones. The study supported the hypothesis that local authorities do not in fact play the role of knowledge brokers intermediating in the transfer of knowledge from the R&D sector to enterprises, and do not support the kind of horizontal links between business entities (i.e. clusters, networks) that enable new knowledge absorption.

The study revealed current R&D efforts to be only of limited applicability for business practice. A wide range of barriers hampering the effectiveness of R&D were identified. Firstly, an information barrier was noted, constricting the R&D sector's ability to recognize the demand among enterprises for product, process, organizational, and managerial innovations, while on the other hand firms also remain unaware of the research sector's current and planned directions of study. This barrier was found to constitute a major hurdle in the transfer of new knowledge to enterprises. Next, a relatively low level of human capital in the R&D sector, resulting from the general conditions under which it operates, was found to be constraining the absorption of innovation-targeted EU funding. Another obstacle was the financial situation of the R&D sector and high costs of innovative projects, which were meant to be mitigated by the absorption of the EU funds (Framework Programmes, structural funds). However, the level of absorption of these funds was low, and the allocation patterns were found to be highly asymmetric, with a marked dominance of expenditures on training and investments in research infrastructure. Expenditures on actual research and development were scarce. In the R&D sector, the lack of incentive systems encouraging commercialization of research results was found to be an important barrier to the transfer of knowledge. Such systems could be used to establish the institution of knowledge brokers.

The study formulated recommendations about how to reduce these barriers. Firstly, we recommended strengthening the role of bank credit in financing the input of R&D entities to EU-supported projects. Secondly, the widespread use of online platforms for



Panel discussion on 8 December 2011

the exchange of information between R&D entities and enterprises was proposed. The transfer of knowledge could also be stimulated by enabling private businesses' employees to pay visits to and work internships at R&D entities, and vice versa. Finally, the priorities of structural fund allocation should be altered to increase the share of funds directly supporting the R&D sector, at the expense of the funding allocated to enterprises.

Our diagnosis of the new knowledge transfer to enterprises from the R&D sector is as worrying as the results observed from the perspective of the intermediary bodies and the R&D sector itself. The study of firms unfortunately confirmed the project's research hypothesis, showing a highly limited impact of EU funds on the innovativeness of enterprises. The analysis identified three major groups of barriers hindering this process, i.e. institutional, demand-side, and financial barriers. An overregulated system for the allocation and control of the flow of funds, in need of simplification, was found to be the main institutional barrier. This group of barriers also included defects in business-environment institutions (consultancy) and weaknesses in intellectual property regulation. The propensity for innovation was found to be weakened to a large extent by demand-side constraints. Factors underpinning the internal demand barrier include a low and still-shrinking level of domestic consumption and the resulting limited demand for new products and services, in conjunction with a very strong information barrier concerning the available results of R&D sector studies. A lack of effort on the part of businesses to monitor on an ongoing basis what the R&D sector has to offer, together with a lack

of effort on the part of the sector itself to analyze the market systematically, are what lies at the root of this problem. Despite the ubiquitous self-financing of Polish enterprises, their shortage of internal resources for financing inputs to EU-supported projects, together with the limited availability of bank credit, make the financial constraint one of the top barriers to the absorption of innovation-targeted EU funds. The high investment risk (particularly during the financial crisis) and the high cost of implementing innovations contribute to strengthening the financial barrier. This group of barriers also includes the insufficient scope of guarantees for venture capital and private equity funds. Nevertheless, despite the presence of such barriers, the absorption of EU structural funds has brought about a minor advancement in the innovative abilities of the enterprises studied.

A wide array of recommendations is made by the study, including very prominently the postulate to deregulate (i.e., to cut the red tape involved in) the mechanism of EU fund allocation. Another recommendation that merits special attention is one to increase the pro-innovative efficiency of EU structural funds by replacing the non-refundable public subsidies with refundable instruments. Wider use of pro-innovative fiscal instruments is also recommended, in conjunction with stronger guarantees for venture capital and private equity funds. The

postulated increase in popularity of public-private partnerships should also play a role in strengthening the innovative activity of enterprises. The regulatory system of higher education institutions and R&D entities should be adapted so as to better stimulate academic entrepreneurship and innovative activities. In specific, this implies creating systemic solutions to promote the development of spin-offs.

These diagnostic and normative issues were analyzed based on a questionnaire study answered by 10 local governments, 18 R&D entities, and 104 industrial and service enterprises, supplemented by conclusions from a Delphi method discussion, expert opinions, and a case study.

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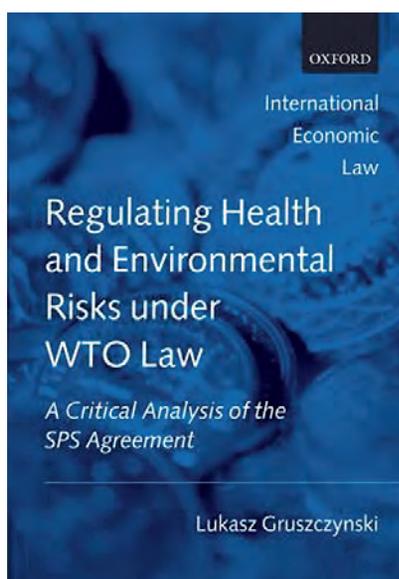
Regulating Health and Environmental Risks under WTO Law

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Dr. Lukasz Gruszczynski received the Manfred Lachs Award for the best monograph published in 2010 by a Polish author in the field of international law (in the 'debut' category). This prize is awarded annually by the Manfred Lachs Foundation and the Polish scientific journal *Państwo i Prawo* in two categories: 'debut' and 'subsequent publication.' The book which formed the basis for the award was *Regulating Health and Environmental Risks under WTO Law: A Critical Analysis of the SPS Agreement*, published by the prestigious international publisher Oxford University Press.

The book analyses the Agreement on the Application of Sanitary and Phytosanitary Measures

(SPS Agreement), one of the treaties concluded within the World Trade Organization (WTO) system. While the analysis is predominantly based on international economic and environmental law, due to the multidimensional nature of the topic the book also contains references to other disciplines, particularly risk science (e.g. sociology and psychology of risk, risk management), philosophy, as well as hard sciences (e.g. epidemiology and toxicology). The research undertaken by the author can be seen as a part of a broader scientific agenda that enquires into the problems posed by the global risk society (in the meaning proposed by Ulrich Beck).



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In particular, the book asks whether the SPS system is able to fully address the challenges faced by WTO Members when regulating health and environmental risks. The analysis is focused on the criterion of scientific rationality, which was introduced by the SPS Agreement as an objective benchmark for assessment of the legality of national measures. The Agreement assumes that a lack of scientific evidence proving a risk indirectly indicates the existence of other motives (e.g. protectionism), or even constitutes an expression of irrationality on the part of a national regulator, which should be eradicated. The book critically assesses the correctness of this premise. In particular, it notes that the introduction of science-based mechanisms has raised a number of difficult questions. To what extent can science perform the function assigned to it? Should national measures be assessed at all as to their scientific rationality? What is the extent of the regulatory freedom enjoyed by WTO Members in cases of scientific uncertainty? Answers to these questions have far-reaching practical consequences and determine what products we buy, what kind of risks we are exposed to, and which costs we are forced to bear (including the costs resulting from a failure to address mere risk perception). A separate part of the research is connected not so much with substantive rules as with the applicable model of dispute settlement. In this context, the book analyzes the issue of the epistemic competence of WTO panels to resolve disputes with a strong scientific component, as well as potential procedural problems related to

the provision of scientific advice by independent experts.

Although the book concludes that the system established by the SPS Agreement may be regarded as an effective mechanism for the supervision of domestic trade measures, it also identifies a number of deficiencies in the WTO jurisprudence. The most problematic one seems to be the applicable standard of review used by WTO dispute settlement bodies. This concept, which can be defined as the level of scrutiny that a reviewing body exerts over the decision or regulation being reviewed, determines the extent of regulatory freedom enjoyed by WTO Members when addressing specific SPS concerns. In theory, the standard of review can range from *de novo* (a tribunal reviews afresh all scientific determinations made at the national level) to full deference (the review is limited to procedural compliance), with a number of intermediate variations. The book argues that some WTO panels, by adopting overly intrusive standards of review, have failed to strike an appropriate balance between the need to control national SPS measures and the necessary regulatory discretion that should be left to WTO Members. The book thus proposes a more deferential approach, which concentrates on the rationality of scientific findings that underlie a specific measure rather than on their 'correctness.'

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Unilateral acts of states in international law

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This study analyzes the theoretical-legal issue of unilateral acts made by states in international law (hereafter referred to as “unilateral acts”). It consists of four parts. In Part I, the author performs a critical analysis of various views concerning the proper definition and catalog of unilateral acts. Part II engages in a search for unilateral acts within various branches of international law. Part III is devoted to unilateral promise, Part IV to recognition, waiver, and protest.

The author adopts an open stance to both the definition of a unilateral act, and to the catalog of such acts. He treats these issues as open rather than given. In any event, he does not automatically adopt the so-called classical list of unilateral acts, encompassing: promises, recognitions, protests, and waivers. In his conviction, the *a priori* adoption of this list of unilateral acts would negate the very sense of engaging in theoretical-legal deliberation about the issue. However, the author does adopt the *prima facie* assumption that we may speak of the existence of a unilateral act when one state takes an action that is not prohibited by unilateral law and gives rise to legal consequences under international law. This action must at the same time be condensed enough to be viewable as a single act, rather than as a long-term process.

The author confronts his own provisory definition against a broad range of various forms and behaviors of states under international law. This is meant to bring us closer to pinning down their catalog, although it is doubtful to what extent some sort of *numerous clausus* could ever be settled upon here. The method applied in the work is novel in this respect: no one has previously approached the issue in this way. The main point of reference in this respect is the aforementioned classical catalogue of unilateral acts, which has exerted a great influence on how the work is structured. Part II is a search for elements that are missing from this classical catalog; Parts III and IV engage in analysis of the elements it contains.

The analysis in Part II encompasses the law of treaties, rules concerning territory, rules concerning population, rules of diplomatic law, and the law of war. The author reaches the conclusion that the following may be considered to constitute unilateral

acts: occupation of *terra nullius* appropriating un-owned territory, symbolic occupation, determining maritime regions, breaking off diplomatic relations, deeming a diplomat to be a *persona non grata*, the recalling of a diplomat by the dispatching state, declaring war or neutrality, imposing a naval blockade, and other types of actions. Under no circumstances can this be deemed to be an exhaustive list.

A review of the individual fields of international law in search of unilateral acts raises a series of interesting issues. There are some fields in which it is the most difficult to identify an element of “unilaterality” (treaty law obviously being most prominent in this respect). There are other fields in which this aspect does not raise doubts, but it is most difficult to identify the occurrence of legal consequences (a situation that arises when dealing with rules pertaining to individuals). Lastly, there are certain fields in which it is the most difficult to conclude whether various events constitute a single act. The author reaches the conclusion that there can be no closed catalog of unilateral acts. That is why the attempts undertaken by the International Law Commission to codify the rules of law concerning such acts were doomed to failure from the outset. Unilateral acts share so little in common that neither are they appropriate for codification, nor do they require such codification.

One significant portion of the work deals with specific conclusions concerning the classical unilateral acts.

The author confirms that promise represents one of the possible ways of taking on obligations, he opts for a narrow interpretation of promises. In determining their binding strength and content, a decisive role is played by the intentions of the actor state. The author also provides for the permissible cancellation of a promise under justified circumstances.

The author seeks the sources of the binding strength of promises in the norms of customary law. By so doing, he distances himself from assertions that essentially come down solely to the principle of good faith, although no one can question its great significance for the emergence of the customary norm of the obligation to fulfill one’s unilateral promises. The attempts made within the work to

identify a larger number of concrete promises lead to a somewhat disappointing assertion: that most of the statements made by states concerning their future actions do not univocally constitute promises.

A series of interesting conclusions is formulated concerning protest, waiver, and recognition.

The author calls into question the perception of protest as a legal action. It is more of an act that *can* have legal consequences, rather than one that has them by definition. *Ipsa facto*, certain protests are, and certain protests are not legal acts.

Not every case of recognition or waiver, in turn, constitute a unilateral act. This assertion is based on the conviction that we cannot deem to be a unilateral act something that is its antithesis, meaning an agreement. A waiver or recognition that stems from an agreement cannot be treated as a unilateral act.

The author does not question the legal nature of waiver – nor that of promise, which is a legal act by definition. While analyzing recognition, in turn, the author comes to the conclusion that its inclusion into the category of legal acts must be investigated on a case-by-case basis. In this sense, its situation is somewhat similar to that of protest. At the same time, in a significantly greater percentage of cases, these consequences cannot be ascertained. For rec-

ognition, therefore, unlike protest, one can assume legal consequences but must reckon with the notion that they may not occur *in concreto*.

In summary, this work is devoted to reexamining a collective category that has been functioning for 100 years in deliberations about international law. The main advantage of the work seems to be the critical stance it takes with respect to the existing, automatically adopted views about the scope encompassed by this collective category. The approach taken seems to be appropriate for dealing with collective categories of this sort, for instance subjects of international law or sources of international law. Although the category of unilateral acts itself seems to be a niche notion, the work addresses a significant number of fundamental questions within the field of international law, and as such can be considered a valuable contribution to that field.

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Foreigners and foreign countries as depicted in Polish dialects

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The work consists of three parts. The first, entitled *Study of ethnic stereotypes*, begins with Chapter 1 – *Panorama of achievements* – which presents an overview of Polish research on the topic. Chapter 2 – *What do we know about the Polish nation's attitude towards other nations* – next examines the motivation for selecting this particular topic. While the stereotypes about other nations that were functioning within the gentry class of Polish society are well-known, there is little evidence of what the peasants, or “the silent majority,” thought about foreigners. Chapter 3 presents the research method adopted in the work: analyzing the usages of ethnonyms (the names of nations) and choronyms (the names of countries), as well as lexical and phraseological units derived from them. Colloquial dialectal

material is further supplemented with quotations from folk songs.

The second part of the work – *The linguistic evidence of Polish nation's relations with foreigners and foreign countries* – is the fundamental, most extensive portion. It presents collected dialect material in the following geographic order: Europe, Asia, Africa, and America. The richest set of words and phrases pertains to Europe. Under each nation and country, the material is further classified into 4 categories: country, people, culture, and nature. If there are many examples within a given category, we single out scripts, i.e. the smallest portions of information, such as THE HUNGARIANS ARE ITINERANT MERCHANTS or THE WEATHER IS COLD IN SIBERIA.



The third part – *A bird's-eye view* – presents the collected lexis and phraseology in a semantic arrangement. Words derived from ethnonyms and choronyms enriched the lexis of the dialects within 3 categories: people (e.g. *niemiec*, the standard Polish word for a ‘German,’ used to mean ‘protestant’), culture (e.g. *krymka*, a nominal derivative of the standard Polish word for ‘Crimean,’ used to mean ‘hat, tubeteika’) and aspects of nature (e.g. *afrykanka*, a nominal derivative of the standard Polish word for ‘African,’ used to refer to the ‘guinea fowl’).

The summary then presents numerical data concerning the frequency of the names of particular nations and countries as well as common words derived from them in the Polish dialects. There are 65 groups of those, the three most numerous among them being the Germans (512 records), the Jews (495 records) and the Gypsies (367 records). The share of the names from particular continents is as follows: Europe (3415 records), Asia (679 records),

America (227 records) and Africa (82 records). These numerical figures reflect the Polish nation’s connections with representatives of foreign nations or familiarity with the products of their civilization, the plant or animal species living in their countries.

Despite the fact that peasants are generally bound to the land, in other words to one place, through various wars, annexations, and work migrations they have had numerous contacts with foreigners, which have found reflection in dialects and folklore.

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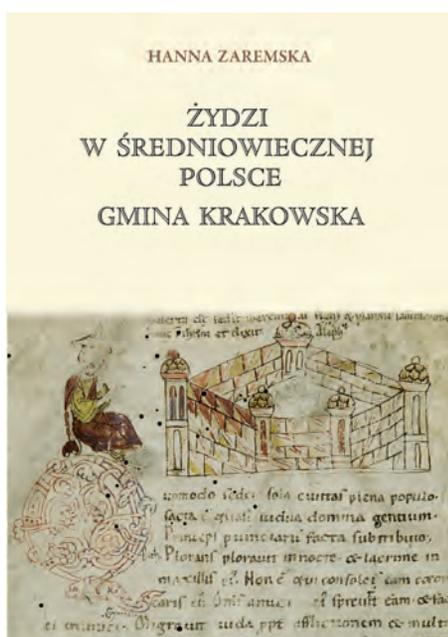
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Żydzi w średniowiecznej Polsce. Gmina krakowska [Jewry in Mediaeval Poland: The Community of Kraków]

H. Zaremska | Tadeusz Manteuffel Institute of History | Polish Academy of Sciences

The book is a collection of 15 studies. Its first part deals with the history of Jews dwelling in Polish lands in the Middle Ages; the second covers

the history of one of the then-largest Jewish religious communities in Poland – i.e. the Kraków community.

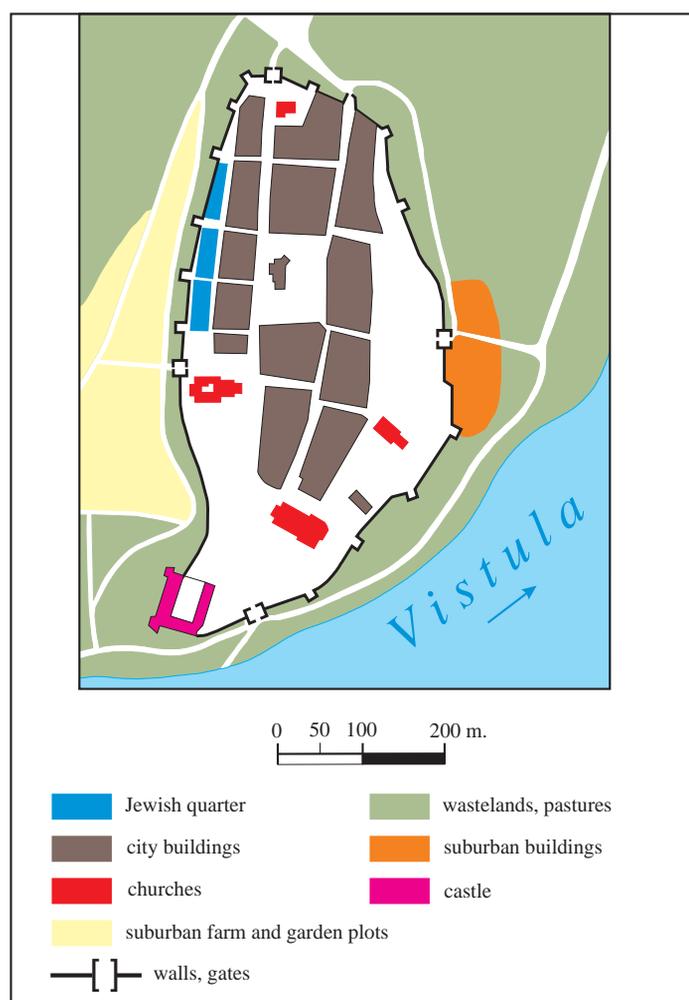


The chapter titled ‘Jewish geography’ offers an introduction to studies of Jewry in Poland, taking the reader along a route from Patriarch Abraham’s times to the distribution of the Diaspora in the Middle Ages. The argument is, expectedly, centred around the Ashkenazi Jewry, i.e. those inhabiting the Rhineland, Flanders, northeast France, and England. The next chapter, ‘Jews in early-mediaeval Central Europe’, takes a combined approach, implied by scarce source accounts, to the Diasporas in Bohemia, Poland and Hungary. Especially in the 10th-11th centuries, these countries formed a homogenous area of penetration of Jewish merchants trading between the Abbasid Caliphate, Western Europe, and Byzantium.

Jews migrated then from the Empire lands to Bohemia, Hungary (then reviving after the Tartar invasion) and Poland – first to Silesia, then to Greater Poland and Lesser Poland, possibly via Bohemia. These migrations followed the Christian settlement expansion originating in the German lands, of fundamental importance to the region’s future.

The 14th century saw the appearance of Jews in Lithuania, as well as in the Halitch Ruthenia, where trading with the Black Sea region led to emergence of strong exchange hubs, with Jewish communities forming part of them.

In medieval Poland, Jews lived, almost in their entirety, in urban areas. Among more than 100 Jewish colonies existing in the late 15th century in the Crown and in Mazovia, some 20 operated in



Jewish quarter in mediaeval Sandomierz, plan by Jarosław Suproniuk, based on: *Atlas historyczny Polski. Województwo Sandomierskie w drugiej połowie XVI wieku*, cz. 1: Mapy, plany, plan nr 2, Warszawa 1993

the nobility’s landed estates, 3 within Church properties, and the remainder in royal towns.

Jewish money-lending operations in late-mediaeval Poland did not exceed 10% of the overall lending activity (with Jews accounting for less than 1% of the country’s population). Interest was apparently within the admissible norms laid down by the Church. Starting from the latter half of the 14th century, if not earlier, a group of wealthy bankers operated in Poland, providing financial services to noblemen, as well as to state and ecclesial dignitaries and monarchs. Another field of economic operations pursued by Jews was trade – a domain inseparably associated with money lending. In the 15th century, Jewish merchants could be encountered on any route and in any important commercial hub of Poland.

Jews inhabiting Polish towns were not subject to municipal jurisdiction and taxes. While participating in the economic life of their town, they remained outside of its political and corporate structures. The monarch's judicial superiority over Jews, Jewish entrepreneurship, including usury- and trade-related abuses (fencing, monetary forgeries), is also portrayed.

The basic issues of Jewish demography still remain subject to scholarly disputes. More precise data on the size of individual colonies can only be provided by taxation-related sources. Toward the end of the Middle Ages, Poland was inhabited by some 5,500 Jews, with the largest communities – in Poznań, Kraków and Lwów (Lviv) – numbering between 500 and 800 members. The average Jewish colony was then a small settlement inhabited by one or two families at a time.

As regards the mediaeval Church's attitude toward Judaist believers, two elements were key: the concept of 'Jewish slavery' as a punishment for their rejection of Christ's truth, and the importance the Church attached to the survival of Jewish people because of the very fact that they had been witnesses to the said truth.

Part two of the book concerns the mediaeval history of the Jewish community in Kraków, its origins and organization. It was one of the earliest Jewish settlements which emerged in order to handle far-reaching trade in the Central-European area.

Three closing chapters deal with separate events of the 15th century: first an incidental pogrom of 1407, then, as described in the chapter 'Jews and the Inquisition', a court trial of a group of Kraków Jews, neutralised by the monarch in 1495. The tem-

poral coincidence with the relocation in 1494 of Kraków Jews to Kazimierz, discussed in the final chapter, cannot be merely accidental.

The work summarises the progress made in research on the mediaeval period in its general, Polish, and Jewish aspects, over the long period since World War II. The history of Polish Jewry in the Middle Ages being written nowadays has ceased to be limited, on the whole, to the continual reinterpretation of the state of research dating back to the first half of the 20th century.

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Biological and Agricultural Sciences

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A biochemist specializing in cell signaling, mitochondria, and the molecular basis of different pathological conditions, especially neurodegenerative diseases. He works at the Nencki Institute of Experimental Biology of the Polish Academy of Sciences where he is the leader of the Laboratory of Bioenergetics and Biological Membranes. He has co-authored over 70 research papers published in major international journals, like *Science*, *Biochemistry*, *Journal of Biological Chemistry*, *Biochimica et Biophysica Acta* and many others. The scientific publications which he co-authored have jointly been quoted more than 1800 times; 4 of them have been quoted more than 100 times. His academic internships include: 3 years in the USA at the laboratories of J.R. Williamson, Pennsylvania University, Philadelphia and K.F. LaNoue, PennState University, Hershey; 1 year in France at the laboratory of P.V. Vignais, Nucleaire Centre, Grenoble (1985-1986); and numerous short-term internships at the laboratories of J.M. Tager (Amsterdam), W. Kunz (Magdeburg), F. Palmieri (Bari), J.P. Mazat (Bordeaux) and V.P. Skulachev (Moscow). He has held numerous administrative positions, including as Director of the Nencki Institute of Experimental Biology, Polish Academy of Sciences (2003-2008), and Deputy Minister of Science and Higher Education (2008-2009). He was a member of the Editorial Board of the *European Journal of Biochemistry* (1987-1996) and is now a member of the Editorial Board of *Biochimica et Biophysica Acta – Bioenergetics*.



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A geneticist and biotechnologist working with crop plants. His main scientific interests are the genetic factors determining the efficiency of *in vitro* techniques, the use of genetic modifications, and genomic and phenotypic stability after *in vitro* plant regeneration. He co-authored 66 research papers published in major international journals and 4 patents, which have 594 citations and index H=14. Supervisor of 25 PhD students in agricultural sciences, 11 from them now with professorial positions.

Throughout 1993-2005, dean of the Faculty of Horticulture and director of the program of Inter-



Faculty Studies in Biotechnology at the Warsaw Life Sciences University and chair of the Plant Breeders Board affiliated with the Ministry of Agriculture. In 2002-2010, Chair of the P06 Commission for Food and Agriculture of the State Committee for Scientific Research, as well as member of the Committee for Science and Technology affiliated with the Ministry for Science and Higher Education. He has received a number of awards, including a team prize from the Secretary of Science in the Polish Academy of Sciences, a team prize from the Polish Ministry of National Education; a prize from the president of Silesian University for his PhD, and many prizes from the president of the Warsaw Life Sciences University.



Andrzej Jerzmanowski (born 13 Nov. 1946 in Warsaw), Deputy Chair of the Council of Provosts of PAS Division Two: Biological and Agricultural Sciences.

A molecular biologist and geneticist working with plants. His main scientific interests lie in the molecular and system biology networks underlying development and maintaining homeostasis in plants, especially during adaptation to unfavorable life conditions. He conducts his research at the Faculty of Biology, Warsaw University and at the PAS Institute of Biochemistry and Biophysics in Warsaw. He has co-authored over 50 research papers published in major international journals, like *Proceedings of the National Academy of Sciences*, *Plant Cell*, *Nucleic Acids Research*, *Journal of Biological Chemistry*, *Genetics* and many others.

In 1995-2005 he was an International Scholar at the Howard Hughes Medical Institute and in 2004-2009 served as a Polish delegate to the European Molecular Biology Conference (EMBC). Between 2004 and 2011 he has been an elected member, first of the Committee for Scientific Research, and next of the Scientific Council to the Ministry of Science and Higher Education. Since 2008 he has been serving as member of the Scientific Council of the Foundation for Polish Science. He has received a number of scientific awards, including the J. Parnas Award for the best research paper (2 times), the Marchlewski Medal of the PAS Committee on Biochemistry and Biophysics, the Polish Prime Minister's Individual Award for Scientific Achievements, and the H. Steinhaus Award for the best popular-science book.

The year 2011 was the first year of operation for the new and extended Division Two: Biological and Agricultural Sciences, which was formed by the merger of the former Division II (Biological Sciences), and Division V (Agricultural, Forest and Veterinary Sciences). Division Two now has 72 national and 49 foreign members.

The Division held three plenary sessions in 2011: on 23 February, 16 May, and 14 November. At the February session, ten resolutions were voted on and accepted, pertaining to rules regulating the Division's operations in the forthcoming term. The

Division also elected a commission for reviewing and restructuring the Division's network of scientific committees, with Professors Jerzy Duszyński, Andrzej Grzywacz, Andrzej Jerzmanowski, Erwin Wąsowicz, January Weiner, and Piotr Węgleński as its members. After discussion, the plenary gathering at the February meeting recommended that the reform of the scientific committees be postponed until the second half of the current term of office. At the same session the Division's Council and Presidium were elected for the 2011-2014 term.

At the autumn meeting on 14 November 2011, the Division evaluated its three research institutions without legal personality: the PAS Centre for Ecological Research in Dziekanów, the PAS Department of Antarctic Biology in Warsaw, and the PAS Botanical Garden – Center for Biological Diversity and Conservation in Powsin. It also passed a resolution on merging the PAS Department of Anthropology in Wrocław into the Faculty of Biology and Animal Sciences at Wrocław University, and merging the PAS Department of Antarctic Biology into the Institute of Biochemistry and Biophysics. Also discussed at the meeting were the overall mission and tasks of the Polish Academy of Sciences and the election of candidates for the Academy for Young Scholars. The plenary gathering at this session awarded the Division Two prizes and awards in 2011.

The awards went to Prof. Mieczysław Wolsan for a series of research yielding “New insights into the evolutionary history of mustelids based on the genetic and geological record,” to the team of team Assoc. Prof. Katarzyna Kwiatkowska, Prof. Andrzej Piątek, Dr. Monika Hereć, Dr. Stefan Józefowski, Dr. Magdalena Kulma, and Dr. Ewelina Szymańska for a series of research on “Sphingolipids and phosphatidylinositol as immune cell receptor signal carriers,” to the team of Assoc. Prof. Paweł Lipiński, Dr. Rafał R. Starzyński, Dr. Agnieszka Styś, and Ewa Smuda for a series of research on “Iron and copper metabolism control in different periods of postnatal mammalian development,” to the team of Dr. Marek Romek, Assoc. Prof. Barbara Gajda, Ewa Krzysztofowicz, and Prof. Zdzisław Smorąg for a series of research on “Lipids in pig oocytes and embryos – a new method of identifying and regulating content and implications for biotechnology,” and to the team of Prof. Jacek Radwan and Assoc. Prof. Wiesław Babik for a series of research probing “The importance of MHC gene variability for species protection.”

The Medal of Michał Oczapowski for 2011 was awarded to Prof. Henryk Czembor, Prof. Zygmunt Reklewski, and Prof. Piotr Skłodowski.

Members of the Division received a number of prestigious awards and prizes in 2011: during the closing ceremony of the Year of Maria Skłodowska-Curie, Prof. Barbara Bilińska received the Knight's Cross of the Polonia Restituta Order conferred by the Polish President for her research and teaching achievements; Prof. Jerzy Duszyński and Prof. Erwin



Plenary session of Division Two: Biological and Agricultural Sciences held at the Staszic Palace in Warsaw on 14 November 2011



The ceremony of granting the Division Two scientific awards, diplomas, and distinctions, held on 6 December 2011 at the seat of Division Two: Biological and Agricultural Sciences in Warsaw

Wąsowicz received the Knight's Cross of the Polonia Restituta Order; Prof. Jan Gliński received an honorary doctorate from the University of Life Sciences in Lublin, from the Volodymyr Dal East-Ukraine National University in Lugansk, and from the Lviv State Agricultural University in Dublany; Prof. Maciej Żylicz was awarded an honorary doctorate from the University of Gdańsk and was elected a member of the German National Academy of Sciences Leopoldina; and Prof. Leszek Kaczmarek received the Polish Prime Minister's Award for outstanding scientific achievements.

The reporting sessions of the Institutes of the Division and the first meeting of their scientific councils took place in 2011. The meetings were

attended by representatives of the Division: Prof. Ryszard J. Górecki, Prof. Jerzy Duszyński, Prof. Stefan Malepszy, Prof. Andrzej Jerzmanowski, Prof. Adam Szewczyk, Prof. Kazimierz Wierzchowski, Prof. Małgorzata Mańka, Prof. Jerzy Lipa, and Prof. Wincenty Kilarski.

The Presidium of Division Two held several meetings in 2011, including an away session held in Wierzba on 4-6 May 2011, with the objective of scrutinizing the situation and activities of the Division's units in the Mazuria region: the PAS Research Station for Ecological Agriculture and Preservation of Native Breeds in Popielno, the PAS Hydrobiological Station and Centre for Ecological Research in Mikołajki, the PAS Institute of Experimental Agrobiolology in Baranowo, and the Research Station of the PAS Institute of Parasitology in Kosewo Górne.

At its meeting on 14 June 2011, the Presidium worked on the preliminary concept of establishing a consortium called the National Museum of Natural History, and dealt with the issue of restructuring some of the units within the Division. Previously, Division Two representatives had taken part in paying visits to the Center for Ecological Research in Dziekanów Leśny and to the Department of Antarctic Biology on 23 March 2011 (Prof. Ryszard Górecki, Prof. Jerzy Duszyński, and Prof. Stefan Malepszy), and to the Institute of Ichthyobiology and Aquaculture in Gołysz on 5-6 April 2011 (Prof. Stefan Malepszy).

On 12-14 October 2011, together with representatives of the PAS Committee on Biotechnology, the Division hosted Prof. Ingo Potrykus of the Department of Plant Sciences, ETH Zurich.

In 2011, the Division continued to issue the research journals *Postępy Nauk Rolniczych* (Advances in Agricultural Sciences) and *Zeszyty Problemowe Postępów Nauk Rolniczych* (Advances in Agricultural Sciences – Problem Issues).

Given that the current Division Two was formed out of the merger of two medium-sized Divisions under the previous structure of the Academy (the Division of Biological Sciences and the Division of Agricultural, Forestry, and Veterinary Sciences), there are now a total of 19 institutes plus six auxiliary scientific units under the care of the Division's Council of Provosts.

The focus of the work done by the Council of Provosts was on: establishing the formal and or-



Session of the Council of Provosts of Division Two, held on 16 May 2011 at the Staszic Palace in Warsaw

ganizational basis for its activity, developing principles for evaluating the institutes and other units and adopting a schedule for the related activity, restructuring the auxiliary units and resolving certain property-related legal issues, organizing and carrying out competitive procedures to appoint directors at the institutes, formulating comments on various proposed legal acts and documents, and expressing opinions on funding applications, by-laws, and statutes under the care of the Council of Provosts – in addition to many other aspects.

The Council of Provosts held three plenary sessions. At its meeting on 23 February, it adopted the bylaws of the Council of Provosts, elected its chair and deputy chair, and expressed its opinions on candidate members from among the pool of Polish scientists (Prof. Jan W. Gawęcki and Prof. Henryk Okarma) and foreign scientists (Prof. Ignacy Misztal, USA, and Prof. Alexander Wlodawer, USA). At its 16 May meeting the discussion included establishing a schedule for the work of the Council of Provosts in 2011, reviewing the potential of the research units, and considering policy proposals and the rules for evaluating scientific institutions. The third meeting on November 14, in turn, adopted a resolution to amend the bylaws of the Council of Provosts, and the proposals of the Committee for the restructuring of the Institute of Ichthyobiology and Aquaculture and Research Station for Experimental Pond Aquaculture. The Council accepted the expediency of merging the PAS Institute of Anthropology into the University of Life Sciences in Wrocław and the PAS Department of Antarctic Biology into the Institute of Biochemistry and Bio-

physics in Warsaw. It also adopted a report on assessing the three auxiliary scientific units (the PAS Centre for Ecological Research, the PAS Department of Antarctic Biology, and the PAS Botanical Garden – Center for Biological Diversity Conservation).

The Chairs of the Council of Provosts held two meetings with the directors of the Division's scientific units. The first, mostly an electoral session, selected three representatives from among these directors to sit on the Academy's Council of Directors (Prof. Piotr Kowalczak, Director of the Institute of Agricultural and Forest Environment in Poznan, Prof. Henryk Okarma, Director of the Institute of Nature Conservation in Kraków, and Prof. Piotr Zielenkiewicz, Director of the Institute of Biochemistry and Biophysics in Warsaw). The second meeting was devoted mainly to: 1) a report on the work of the National Science Center (lecture by Prof. Michał Karoński, Chairman of the Center's Scientific Council), 2) a report on the work plan for the Council of Provosts, and 3) matters related to turning over ownership of real estate properties to the scientific units (in the presence of the Director of the PAS Office of Real Estate Management).

The Council appointed the following: eight committees to carry out competitive procedures to select directors of research units (by way of resolutions); a panel to develop rules for the assessment of the scientific committees; four committees for the assessment of scientific institutions. Competitive procedures for directorship posts were won by the following individuals: Prof. Jarosław Horbańczuk (PAS Institute of Genetics and Animal Breeding), Prof. Tomasz Misztal (Jan Kielanowski PAS Institute of Animal Physiology and Nutrition), Prof. Marek Figlerowicz (PAS Institute of Bioorganic Chemis-

try), Assoc. Prof. Zbigniew Bocheński, (PAS Institute of Systematics and Evolution of Animals), Prof. Piotr Zielenkiewicz (PAS Institute of Biochemistry and Biophysics) (from 1 January 2012), and Prof. Bogdan Wolko (PAS Institute of Plant Genetics). Five of these individuals have been appointed for their first term as directors. The Council completed the process of incorporating the PAS Department of Antarctic Biology into the Institute of Biochemistry and Biophysics in Warsaw.

The year 2011 saw the completion of the project to expand the Bohdan Dobrzański Institute of Agrophysics in Lublin. A large investment project was launched at the Institute of Experimental Biology, called the Centre for Preclinical Research and Technology (CEPT). The Council approved a concept for establishing a National Museum of Natural History in Warsaw, invoking the unrealized ideas of the Polish government back in 1919.

The Division has 26 scientific committees. All of them carried out secret ballots, while 17 committees held their first plenary meetings at which they constituted themselves and chose their chairpersons for the 2011-2014 term. The Committee on Biotechnology, a former PAS task-force committee is now included under the current Division Two. The Committee on Neurobiology, formerly affiliated with Division Two, is now incorporated into the structure of the Division of Medical Sciences, whereas the Committee on Agricultural Economics, formerly falling under the Division of Agricultural, Forestry, and Veterinary Sciences, has now been renamed and incorporated into the Division of Humanities and Social Sciences. Assisted by the DUN funding measure for the dissemination of science, the committees were involved in organizing or co-organizing 36 conferences and in publishing 5 research periodicals.

Mycological characterization of dairy sewage sludge and its influence on soil microbial activity

M. Frąć | K. Oszust | A. Siczek | J. Lipiec | Bohdan Dobrzański Institute of Agrophysics | Polish Academy of Sciences

The increasing level of urbanization and industrialization significantly contributes to the dramatic rise in the amount of sewage sludge produced all over the world. That surge is also reflected in increas-

ing numbers of sewage treatment plants, which produce ever-increasing amounts of sewage sludge, including dairy sewage sludge. While on the one hand these wastes may provide a host environment



Fig. 1. Dairy sewage sludge

for microbial growth, including for potentially pathogenic bacteria and filamentous fungi, on the other hand sewage sludge can be neutralized and utilized as agricultural amendments. Filamentous fungi play a vital role as decomposers of different materials and are capable of producing different enzymes important in environmental protection. Such fungal strains and enzyme production may be harnessed in waste biodegradation, such as for dairy sewage sludge.

Soil microorganisms play a key role in maintaining soil productivity, participate in nutrient cycles, but are on the other hand extremely sensitive to environmental changes caused by anthropogenic factors. This is why evaluating the microbiological state of soil is one of the most important tasks in the environment protection field. The assessment of microbial functional diversity using the CLPP (community level physiological profile) method has been reported to offer a sensitive approach to detect-

ing modifications due to soil use and management. Agricultural utilization of dairy sewage sludge as an organic fertilizer seems to have a positive impact on community level physiological profile. Dairy sewage sludge amendments may alter the community and activity of soil microorganisms.

The aim of this study was to scrutinize the mycological characteristics of dairy sewage sludge in terms of isolated fungal strains, and to assess the metabolic potential and efficiency of enzyme synthesis by selected fungi isolates and their applicability in waste degradation. Another objective was to evaluate the impact of dairy sewage sludge on soil microbial activity.

The study involved:

- Molecular identification of fungi isolated from dairy sewage sludge, using modern molecular biology techniques (DNA extraction, amplification and sequencing of comparative rDNA LSU D2 region using MicroSEQ kit and software, phylogenetic analysis and creation of Neighbor-Joining trees)
- Developing a characterization of the metabolic properties of fungi isolated from wastes, using BIOLOG™ System (analysis of fungal capabilities to metabolize different carbon substrates using 96-well microplates (FF) with different (95) substrates, such as: polymers, carbohydrates, carboxylic acids, amines, amino acids, proteins, amides, and alcohols)
- Evaluation of the enzymatic activity (amylase, protease, β -glucosidase and lipase) of fungal strains isolated from dairy sewage sludge and their applicability in waste degradation
- Evaluation of the microbial functional diversity (CLPP – *community level physiological profile*) of soil fertilized with dairy sewage sludge (analysis based on catabolism process of 31 different carbon substrates in Eco-plates).



Fig. 2. Isolated and cultured fungi

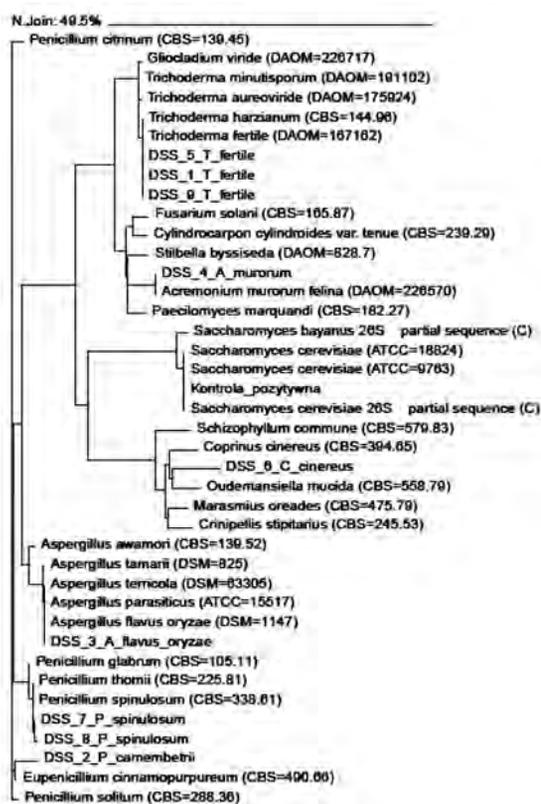


Fig. 3. Phylogenetic tree of fungi isolated from dairy sewage sludge

The evaluation of community level physiological profiles was conducted in a field experiment on an *Eutric Cambisol* soil type developed from loess. The microbial activity of particular treatments was assessed using: mean optical density (OD) of 31 carbon substrates (AWCD – Average Well-Color Development), the R (Richness) index, described as the number of oxidative metabolized carbon substrates, and the Shannon-Weaver (H) index, describing the response evenness of the metabolic activity of each substrate.

The study found that the genetically identified strains belonged to the following genera, among others: *Trichoderma*, *Aspergillus*, *Galactomyces*, *Beauveria*, *Penicillium*, *Acremonium* and *Coprinus*. The dominant species isolated from dairy sewage sludge was *Trichoderma fertile*. The isolated fungi belonged to the yeast and filamentous fungi. The results suggested that filamentous fungi were able to grow in dairy sewage sludge and participated in the degradation of the organic compounds of this waste. The results indicated significant differences in the metabolic properties of particular fungal strains. Among

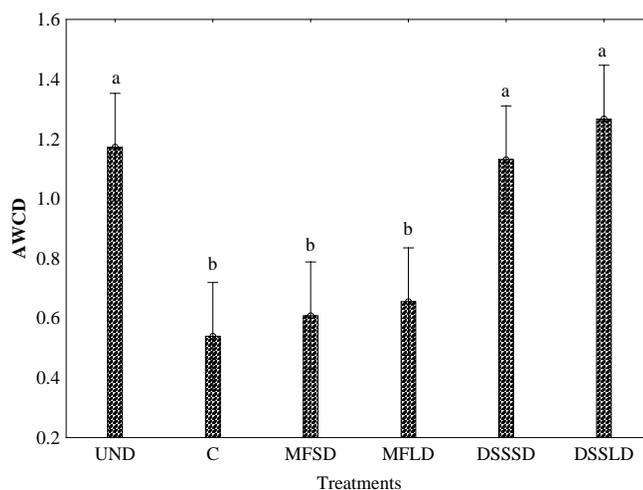


Fig. 4. Average well-color development (AWCD) of metabolized substrates in Biolog EcoPlate™ after amendment application. UND – undisturbed native vegetation, C – control soil without mineral and organic fertilization, MFSD – mineral fertilization amendment, small dose, MFLD – mineral fertilization amendment, large dose, DSSSD – dairy sewage sludge, small dose, DSSLD – dairy sewage sludge, large dose, n = 3

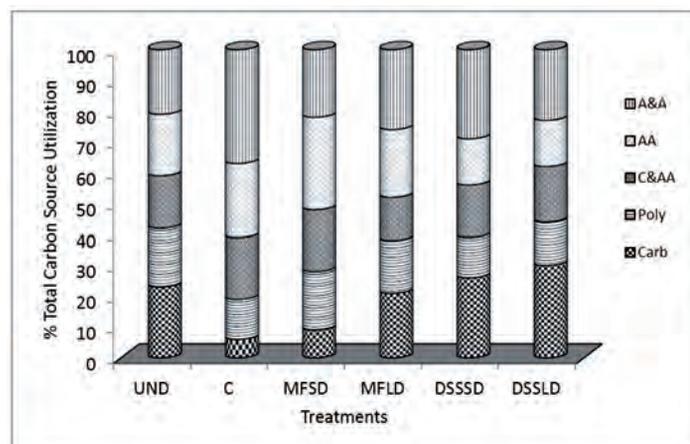


Fig. 5. Percent of total carbon source utilization response tracked due to treatment type, for the different guilds – amines and amides (A&A), amino acids (AA), carboxylic and acetic acids (C&AA), polymers (Poly) and carbohydrates (Carb). UND – undisturbed native vegetation, C – control soil without mineral and organic fertilization, MFSD – mineral fertilization amendment, small dose, MFLD – mineral fertilization amendment, large dose, DSSSD – dairy sewage sludge, small dose, DSSLD – dairy sewage sludge, large dose

the fungi isolated, the strains G8 – *Galactomyces geotrichum* and G10 – *Beauveria felina* had the highest lipolytic activity compared to other fungal strains. G1 – *Aspergillus flavus oryzae* showed a potential capability to degrade protein compounds. Isolates G1, G8 and G10 had an ability to attack starch. The results of our research could prove useful in the agricultural and environmental protection

sector, suggesting the possibility of the synthesis of various enzymes by the fungi used in this research and their promising biotechnological application.

There were observed differences in metabolic profiles of soil after dairy sewage sludge amendments and mineral fertilization. The addition of dairy sewage sludge to the soil promotes the functional diversity (catabolic potential) of the soil microbial population and at the same time can be a useful opportunity for its recycling. The applicability of the sludge used in this study may be enhanced by its low concentrations of heavy metals.

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Cortisol potentiates prostaglandins and interferon- τ actions in the bovine reproductive tract: A novel regulatory loop that may contribute to early pregnancy establishment and maintenance

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The interaction between the embryo and maternal unit (uterus) is a prerequisite for maternal recognition of pregnancy, embryo development and implantation. In ruminants, the cytokine interferon- τ (IFNT) has been identified as an embryonic signal. IFNT inhibits luteolytic prostaglandin (PG)F_{2 α} while stimulating luteotropic PGE₂ output by the uterus to maintain the secretion of progesterone (P4) in corpus luteum (CL). This mechanism could be modulated by several pro- and anti-inflammatory cytokines/factors. Cortisol (Cr), an active glucocorticoid (GC), is an anti-inflammatory agent modulating the production and action of cytokine and PGs required for ovulation, luteolysis, embryo implantation, fetal growth, placenta development, and labor. Effects of GCs on target tissues are modulated by 11 β -hydroxysteroid dehy-

drogenase (HSD11B). Two isoforms of the enzyme have been identified. The type 1 enzyme (HSD11B1) converts cortisone (Cs) to Cr, while type 2 isoform (HSD11B2) inactivates Cr by metabolizing it to Cs. The biological action of GCs is mediated through the activation of intracellular receptors (NR3C1, nuclear receptor subfamily 3, group C, member 1 - GR).

In our previous *in vitro* studies (Polish-Japanese Project under a PAS-JSPS agreement, 2007-2008) we found that Cr regulates PGs secretion in the non-pregnant uterus. However, the interaction between GCs and factors responsible for maternal recognition of pregnancy (i.e. P4, PGE₂, IFNT) remains unclear. In the present study, to determine whether Cr serves as a modulator and mediator of IFNT action within bovine endometrium during

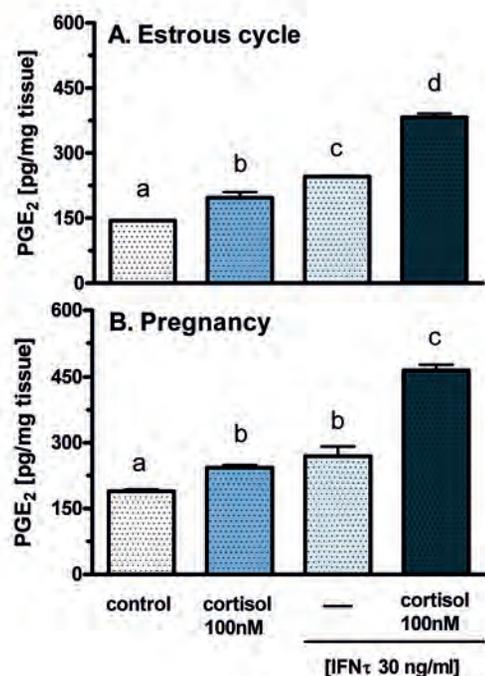


Fig. 1. Secretion of PGE₂ in bovine endometrial tissues in response to cortisol (100 nM), interferon- τ (IFNT; 30 ng/ml) and cortisol combined with IFNT. Different subscript letters indicate significant differences ($P < 0.05$) between control and treated groups as assessed by one-way ANOVA followed by Newman-Keuls Multiple Comparison Test. Reprinted with permission (Majewska et al. 2012)

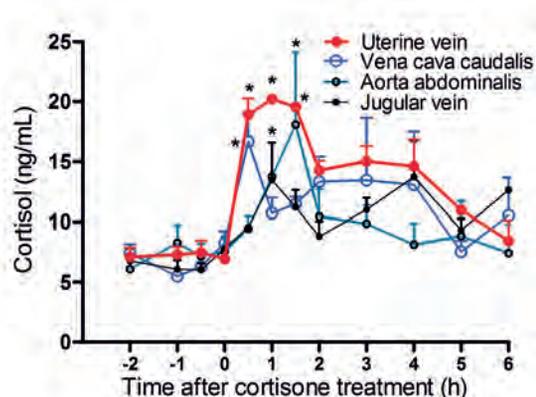


Fig. 2. Plasma concentrations of cortisol (Cr) in uterine vein, vena cava caudalis, aorta abdominalis and jugular vein in cortisone-treated group (intravaginal application) on Day 16 after ovulation. Data are the mean \pm SEM for three samples/time-point. Asterisks indicate significant differences ($P < 0.05$) in Cr concentrations compared with the baseline (before cortisone application). Reprinted with permission (Duong et al. 2012a)

the peri-implantation period, we examined: 1) the patterns of NR3C1, HSD11B1, and HSD11B2 expression and HSD11B1 activity; 2) the effects of IFNT on NR3C1, HSD11B1 and HSD11B2 expression and HSD11B1 activity; 3) the effects of cortisol on IFNT-regulated PG production in endometrium; 4) conversion of Cs into Cr in the bovine reproductive tract and 5) the effects of Cr on the pregnancy rate and P4 secretion *in vivo*.

For *in vitro* study, endometrial tissues were collected from cyclic and pregnant cows on Days 16-17 after ovulation. The mRNA and protein expressions of NR3C1, HSD11Bs in endometrial strips and cultured endometrial stromal and epithelial cells were analyzed. Endometrial slices and both types of endometrial cells were incubated with Cr in the presence or absence of IFNT, and HSD11B1 activity was evaluated. Expressions of HSD11Bs and NR3C1 mRNA and protein in bovine endometrium were higher during early pregnancy. IFNT increased HSD11B1 activity, and influenced on NR3C1 and HSD11Bs expression in endometrial strips and both types of endometrial cells. Moreover, the cytokine increased the net conversion of Cs into Cr (HSD11B1 activity) in pregnant endometrium. Finally, on Days 16-17 after ovulation, Cr increased basal and IFNT-stimulated luteotropic PGE₂ secretion by the bovine endometrium (Fig. 1). Cr decreased PGF_{2 α} in cultured stromal endometrial cells.

In vivo studies were carried out to test the hypothesis that bovine reproductive tract has the capacity to convert Cs to Cr and to evaluate effects of intravaginal application of Cr or metyrapone (an inhibitor of HSD11B1) on pregnancy rate, P4 and PGs secretion during the estrous cycle and early pregnancy. The concentrations of Cr, P4, and PGs were measured peripherally (jugular vein and aorta abdominalis) and locally (uterine vein and vena cava caudalis). Intravaginal application of Cs increased plasma concentrations of Cr between 0.5 and 1.5 h in uterine vein (Fig. 2). Moreover, cortisol increased the pregnancy rate (75%) compared to control animals (58%), whereas metyrapone reduced pregnancy rate to 16.7% ($P < 0.05$) inhibiting P4 secretion during early pregnancy in cattle (Fig. 3).

The overall results suggest that Cr acts as modulator and mediator of IFNT action in bovine uterus and that IFNT regulates PG secretion by up-regulating local cortisol, resulting in the maintenance of the CL during early pregnancy (Fig. 4).

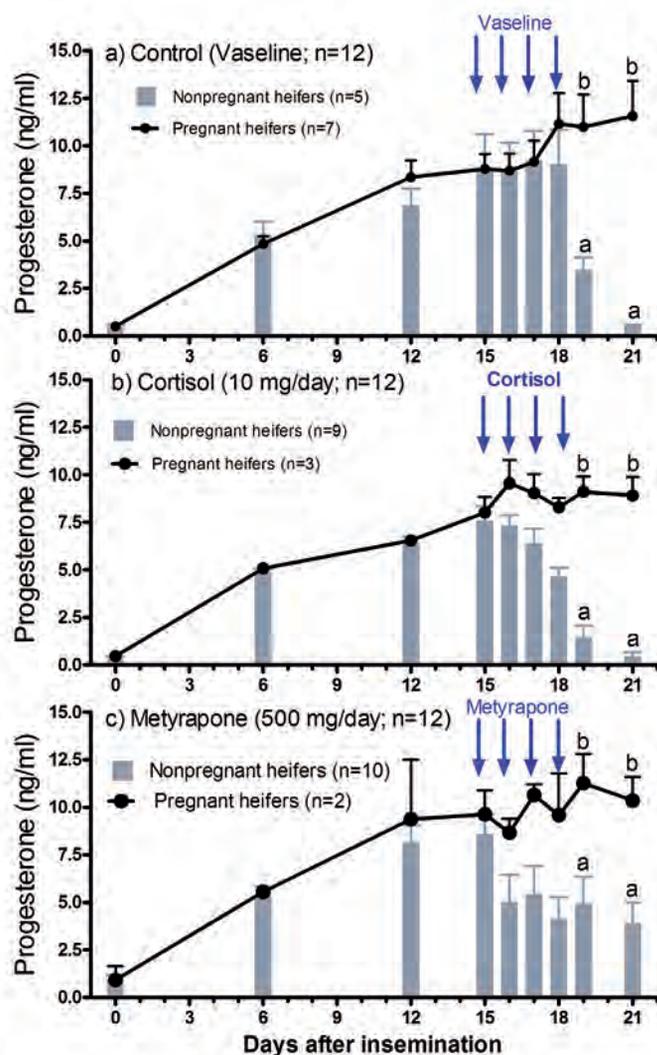


Fig. 3. Changes in plasma concentration of progesterone in pregnant and non-pregnant heifers. Heifers were inseminated on Day 0 of the estrous cycle. Vaseline gel (a; control), cortisol (b) or a HSD11B inhibitor – metyrapone (c) dissolved in 10 ml of vaseline gel were intravaginally applied once a day from Day 15 to Day 18 after insemination. Different superscript letters indicate significant differences ($P < 0.05$) between pregnant heifers and non-pregnant heifers. Reprinted with permission (Duong et al. 2012b)

The level of cortisol is locally regulated in bovine endometrium during early pregnancy by HSD11B1. IFNT increases local concentration of cortisol and selectively stimulates PGE_2 secretion, resulting in the maintenance of the CL during early pregnancy in cattle. Given this evidence, taken altogether, it is beyond doubt that CR is one of the most important components of the intrauterine regulatory loop, contributing to early pregnancy establishment and maintenance.

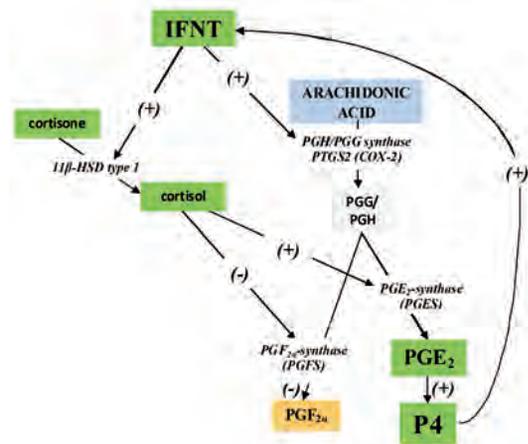


Fig. 4. Hypothetical model of the influence of cortisol on interferon- τ (INFT) action during the early pregnancy in cattle: modulatory effect on prostaglandin (PG) production in the endometrium (see text for details)

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Not all roots are born the same – Links to function and decomposition rate

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Plant roots' diversity is one of the most significant evolutionary achievements that help them to grow in variable environments. Such diversity provides plants with quick access to water and nutrients in the soil, enabling them to survive periodic as well as sudden disturbances, such as drought, cold, or nutrient shortage. Thus, understanding the dynamics of root function, composition, and structure is a priority in forest and ecological sciences. The research project presented here describes the variety of structures and roles of roots and comprises three modes: i) root structure and its links to function; ii) mycorrhizal fungus identity and its role in root metabolic activity and nitrogen partitioning; iii) root order as a determinant of decomposition rates.

Although the topic of root diversity based on branching hierarchy has been considered before (Fig. 1), the variation in structure and functions of new roots across plant species of different lifestyles has not yet been explored. In woody plants, researchers have commonly distinguished fibrous (=short) roots from pioneer (=long) roots, whereby the former are thought to be the principle roots for water and nutrient absorption, while the latter are considered the main exploratory roots that eventually develop the framework of the root system (Fig. 2). The purpose of our study was to make a detailed examination of fibrous and pioneer roots in their early stages of development (the first two weeks). We found that fibrous and pioneer roots clearly differ in structure, fungal colonization extent, and growth responses from their first days of development. We showed that new pioneer roots have a higher growth rate and much larger diameter, in addition to having more layers of hypodermis with fewer passage cells and more protoxylem poles than fibrous roots. This permits pioneer roots to defend more effectively against biotic and abiotic stress factors and to explore soil for a long distance, facilitating the potential extensive lateral fibrous root branching and a high axial hydraulic conductivity at the expense of absorptivity of water and nutrients, and encouraging mycorrhizal colonization. The significance of demonstrating that not all roots born

as first-order branches are the same, which has important consequences for overall function, could improve our understanding of plant growth and ecosystem functioning.



Fig. 1. Fragment of a branching fine root system. Different root orders are visible. Notice ectomycorrhizal root tip (single arrowhead). Bar = 4 mm



Fig. 2. Morphology of fibrous and pioneer roots. View from root-access window showing fibrous (single arrowhead) and pioneer (double arrowhead) roots. New root growth traced every day with a different-color marker. Bar = 1 cm

Fibrous roots play a significant role in plant and ecosystem respiration (RS); therefore, understanding factors controlling that process is important to advancing our understanding and improving our modeling of carbon budgets. However, very little is known about the extent to which ectomycorrhizal (ECM) fungal identity may influence RS or the underlying chemistry that may determine those rates. In order to investigate these relationships, we examined RS, measured as oxygen consumption, of first-order ECM root tips of pine (*Pinus sylvestris*)

and oak (*Quercus robur*) in relation to their ECM fungal symbionts and associated nitrogen. ECM-RS rates for different host species were significantly different and more than 97% of the variation in RS within a host species was explained by ECM root tip N concentrations. This may indicate that some of the variability in fine root RS–N relationships observed between and within different host species or their functional groups may be related to intraspecific host species differences in root tip N concentration among ECM fungal associates. Nitrogen is considered to be the element with the strongest impact on metabolic activities in plants. Nitrogen in ectomycorrhizae is located mostly in chitin, proteins, and NO_3^- and NH_4^+ . While we found a strong positive correlation between N content and respiration of ectomycorrhizae of different fungal identities on *Quercus* and *Pinus* seedlings, we do not know what portion of the N is in chitin versus other parts of root and fungal tissue. More fundamentally, which portion of the N drives the relationship? Thus, our current effort is concentrated on estimating N in chitin, proteins, and NO_3^- and NH_4^+ , and linking this to respiration of ectomycorrhizal root tips of different fungal species (Trocha and Eissenstat, in preparation).

Information on how particular root orders are constructed is also of essential importance for making generalizations about root turnover and nutrient cycling in nature. Different sets of functions among root orders strongly influence tissue chemical properties that have a significant impact on decomposition. Thus, we determined the effect of root order on root tissue chemistry and rates of decomposition among four European temperate tree species that vary widely in tissue traits. Our analysis of root decomposition, based on differences in structure

and function, revealed that decomposition rates in the lowest orders were significantly slower than those of higher root orders. The patterns of decomposition in different root orders were contrary to what might be expected from C:N ratio or root diameter. We found carbon to be the best estimator of decomposition, which is contrary to previous studies highlighting the importance of N. This is a fundamental finding that may help us to estimate carbon cycling in a changing environment.

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New insight into embryonic diapause in mammals

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Embryonic diapause (ED) is a temporary arrest of embryo development. This phenomenon is widespread in both plant and animals species as a re-

sponse to specific situations when further embryonic development is imperiled due to – for example – harsh climates, temperature fluctuations,

under-nutrition, or lactation. In mammals, embryonic diapause occurs at the blastocyst stage and is characterized by the delayed implantation of the blastocyst in the uterus. Although ED occurs only in less than 2% of mammalian species (out of approximately 5,500 species known) this phenomenon has been observed in species that belongs to seven highly represented mammalian orders. It is not clear if ED occurs in *Primates* (including humans) since its occurrence in this order has not been explicitly investigated. It is commonly believed that the phenomenon of embryonic diapause evolved independently in different mammalian orders. However, our previous unpublished observations suggested that ED might be an evolutionarily conserved phenomenon. If so, then it should be possible to induce ED in blastocysts of non-diapausing mammals, such as livestock species. To prove this hypothesis, we tested whether blastocysts from domestic sheep, which is a non-diapausing species, could enter into diapause following their transfer into pseudo-preg-

nant mice in which uteri diapause conditions were experimentally induced by ovariectomy and progesterone treatment. The scheme of the experiment is shown in Fig. 1. The experimental groups (1 and 3) consisted of inter-species (sheep → mouse; group 1) and intra-species (mouse → mouse; group 3) transfers. In group 1 early ovine blastocysts, and in group 2 mouse blastocysts, were transferred into mouse uteri. After 7 days the uteri were flushed out and 21% and 49% of viable ovine and murine blastocysts were recovered, respectively. The viability of these blastocysts was confirmed by their reexpansion within 1–2 hours of *in vitro* culture. None of the ovine blastocysts had elongated (as normally observed in ruminants), and their size – judging by the diameter of their *zona pellucidae* – had not changed during their stay in mouse uteri. In contrast to the control groups, represented by ovine blastocysts cultured *in vitro* (Fig.1; group2) and murine blastocysts flushed from non-diapausing mice (Fig. 1 group 4), which exhibited a high level of

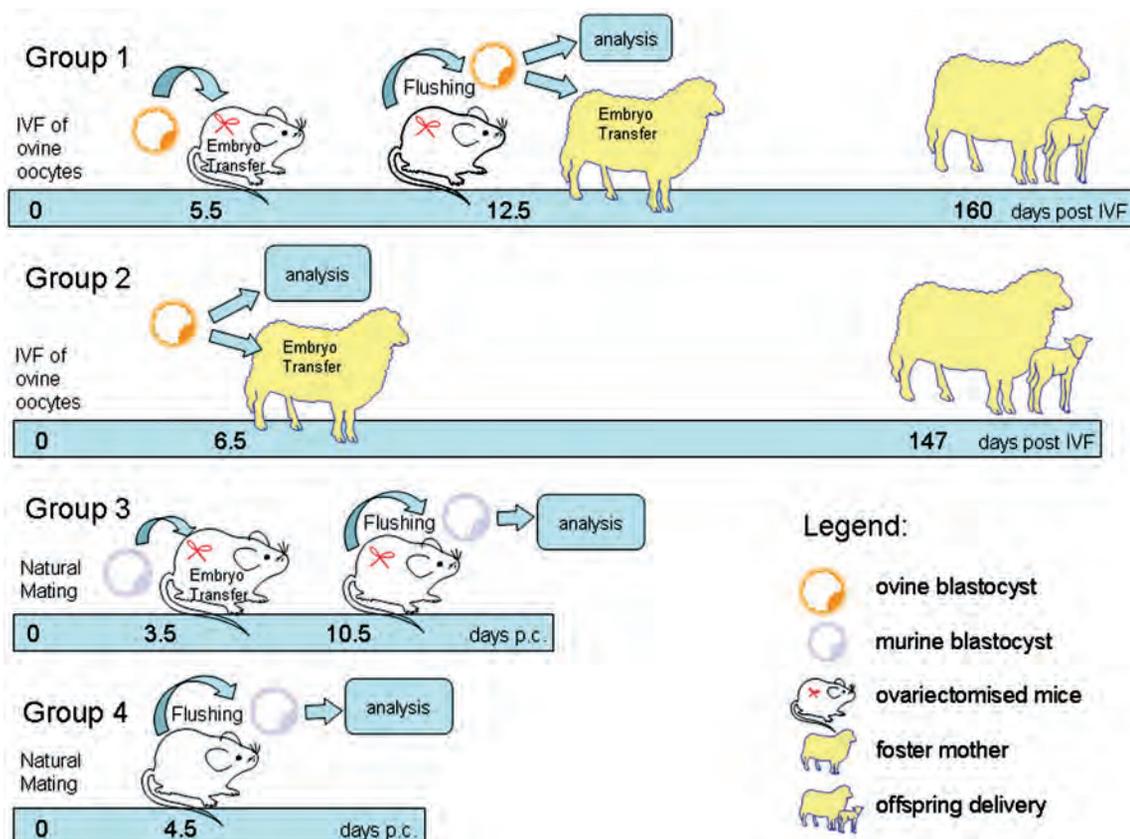


Fig. 1. Experimental design of embryonic diapause (ED) induction in ovine blastocysts by transfer into ovariectomised pseudopregnant mice at 2.5 dpc. Following uterine flushing, diapausing ovine blastocysts were analyzed or transferred to foster ewes at day 6 after oestrus for full term development. The timing indicated in the diagram refers to embryos. From: Ptak G.E., Tacconi E., Czernik M., Toschi P., Modliński J.A., Loi P. (2012). Embryonic diapause is conserved across mammals. *PLoS One* 2012; 7(3):e33027. doi:10.1371/journal.pone.0033027

DNA synthesis, the diapausing, viable ovine and murine blastocysts showed arrested DNA replication, as was assessed by BrdU incorporation. Also, the percentage of dead cells was significantly lower in diapausing ovine and murine blastocysts than in blastocysts from the control groups.

Further analysis revealed differential expression of ED markers between diapausing and non-diapausing ovine blastocysts. In diapausing ovine blastocysts, genes that positively regulate cell proliferation (PCNA; **P**roliferating **C**ell **N**uclear **A**ntigen) and signaling (HB-EGF; **H**eparin-**b**inding **E**GF-like growth factor) were down-regulated, whereas the anti-proliferative BTG1 (**B**-cell **T**ranslocation **G**ene **1**) gene was strongly up-regulated. Conversely, the expression of IGF2R (**I**nsulin-like **G**rowth **F**actor **2** **R**eceptor) did not differ significantly between diapausing and non-diapausing ovine blastocysts. On the other hand, CB1 (**C**annabinoid **R**eceptor **T**ype **1**), which is normally down-regulated before implantation, was highly expressed in diapausing ovine blastocysts.

Our study showed, for the first time, that induction of diapause in blastocysts of non-diapausing species is fully reversible. Diapausing ovine embryos restarted growing *in vitro* (even at a higher rate than the controls), can hatch from their *zonae pellucidae* and, after transfer to a recipient ewe, are able to develop to full-term at a proportion significantly higher than in the control group (44.4%; 8 lambs / 18 transferred blastocysts *vs.* 27.2%; 6 lambs / 22 transferred blastocysts) The pregnancy length following transfer of diapausing blastocysts was similar to the controls (147.4 *vs.* 148.1 days, respectively). All offspring also had normal birth weight and were healthy.

Our study showing that non-diapausing ovine embryos can enter into diapause implies that ED is a phylogenetically conserved phenomenon and not secondarily acquired by embryos of diapausing species and calls into question the current model of independent evolution of ED in different mammalian orders. Therefore, it provides a starting point for verifying the flexible occurrence of ED in mammals and opens up new perspectives for reproductive and evolutionary biology.

If diapause does occur in all mammals, this has huge implications for human pregnancy. Based on this finding, we consider it important to verify whether diapause may also occur in human embryos.

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Significance of MHC genes for species conservation

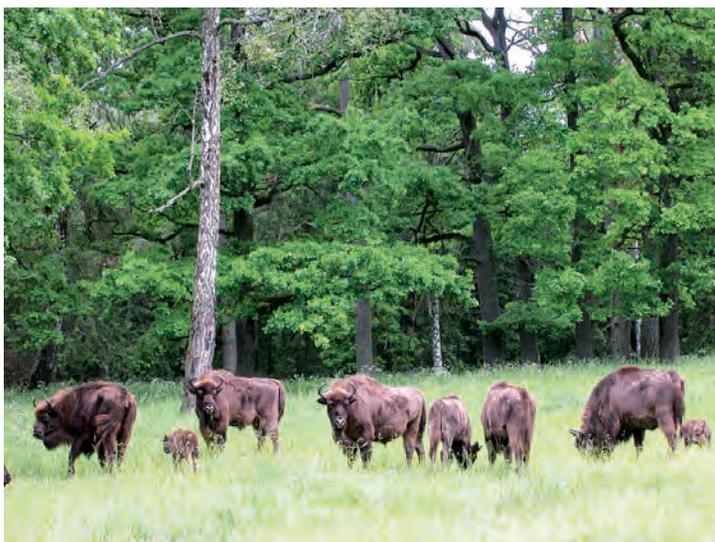
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This series of three scientific articles published in prestigious international journals has investigated the significance of Major Histocompatibility Complex (MHC) genes for biological conservation. MHC genes are the most polymorphic genes in

vertebrates, which is related to their function in presenting antigens from diverse and fast-evolving parasites to the immune function. In species threatened with extinction, genetic diversity is often reduced. The review published by Prof. Radwan's team shows



Bison in the Białowieża Forest (R. Kowalczyk)

that loss of variation also affects MHC genes, which may increase the risk of extinction due to a decreased ability of populations to respond to infections.

The European bison is a prominent example of a species which has undergone population bottleneck, and loss of genetic diversity is implied as one of the reasons for the health problems reported in this species, such as posthitis or asworthiosis, a massive infection with invasive nematode. Prof. Radwan's team characterized variation of MHC genes in bison and found very little variation (only four alleles, compared to dozens in American bison or cattle). This may be a reason for the decreased ability of European bison to respond to parasites. The work has also shown that supplementary feeding of free-living bison leads to increased group sizes in winter, and this leads to increased infection with invasive nematodes.

Prof. Radwan's team also investigated variation of MHC genes by means of computer simulations. These showed that contrary to common wisdom,

even in large populations, selection acting on MHC genes may result in a frequency distribution of alleles which is indistinguishable from that expected under genetic drift. Ultimately, selection acting in a small population may increase, rather than prevent, the loss of diversity of MHC genes.

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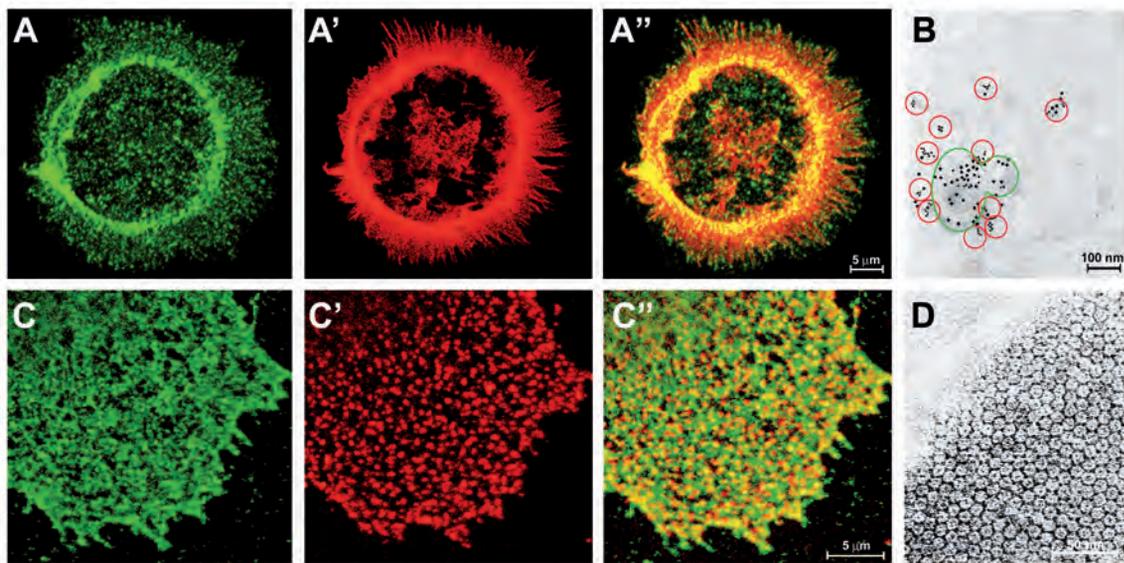
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The signaling role of sphingolipids and phosphatidylinositols in immunoreceptor activity

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The activation of several immune cell receptors is correlated with a profound structural reorganization of the plasma membrane. Under these condi-

tions, coalescence of nanoscale domains containing sphingolipids and cholesterol occurs, leading to the formation of assemblies, known as "rafts," accessed



Phosphatidylinositol PI(4,5)P₂ and sFingomyelin colocalize with activated FcγRIIA. (A-A'') PI(4,5)P₂ visualized with PH-GFP probe (green fluorescence) accompanies actin filaments (red fluorescence) which polymerize during activation of FcγRIIA. (B) Raft-based assemblies of activated FcγRIIA (10 nm gold particles, green contour) are surrounded by PI(4,5)P₂ molecules (6 nm gold particles, red circles). (C-C'') Sfingomyelin recognized by lysenin WT (green fluorescence) colocalizes with clusters of activated FcγRIIA (red fluorescence). Colocalization of the examined molecules is reflected by yellow color in merged images. (D) Upon binding to sFingomyelin-containing liposomes, lysenin WT forms hexamers organized into a honey-comb structure (K. Kwiatkowska, A. Sobota)

by the activated receptors and signaling proteins. Fcγ receptor IIa (FcγRIIa) is among the receptors that associate with rafts upon activation. The receptor in rafts is phosphorylated by Src family kinases and triggers signaling cascades. Lateral separation of raft components from the glycerophospholipid-enriched membrane milieu is governed by the unique physiochemical properties of the raft lipids. Among those, the presence of long saturated fatty acid residues in sphingolipids and their favored interaction with cholesterol is of central importance. Sphingomyelin, one of sphingolipids, additionally has a signaling function, giving rise to ceramide, which controls the activity of several intracellular proteins (Józefowski et al., 2010).

In order to study the participation of sphingomyelin in FcγRIIa signaling, we developed a probe, lysenin, which was obtained as a recombinant protein and recognized sphingomyelin with high specificity and sensitivity. Clusters of sphingomyelin formed in the plane of membranes were preferential targets for lysenin, as demonstrated by surface plasmon resonance analysis. A specially designed mutant lysenin carrying W20A amino acid substitution, although still specific for sphingomyelin, lost the preference to bind sphingomyelin in microdomains. The difference in interaction of lysenin WT and

lysenin W20A with sphingomyelin ensued from an ability of lysenin WT to oligomerize, which was abolished upon mutation. Lysenin WT, but not W20A, self-associated into trimers in solution and upon binding to sphingomyelin in membrane formed stable hexamers, as demonstrated by native gel electrophoresis and an analysis of surface pressure changes during adsorption of lysenin at the argon/water interface. When applied to detect sphingomyelin on the cell surface, lysenin WT recognized the sphingomyelin pool clustered in rafts. This can be explained by the fact that lysenin hexamer engages at least 30 sphingomyelin molecules. The pool of sphingomyelin dispersed outside rafts was marked by lysenin W20A. Upon activation, FcγRIIA and its accompanying signaling molecules colocalized with sphingomyelin decorated by lysenin WT, supporting the raft-based model of FcγRIIa activation (Kulma et al., 2010).

The signaling pathways triggered by FcγRIIa lead eventually to polymerization of actin, which provides the driving force for FcγRIIa-mediated phagocytosis. Our studies indicated that sphingolipid/cholesterol rafts serve as centers of FcγRIIa-induced generation of phosphatidylinositol PI(4,5)P₂ and this process is required for actin polymerization, and hence for phagocytosis to occur. Elevation of PI(4,5)

P_2 in the raft fraction in the course of Fc γ RIIa activation, revealed by HPLC chromatography, was accompanied by recruitment of PIP5-kinase I α to the plasma membrane. In order to elucidate the mechanism of PIP5-kinase I α recruitment, we analyzed an interaction of the kinase with lipids and found that the enzyme bound strongly to its substrate [PI(4)P] and product [PI(4,5)P $_2$]. Subcloning of PIP-5 kinase I α fragments showed that the C-terminus of the enzyme bound PI(4,5)P $_2$ and mediated interaction of the kinase with lipid microdomains. Overexpression of two PI(4,5)P $_2$ -binding proteins, the C-terminus of the kinase and the pleckstrin-homology domain of PLC β , interfered with binding of the kinase to the plasma membrane. As a result, generation of PI(4,5)P $_2$ in cells was inhibited and Fc γ RIIa-mediated phagocytosis was reduced. The data demonstrate that interaction of PIP-5 kinase I α with PI(4,5)P $_2$ in the plasma membrane is crucial for the involvement of this enzyme in Fc γ RIIa-triggered signaling cascades.

Ultrastructural analysis of raft-based signaling platforms of Fc γ RIIa revealed a spatial organization of these assemblies. The receptor was located in the core of the signaling platforms, while PI(4,5)P $_2$ and PIP-5 kinase I α occupied their peripheries serving as anchors for the actin cytoskeleton (Szymańska et al., 2008). Taken together, our studies indicate that clustering of raft precursors into spatially organized

platforms underlies the transduction of signals by Fc γ RIIa.

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Mathematics, Physics, Chemistry and Earth Sciences



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Prof. Henryk Szymczak, Ordinary Member of the Polish Academy of Sciences, served as Dean of Division Three: Mathematics, Physics, Chemistry, and Earth Sciences until 1 July 2012.



Division Three: Mathematics, Physics, Chemistry and Earth Sciences covers scientific activity in the fields of astronomy, physics, mathematics, chemistry, and Earth sciences. The Division consists of 90 national members of the Academy (55 ordinary members and 35 corresponding members), 58 foreign members, and 6 members of the Academy of Junior Scholars.

Division Three coordinates the activity of 19 research institutes, with 1,244 researchers (compared to 1,034 in 2010) pursuing fundamental research in the domains represented in the Division as well as in various applied fields. In 2011 the institutes carried out 1,167 (1,033 in 2010) research projects, 234 (167) of which were foreign. Over the past year, researchers from the Division's institutes

published 1,969 (1,917) papers in refereed journals of international circulation, and the institutes were engaged in editing 15 (15) scientific journals.

Fifteen of the institutes affiliated with the Division are authorized to confer doctorate (PhD) degrees, while 14 may confer *habilitation* (DSc) degrees. The institutes run their own four-year post-graduate studies leading to PhD degrees, or participate in such programs run by local universities. Scientists from the institutes are also engaged in teaching and joint research programs in collaboration with neighboring universities.

The scientific committees affiliated with the Division, encompassing a total of 467 members, are as follows: the Committee on Analytical Chemistry, Committee on Astronomy, Committee on Chemistry, Committee on Crystallography, Committee on Geographical Sciences, Committee on Geological Sciences, Committee on Geophysics, Committee on Maritime Research, Committee on Mathematics, Committee on Mineralogical Sciences, Committee on Physics, and Committee on Quaternary Research. Acting as bodies representing the entire scientific community, these committees express scientific opinions, discuss research directions, and are engaged in organizing scientific events and publishing journals. Committees associated with the Division play the role of National Committees within the scope of their disciplines and represent the Polish scientific community

among corresponding international scientific organizations.

The institutes and committees of Division Three are involved in publishing numerous scientific journals: *Acta Physica Polonica A*, *Artificial Satellites – Planetary Geodesy*, and *Molecular Physics Report* in the domain of astronomy and physics, *Biotechnologia* (Biotechnology) and *Polish Journal of Applied Chemistry* in the domain of chemistry, *Fundamenta Mathematicae*, *Studia Mathematica*, *Acta Arithmetica*, *Colloquium Mathematicum*, *Annales Polonici Mathematici*, *Bulletin of the Polish Academy of Sciences – Mathematics*, and *Dissertationes Mathematicae* in the domain of mathematics, and *Acta Geophysica*, *GeoPlanet: Earth and Planetary Sciences Series*, *Oceanology*, *Review of Geophysical*, *Studia Quaternaria*, and *Acta Geologica Polonica* in the domain of Earth sciences.

The Division was engaged, directly or via its Committees, in the promotion of gifted high school and university students. The International PhD Studies program established at Division Three in 2000 continued its program in 2011. The Division's institutes participated actively in various projects under the 7th EU Framework Programme. For example the PAS Institute of Physical Chemistry received an important grant under the "Research Potential" measure, recognizing its excellence. The Division continued its coordination of the Polish part of the EU – Republic of Korea scientific cooperation Program (KORANET). Close collaboration with scientific societies, active in the domains represented in the Division, has been continued. The Division coordinated celebrations of the International Year of Chemistry 2011 and the 100th anniversary of Nobel Prize in Chemistry for Maria Skłodowska-Curie.

Three plenary sessions of Division Three were held in 2011. At its fall session the Division elected the following six candidates to become members of the Academy of Young Scientists: Dr. Michał Chmielewski, Dr. Sławomir Dinew, Dr. Igor Soszyński, Dr. Witold Szczuciński, Dr. Maciej Wojtkowski, and Dr. Michał Zatoń.

As is traditional, the Division granted its annual prizes in 2011. The prestigious Maria Skłodowska-Curie Award was bestowed upon Prof. Krzysztof Pachucki from the Institute of Theoretical Physics, Warsaw University, for his contribution to the theory of nuclear structure effects in atomic spectra. Division Three's research awards, in turn, were



From left Prof. Marek Chmielewski (corresponding member of the Academy, PAS vice-president) and Prof. Janusz Lipkowski (corresponding member of the Academy, chair of the Council of Provosts of PAS Division Three: Mathematics, Physics, Chemistry and Earth Sciences)



From left: Prof. Krzysztof Pachucki (laureate of the Maria Skłodowska-Curie Award in 2011), Prof. Janusz Jurczak (ordinary member of the Academy, chair of the MSC Award Committee), Prof. Henryk Szymczak (ordinary member of the Academy), and Prof. Michał Kleiber (ordinary member of the Academy, PAS president) (R. Szaruch)



From left: Dr. Agnieszka Szumna (laureate of the Włodzimierz Kołos Scientific Award in 2011), Prof. Michał Kleiber, Prof. Krzysztof Pachucki, Prof. Henryk Szymczak (R. Szaruch)

given as follows: the Waclaw Sierpiński Award in mathematics to Dr. Piotr Śniady from the PAS Institute of Mathematics for work entitled “Asymptotics of characters of symmetric groups related to Stanley character formula;” the Stefan Pieńkowski Award in physics and astronomy to Dr. Michał Matuszewski from the PAS Institute of Physics for a set of papers related to Bose-Einstein condensates; and the Włodzimierz Kołos Award in chemistry to Dr. Agnieszka Szumna from the PAS Institute of

Organic Chemistry for a set of papers about chiral molecular containers.

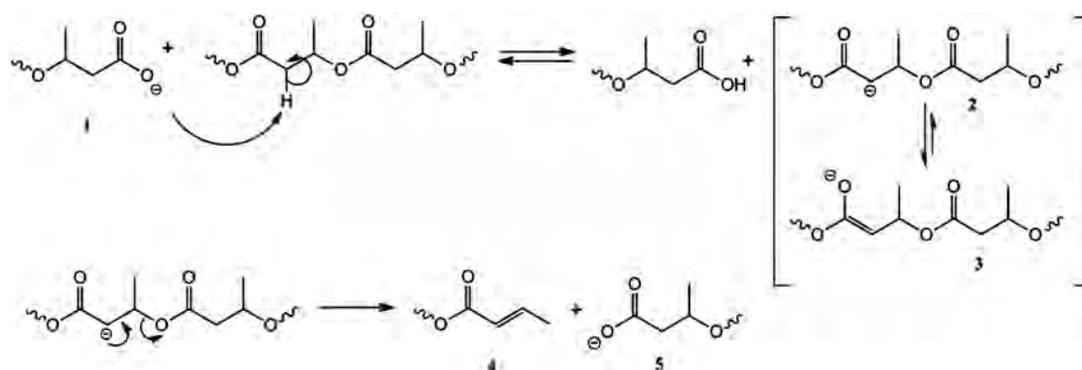
In 2011 the members of the Division were frequently commended and honored for outstanding achievements in science. Honorary doctorates were granted to Prof. Andrzej K. Wróblewski by the Technical University in Warsaw and to Prof. Bogdan Bojarski by the Tbilisi State University.

E1cB degradation mechanism of aliphatic biopolyesters

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Poly([R]-3-hydroxybutyrate) (PHB) is a natural and biodegradable polyester which belongs to much wider family of poly(3-hydroxyalkanoate)s (PHAs). The short-chain PHB is present in a wide variety of human tissues; a wide variety of microorganisms produce the polyester, comprising even more than 10,000 units, and store it as a carbon and energy

source used in nutrition-limited conditions. Systematic investigation of the properties, application and biodegradability of PHAs have been undertaken at the PAS Center of Polymer and Carbon Materials in response to modern society’s increasing awareness of environmental issues. Moreover, the use of PHAs for biomedical applications is also being studied.



Scheme 1. Moderate-temperature anionic degradation of poly(3-hydroxybutyrate)

PHAs are interesting thermoplasts with properties dependent on the polyesters' molar mass and composition. Therefore, one of our relatively recent studies was devoted to PHA thermal stability. Until recently, the random intramolecular chain scission by non-ionic *cis*-elimination mechanism was considered the general pathway of PHB thermal degradation. However, detailed investigations performed at the Center of Polymer and Carbon Materials revealed a much more complex character of reactions occurring during thermal treatment of PHAs. It was discovered that a peculiar group of 3-hydroxyalkanoate (3HA), being a repeatable building block of most PHAs, undergoes relatively easy proton abstraction. The ionization of 3HA groups occurs even in moderate temperatures when carboxylate active centers are present in the system (Scheme 1.). A carboanion, being in equilibrium with its enolate tautomer, is formed as a result but, most importantly, this peculiar chemical structure of the carboanion leads to its irreversible decomposition, generating a crotonate terminal group, and accordingly leads to the intermolecular scission of the polymer backbone.

Highlighting this seemingly inconspicuous intermolecular reaction, the input of which is significant even in moderate temperatures, led to an explanation of the observed major differences in the thermal stability of PHAs. As an outcome of this understanding of elementary processes occurring during PHA processing, several methods for improving their thermal stability have been developed and protected worldwide.

Notably, despite their biodegradability, PHAs are biocompatible materials and in conjunction with their temporary character they constitute very promising compounds for application in novel (bio) medical and pharmaceutical fields. Therefore, their

short-chain isomers are potentially valuable objects in, for instance, the development of new drug delivery systems or nanofiber scaffolds for regenerative medicine. Just recently, novel block copolymers of atactic PHB with natural PHA for cardiovascular engineering have been synthesized and characterized. Understanding of the PHA degradation process has also yielded one more outcome; the finding has been applied in the development of a convenient route to PHA macromonomers or macroinitiators via anionically controlled moderate-temperature degradation, leading to the production of short chain PHAs with predictable polymer length and carboxylate end groups. The controlled degradation can be carried out in bulk at moderate

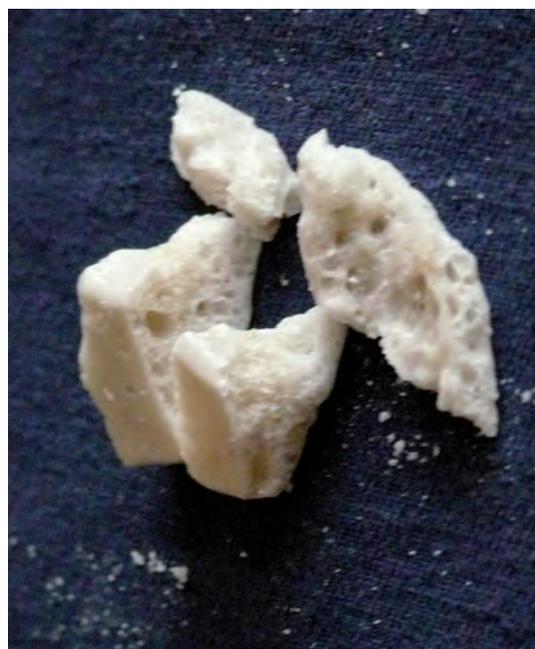


Fig. 1. Foamed sample of short chain PHB derived by anionically controlled degradation of high molar mass material in a reactive extrusion process

temperature even as a reactive extrusion process and the resulting materials are derived in form of foams, instead of a brittle block (Fig. 1).

The examples of research carried out at the Center of Polymer and Carbon Materials described herein underscore the importance of basic investigations leading to significant technological developments, for instance under the framework of the MARGEN structural project coordinated by our Center (for details, please consult the references listed below).

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Quest for superdeformed shapes in $A \sim 70$ mass nuclei with the Kraków Recoil Filter Detector

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The atomic nucleus, an aggregation of strongly interacting fermions (protons and neutrons), displays a remarkable diversity of phenomena. Even after decades of study, new and unexpected properties of this system are being revealed by modern, increasingly sensitive detectors. Some of these new phenomena are related to the rotation of the nucleus – they appear when angular momentum of the object increases.

The spin of a nucleus is composed of a collective part and a contribution arising from single particles. Rotating the nucleus to increasingly higher spin forces the system to adopt a configuration which has the lowest rotational energy. Energy minimization can be achieved by, for example, increasing the nuclear moment of inertia. This scenario is particularly well manifested in certain nuclei when quantum shell effects stabilize an elongated shape (having high moment of inertia).

The most extreme stable deformation known in a nucleus is called superdeformation (SD), corresponding to an ellipsoidal shape with a ratio of long-

to-short axis lengths of 2:1. A superdeformed nuclear rotor releases its excitation energy (slows down the rotation) by emitting γ radiation, coming 10^{-15} - 10^{-13} seconds after the formation of such an exotic shape. Regular series of these very fast γ transitions constitute SD rotational bands. Superdeformation can be generated in heavy ion fusion-evaporation reactions, but this exotic excitation mode yields only a small fraction of the total reaction cross section. It can therefore only be observed by measuring γ radiation with efficient high purity germanium multi-detector systems that surround the target location.

Many SD rotational bands have been reported in various regions of the nuclear chart. However, they appear, as in the rare earth nuclei with the mass number $A \sim 150$, at quite high spins ($I \sim 25$ - $70\hbar$), and can hardly be linked to the excited structures lying closer to the ground state. Of particular interest in this respect, then, are studies regarding the SD phenomenon in nuclei with $A \sim 70$. Here, the number of active nucleons is big enough to create a

coherent motion, but on the other hand this collectivity can be still tracked down to the single-particle degrees of freedom. Investigations in this region were hampered for many years by experimental difficulties arising from the low detection efficiencies due to the high γ -ray energies involved, and the poor energy resolution resulting from Doppler broadening caused by large velocities of product nuclei. In addition, full identification of SD bands requires accurate knowledge of transition rates (state lifetimes), which are also difficult to measure.

We have overcome these difficulties by coupling the GASP germanium detector array that was operational at the Laboratori Nazionali di Legnaro (Padova) with the Recoil Filter Detector (RFD) being built at the PAS Institute of Nuclear Physics, and used such a detection system, shown in Figure 1, to study rotational bands in ^{69}As . The ^{69}As nucleus was produced in a fusion-evaporation reaction of a 95-MeV ^{32}S pulsed beam from the Tandem XTU accelerator at LNL on a 0.8 mg/cm^2 ^{40}Ca target.

The RFD detector is a heavy ion detector which provided the time of flight and the direction of every detected fusion-evaporation reaction product (evaporation residuum) with respect to the beam pulse signal. In this way, the recoil velocity vector could be determined and used for the event-by-event Doppler correction of the coincident prompt

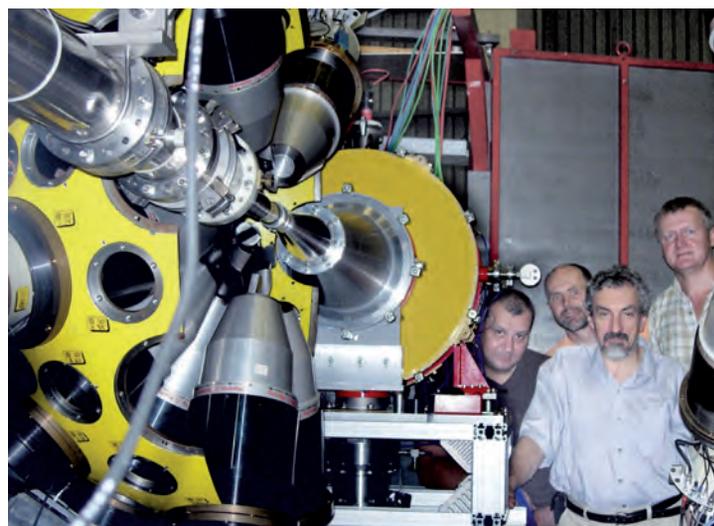


Fig. 1. Photo of the RFD detector (middle) coupled to the GASP spectrometer (left) at LNL, Legnaro. The PAS Institute of Nuclear Physics team, from left to right: B. Sowicki, P. Bednarczyk, W. Męczyński, and M. Ziębliński

γ -rays. In consequence, a gain in γ -energy resolution by factor of 2 could be achieved.

One unique feature of the RFD detector is the possibility to determine the lifetime of an excited state if it is comparable to or shorter than the transit time of the recoil through a target material (typically on the order of femtoseconds). Gamma lines corresponding to very fast transitions

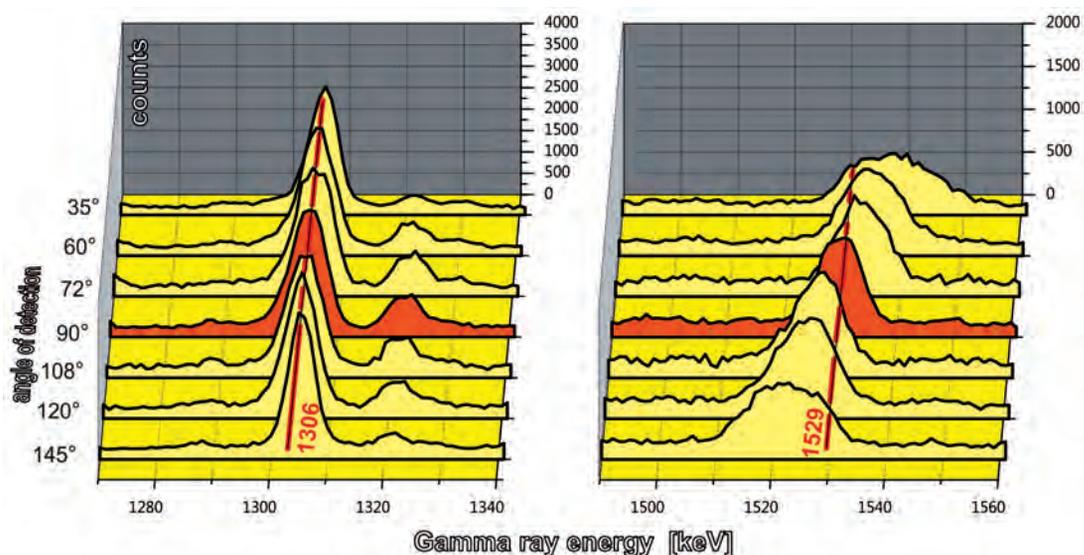


Fig. 2. Partial spectra of γ -rays emitted from the excited ^{69}As nucleus, registered at forward and backward angles with respect to the beam axis. The symmetric peak at $E_\gamma = 1306\text{ keV}$, seen at all the angles, corresponds to a slow transition feeding the nearly spherical ground state, whereas the increased tail of the $E_\gamma = 1529\text{ keV}$ line indicates a very short lifetime of the presumably superdeformed high spin state at $J^\pi = 33/2^+$ (for detailed explanation see text)

emitted inside the target are broadened and exhibit an angle-dependent shift due to a difference in the true recoil velocity at the time of the γ -emission and the measured value when exiting the target. Figure 2 presents the γ - γ -recoil coincidence spectra gated by the ^{69}As transitions, as seen by detectors at different angles. The picture illustrates the effect of broadening the 1529 keV line (the $33/2^+ \rightarrow 29/2^+$ transition) caused by a short level lifetime, which according to our analysis is significantly below 50 fs. A similar effect was also visible for consecutive transitions belonging to the same rotational band. So short lifetimes would correspond to a superdeformed shape of ^{69}As . In contrast, the 1306 keV transition feeding the nearly spherical ground state resulted in a narrow γ -line seen at all the angles.

The combined GASP + RFD setup has demonstrated that significant improvement in studying exotic shapes in A~70 mass nuclei produced in fusion-evaporation reactions can be achieved. The possibility to extract very short level lifetimes, on the order of femtoseconds, enables further detailed structural investigations in this interesting region of the nuclear chart.

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Highest energy particles in the Universe

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The aim of the Pierre Auger Observatory is to provide experimental data needed to explain the origin of ultra-high energy cosmic rays. The energies of cosmic rays reach 10^{20} eV, i.e. about a hundred million times higher than energies achieved so far in man-made particle accelerators. These are the highest-energy particles known to exist in nature. The Observatory was constructed and is operated by an international collaboration of scientific institutes from 18 countries, including the Henryk Niewodniczański Institute of Nuclear Physics of the Polish Academy of Sciences. It is the largest cosmic-ray detection system ever built: the detectors are spread over 3000 km² in Argentina. The hybrid detection system, simultaneously utilizing two techniques of air shower detection, ensures an unprecedented accuracy of experimental data. The Pierre Auger Collaboration has published its first results on the arrival directions, energy spectrum, and composition of ultra-high energy cosmic rays.

Statistical investigation of the arrival directions shows that highest energy cosmic rays do not arrive isotropically. The arrival directions seem to be correlated with the distribution of matter in our neighborhood in the Universe, with active galactic nuclei being among possible candidate sources.

However, no strong clustering of arrival directions is observed.

The precise measurement of the shape of the cosmic ray energy spectrum is needed to verify the existence of the Greisen-Zatsepin-Kuzmin (GZK) effect, i.e. the suppression of the spectrum due to

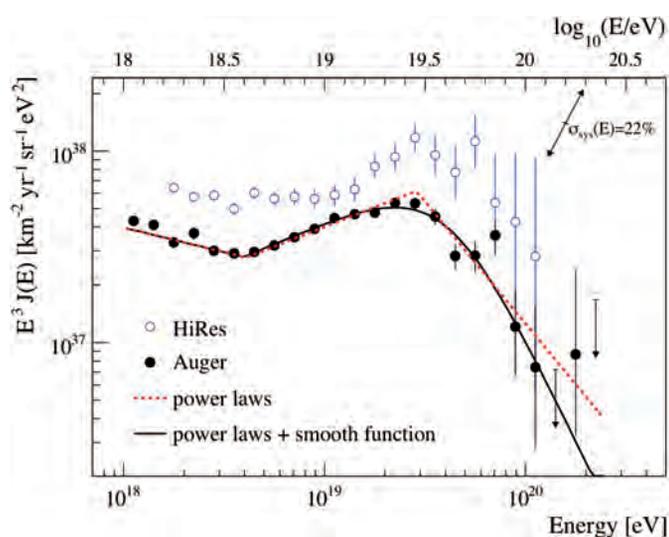


Fig. 1. Cosmic ray energy spectrum fitted with two functions and compared to data from the HiRes instrument. The systematic uncertainty of the flux scaled by E^3 due to the uncertainty of the energy scale of 22% is indicated by arrows

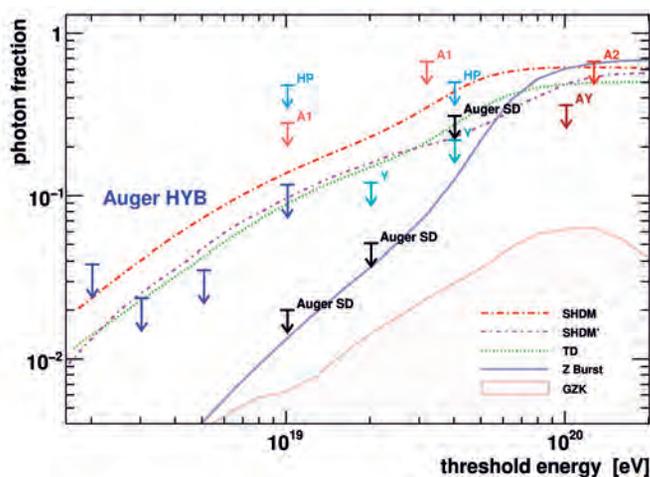


Fig. 2. Upper limits on the photon fraction in the integral cosmic-ray flux for different experiments: AGASA (A1, A2), AGASA-Yakutsk (AY), Yakutsk (Y), Haverah Park (HP). In black the limits from the Auger surface detector (Auger SD) and in blue the limits above 2, 3, 5, and 10 EeV from Auger hybrid detector (Auger HYB). The shaded region shows the expected GZK photon fraction. Lines indicate predictions from exotic top-down models

interactions of cosmic rays with the cosmic microwave background radiation. The GZK effect was predicted in 1966, but its experimental confirmation was uncertain until recently. The spectrum determined by the Auger collaboration exhibits a break at $4 \cdot 10^{19}$ eV, which is very consistent with the expected GZK feature. The significance of the break is more than 20 standard deviations.

Identifying the type of incoming cosmic-ray particles is the biggest experimental challenge. Interpreting the measurement of depth of shower maximum depends on the properties of hadronic interaction models at the highest energies, e.g. on cross sections and inelasticity. If these properties, determined at lower energies, can be extrapolated to highest energies, the Auger experiment data may

indicate a change of cosmic ray composition towards heavier nuclei with increasing energy.

The Pierre Auger Collaboration has set limits to the fractions of photons and neutrinos among the highest-energy cosmic rays. The specific photon and neutrino fractions are characteristic for different scenarios of cosmic ray origin, so that a measurement of these fractions will help to select the right model. In particular, the determination of the upper limit on the photon fraction from the Auger experiment data already strongly constraints the so-called exotic models of cosmic ray origin.

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Solitons in rapidly cooled one-dimensional Bose gas

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Gas of bosonic atoms, cooled to nanokelvin temperatures, exhibits macroscopic wave properties undergoing a phase transition to a state of Bose-Einstein condensate – a state in which all atoms share the same wave function. Properties of the

condensate depend strongly on the shape of the trapping potential holding the gas sample. Elongated traps may be approximated by a one-dimensional model. The nonlinear wave equation describing these waves, the Gross-Pitaevskii equa-

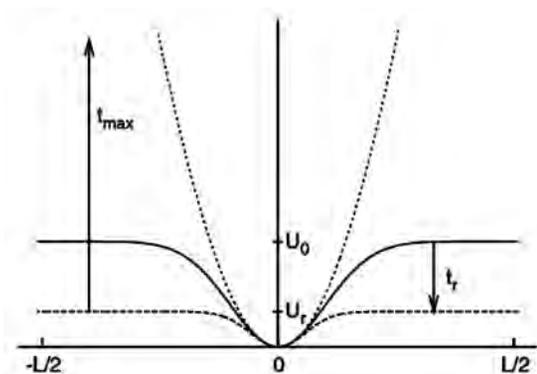


Fig. 1. The evaporative cooling potential. Solid line – potential at the initial time. Wings are lowered as shown and then raised to close the trap

tion, admits soliton solutions – indestructible wave packets, travelling without significant distortions along the system.

In a recent Letter, W. Żurek predicted that solitons should be formed spontaneously during rapid cooling of (nearly) one-dimensional Bose gas. Simply speaking, when the cooling is fast enough, the condensation process is taking place independently in different parts of the system and phase domains are formed with solitons present at their borders.

In our Letter published in 2011 in *Physical Review Letters* we demonstrated that indeed, the mechanism conjectured in Ref. 1 takes place in realistic simulations.

For the simulations we used our method of classical fields in which the long wave length part of the atomic field is represented as a classical complex function, very much as everyday electromagnetic fields are described well by the classical vectors of electric and magnetic fields.

In our simulation we subject a field corresponding to relatively high temperature uncondensed gas to a time-dependent potential as shown in Fig. 1. Then, lowering the shoulders of this potential, we model the cooling process allowing the most energetic particles to escape. We watch the condensation process and indeed observe the appearance of gray solitons. These are “snake”-like lines winding as the system evolves.

As expected, the phase of the field is nearly constant between the solitons and exhibits jumps at the solitons. Thus, the phase domains are formed shown in Fig. 3 for the final stage of the evolution in Fig. 2.

In our Letter [2] we also studied the coherence length in the system and the scaling law of the number for solitons created as a function of the speed of cooling.

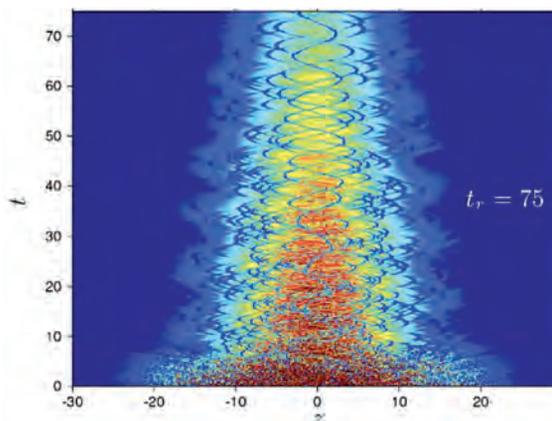


Fig. 2. Time evolution of the density of one-dimensional Bose gas during the process of evaporative cooling. Dark blue winding lines are local minima of the density – gray solitons, traveling in the gas, bouncing back and forth between turning points near the end of the cloud

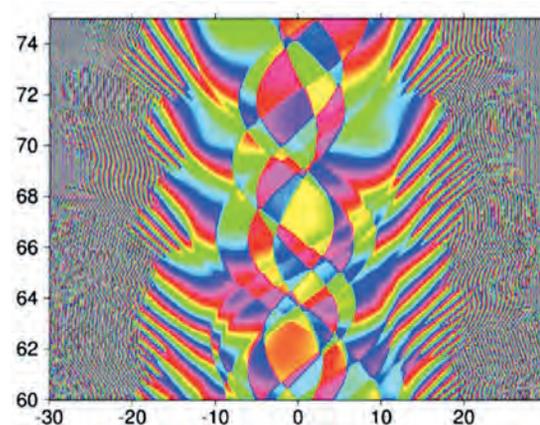


Fig. 3. Phase domains between solitons formed during the final stage of evolution shown in Fig. 2

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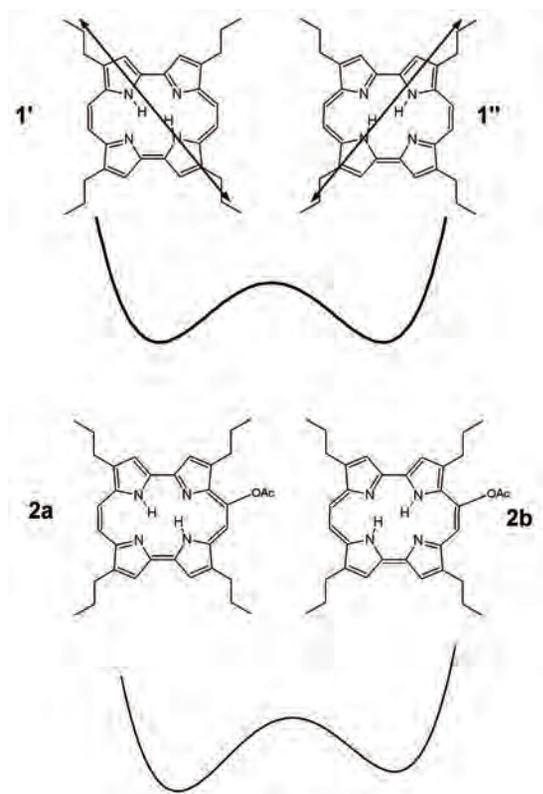
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Hydrogen tunneling in molecules

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Porphyrin and its derivatives are compounds occurring in nature – such as in human blood, where they play an important biological role by taking part in oxygen-transfer related reactions. Derivatives of porphyrin have been studied at the PAS Institute of Physical Chemistry in Warsaw for well over a decade. These molecules have the form of flat carbon rings, with hydrogen atoms outside and four nitrogen atoms inside the ring. In the center of the molecule, in an inner cavity surrounded by nitrogen atoms, there are two hydrogen atoms that display an interesting feature: they can move between the nitrogen atoms. Do the hydrogen atoms move clas-

sically, as in typical chemistry, or is it tunneling, a quantum effect that makes it possible to cross potential barriers without any need to gain additional energy, that is responsible for their movements?

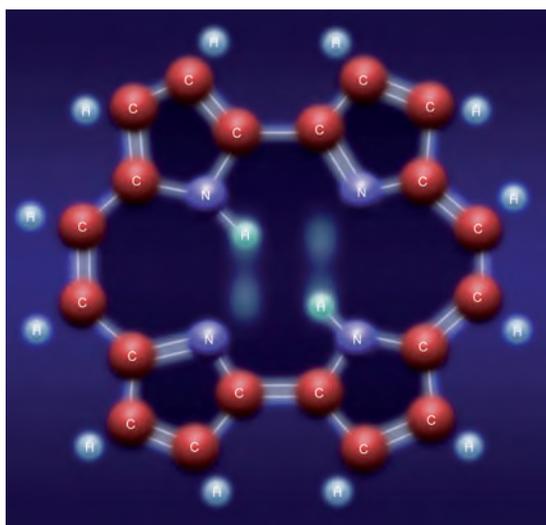


Depending on the type of porphyrin derivative, the hydrogen atoms in the central part of the molecule can move between nitrogen atoms in a symmetric (upper figure) or somewhat asymmetric (lower figure) potential. The way protons behave in a non-symmetric potential provides some indications as to the nature of the process, which – as it seems at present – occurs via a tunneling mechanism (IPC PAS)



Dr. Jacek Dobkowski from the PAS Institute of Physical Chemistry in Warsaw, examining the experimental setup used to study hydrogen tunneling in porphycene (G. Krzyzewski)

In 2011, a team of researchers from the Institute of Physical Chemistry of the PAS, headed by Prof. Jacek Waluk, was focused on searching for clues about the nature of this hydrogen atom transfer in porphyrin derivatives. Prof. Waluk's group used molecules modified so that the electric potential, where the hydrogens were moving, was slightly asymmetric: one barrier in the potential well was somewhat lower than the other. The theoretical model of the phenomenon predicted that if the hydrogen atoms were moving classically, just overcoming the barrier, the rate constant of the reaction should increase. However, the measurements carried out at the PAS Institute of Physical Chemistry in cooperation with the Faculty of Physics at Warsaw University indicated an opposite effect: the rate constant decreases. This result is explained well by a model assuming that the primary mechanism responsible for hydrogen atom transfers in the molecule is tunneling.



A scheme of the porphycene molecule. When two hydrogen atoms in the center of the molecule tunnel simultaneously between the lower and the upper nitrogen atoms, the process occurs faster and easier than when only one hydrogen tunnels (IPC PAS)

These recent findings from studies on proton tunneling in porphyrin derivatives agree with the earlier research work at the PAS Institute of Physical Chemistry on molecules with symmetric potential. In 2010, Prof. Waluk's team showed that, depending on the vibrational state of the porphycene molecule ($C_{20}H_{14}N_4$), the tunneling may be faster or slower. Tunneling was then monitored with laser techniques, providing measurements with time resolution down to 50 femtoseconds. It was shown that the way the tunneling hydrogen in porphycene behaves has a significant effect on the lifetime of fluorescence, i.e. the light emitted by the excited molecule. At room temperature in highly viscous solutions, the fluorescence lifetime increased even by thousand times: from picoseconds to nanoseconds. Combined with theoretical modeling, the measurements revealed that when one proton is

transferred, the energy of the molecule changes and the molecule must appropriately modify its structure, whereas when two protons tunnel simultaneously, the energy remains unchanged. The atoms in the molecule then do not need to be reorganized and the tunneling becomes easier.

The study of proton tunneling may lead not only to a better theoretical understanding of molecular processes, but also to practical applications. Excited porphycene molecules might be used as probes for viscosity measurements on a micro- and nanoscale, allowing one to observe selected parts of cells and to detect certain pathological conditions. Due to the strong dependence of their photophysical properties on solution viscosity, the porphycene derivatives described by the PAS Institute of Physical Chemistry researchers also open up interesting prospects for selective killing of cancer cells with photodynamic therapies.

Edited by Jarosław Chrostowski IPC, PAS

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Architecture of a mesoporous support – A key factor controlling catalytic activity of supported ruthenium (II) complex

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Homogeneous catalysis, in which the catalyst is in the same phase as the reactants, plays an important role in a number of large-scale industrial chemical processes. It is also crucial for living organisms whose functions depend on enzyme-catalyzed reactions. In most practical applications, the catalyst, which most commonly is a soluble metal complex, is co-dissolved in a solvent together with the reactants. One of the major drawbacks of homogeneous systems is the difficulty of catalyst separation from the reaction medium, required for the efficient recovery and recycling of the catalysts.

Deposition of a homogeneous catalyst onto the surface of a solid support, referred to as heterogenization, represents a very convenient way of combining the advantages of homogeneous catalysts with the better handling offered by heterogeneous systems. Fixation of metal complexes to solid supports may be accomplished in different ways, e.g. by covalent bonding, coordinative linkage, electrostatic interactions, or via functionalized ligands. Appropriate choice of a porous support material can lead to a new class of hybrid systems whose cata-

lytic properties are determined by both the catalyst and the host.

This study investigated the hybrid catalysts resulting from the deposition of a special type of metalloorganic complex within the pore network of various ordered mesoporous silicas. It demonstrated that the catalytic activity of the supported active species depends on the complex orientation with respect to the surface at which it is anchored, and that this factor can be controlled by choosing an appropriate choice of support type.

The phosphaaallyl cationic ruthenium (II) complex $[(\eta^5\text{-MeC}_5\text{H}_4)\text{Ru}(\eta^3\text{-DPVP})(\eta^1\text{-DPVP})]^+$ (DPVP = $\text{PPh}_2\text{CHCH}_2$) (Fig. 1), abbreviated as $(RuL)^+$, contains a hemilabile ligand ($\eta^3\text{-DPVP}$) which opens one of its bonds to the Ru center while used in catalytic reaction, providing a coordination site for an incoming substrate. This function may induce transformations of reactants that otherwise would not occur. In particular, $(RuL)^+$ is very selective in the reaction of partial hydrogenation of phenylacetylene to styrene, a reaction of practical and scientific interest. In polystyrene manufacturing, traces of phenylacetylene in the styrene feed deactivate the polymerization catalyst. This is counteracted by semihydrogenation of phenylacetylene, which transforms the contaminant directly into substrate.

Porous supports with channel size in the mesopore range (2–50 nm) are particularly suitable as carriers of large metalloorganic catalytically active species. $(RuL)^+$ is a complex of ca. 1.1 nm diameter. For this reason we have employed ordered mesoporous silica materials characterized by hexagonal arrays of uniform pores whose size ranged from 2 to 4 nm (Fig. 2). The materials possessed cation exchange properties due to partial substitution of Si^{4+} ions with Al^{3+} . This allowed for the immobilization of the cationic ruthenium (II) complex $(RuL)^+$ by means of electrostatic interactions. The conse-

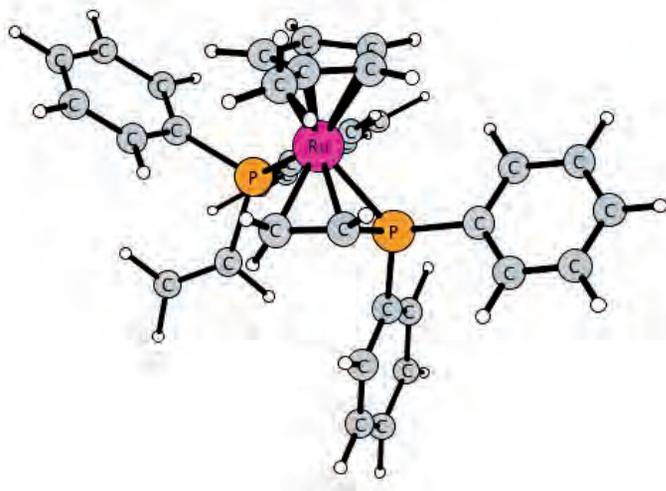


Fig. 1. Structure of $(RuL)^+$ complex

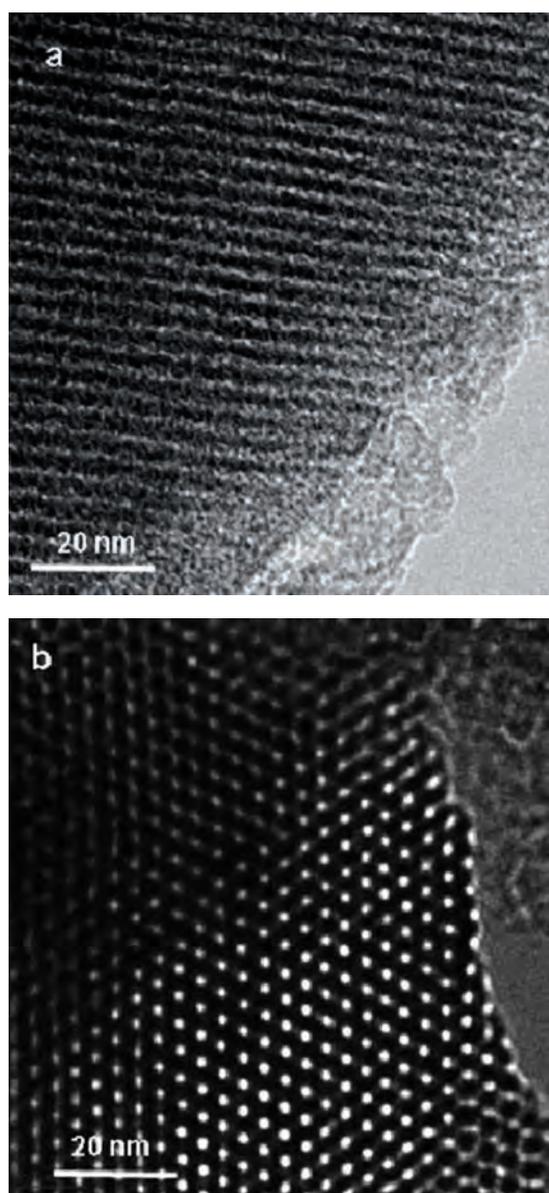


Fig. 2. Transmission electron microscopic images of a mesoporous silica support showing a) pore alignment, b) hexagonal array of pores

quence of such binding was that distribution of metalloorganic species at the support surface followed that of aluminium sites. The latter depended on the manner of alumination. In silicas aluminated directly during support synthesis, Al sites predominantly occupied inner pore walls. Materials aluminated by post-synthesis impregnation of purely siliceous materials, on the other hand, contained significant amounts of Al sites at the external support surface.

Catalytic tests of phenylacetylene hydrogenation showed that the supported catalysts were ac-

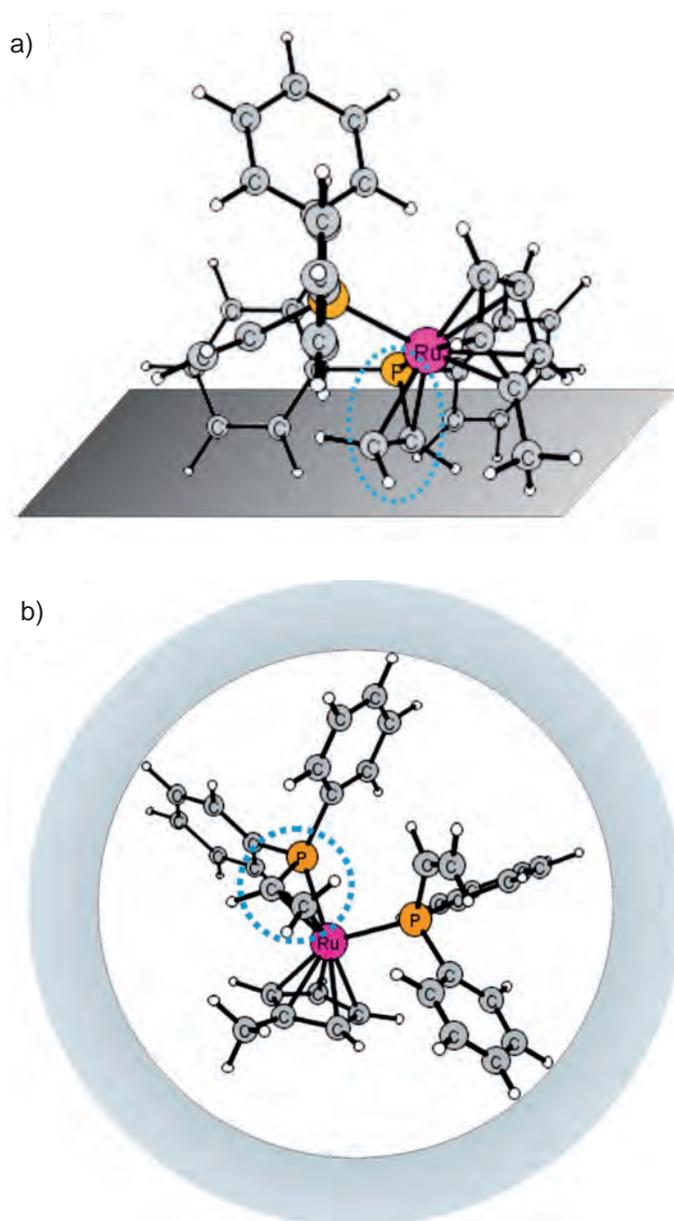


Fig. 3. Modes of $(RuL)^+$ complex binding a) at the surface free of spatial limitations and b) inside the mesopore channel (labile phosphine ligand marked)

tive in the reaction, and could be easily recovered and reused without loss in catalytic performance. Their activity depended critically on the type of the used support. In particular, it has been demonstrated that the key factor in the optimization of catalytic performance was the knowledge of $(RuL)^+$ complex distribution between the external surface and the mesopore network, and the choice of the appropriate pore size. The physico-chemical and quantum chemical characterization of the catalysts showed that, depending on the complex location,

the functionality of the hemilabile ligand could be either blocked or enhanced. The attachment of $(RuL)^+$ complex to the external surface of the mesoporous support was associated with participation of the hemilabile phosphine ligand in the electrostatic interaction with the negatively charged Al-O-Si site, which deactivated the metalloorganic catalyst (Fig. 3a). In contrast, the spatial constraints experienced by the complex located within the network of mesopores promoted the mode of bonding via peripheral areas of Ru coordination sphere, which exposed the hemilabile phosphine ligand to the reaction environment and ensured high catalytic activity of the supported system (Fig. 3b). This manner of binding was favored in pores of diameters close to the mesopore/micropore border, i.e. close to 2 nm.

This finding represents the first experimental evidence that binding of a catalytically active metalloorganic complex to the support surface free of spatial constraints is detrimental to catalytic action, while its location within the limited space of the porous network is a prerequisite for ensuring high catalytic activity of the supported system.

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The dusty nature of quasars

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Quasars are the most luminous persistent sources in the Universe, located at cosmological distances. They represent an extreme case of galactic nuclear activity: their energy comes from accretion onto a supermassive black hole located at a galaxy's center, and in quasars this emission outshines, by hundreds to thousands of times, the emission of all the stars of the host galaxy. Some insight into the nature of quasars is given by the broad and strong emission lines seen in their optical spectra, although the origin of these lines and the reason for their

strong intensity has long remained unknown. Research done recently at the Nicolaus Copernicus Astronomical Center showed that the underlying mechanism is the presence of dust in the accretion disk atmosphere. This breakthrough in our understanding of these lines now opens up the possibility of using quasars as cosmological probes to study the dark energy distribution in the Universe, and an observational project to this effect has just been launched using the 11-meter Southern African Large Telescope.

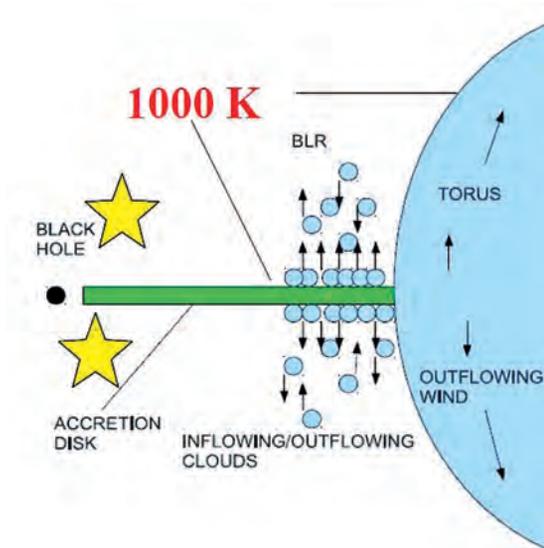


Fig. 1. The schematic structure of the failed wind in the Broad Line Region of quasars. This region in our model covers the range of the disk with an effective temperature lower than 1000 K: the dusty wind rises and then breaks down when exposed to the radiation from the central source. The standard dusty torus is the disk range where the irradiation does not destroy the dust and the wind flows out

Intense and extremely broad emission lines of hydrogen are the most characteristic features of the spectra of active galaxies. Their width, corresponding to the kinematic velocities of the emitting gas (on the order of a few thousand km/s), is due to the orbital motion of the emitting plasma in the gravity field of the central black hole, and the intensity shows that as much as 30% of the all radiation produced by accretion material close to the black hole is intercepted by the Broad Line Region, i.e. the region where the lines form. It has been known for many years that the material producing these lines must have a flattened configuration, since no signatures of absorption due to this material are seen, whereas a puffed-up configuration can only be explained in terms of wind outflow and yet no Doppler shifts due to outflow from the nuclear region are seen in hydrogen lines.

In past years a lot of effort has been devoted to studying this region through the monitoring of selected sources. Large international teams observed selected objects (close to 40 in total) in order to follow the variability of the continuum emission close to the black hole and the corresponding delayed response in the line emission. This monitoring revealed that there is a simple relation between the measured time delay of the lines and the square root



Fig. 2. The Southern African Large Telescope, being utilized for the first observations aiming to use quasars to determine the dark energy distribution (Wojtek Pych)

of the mean value of the monochromatic flux in a given source. The relation shows very little dispersion despite the fact that two parameters – the black hole mass and the accretion rate – are needed to determine the monochromatic luminosity of the source in theoretical models. This puzzle was not understood.

In our paper, published as a Letter to *Astronomy & Astrophysics*, we showed that there is a simple theoretical explanation for the phenomenon, which actually could have been thought of on purely theoretical grounds.

The observed relation can be reproduced in theory, with exact coefficients, when we realize that in the outer parts of an accretion disk – a major constituent of any active galaxy – the effective temperature in the disk atmosphere is lower than 1000 K and at such temperatures dust must form in the atmosphere. It is also known that cool stars have powerful winds due to dust formation. We thus understood the situation in the outer parts of the accreting disk flow in the following way. Stage (1): dust forms in the atmosphere, dusty wind is launched, material rises up well above the disk. Stage (2): further from the equatorial plane, well above the disk, there is a strong radiation flux which irradiates the outflowing material; emission lines are produced but the temperature becomes higher than 1000 K and the dust is destroyed (evaporates) due to the irradiation. Stage (3): dustless wind loses the

radiation pressure support from below and falls back towards the disk.

This mechanism of a failed wind explains why a lot of material is rising so high from the disk plane but it also explains why no net outflow is seen. In addition, the turbulence created in the process is welcomed as explanation of the line profiles and the total energy budget – detailed models frequently required that such highly super-sonic turbulence be added *ad hoc*.

The idea has met with considerable interest, and we already have plans to develop more detailed models of the failed wind in collaboration with Dr. Martin Elvis from Harvard/Smithsonian Center for Astrophysics and Dr. Guido Risaliti from Osservatorio Astrofisico di Arcetri, by using their wind code and replacing their driving mechanism with our dust driving. This may be useful in order to search for numerical corrections to the basic analytical model.

Our theoretical understanding of the observational relation between the hydrogen line delays and the monochromatic flux opens a possibility to use quasars as cosmological probes, with an ability to assess systematic errors.

All cosmological probes are based on the same basic idea: one needs a way to determine the distance to a source which is independent from the redshift, and then it is possible to construct a distance–distance diagram which shows the geometry of the space and its evolution with cosmological time. The most famous method is based on Supernovae Ia: the luminosity profile of the supernova (its evolution in time), after some scaling, gives the absolute luminosity. In much the same way distant quasars can be used: the monitoring of a quasar and the measurement of the time delay will give the absolute monochromatic luminosity of the source.

The basic application thus follows directly from the observed relation, but our theory allows for

controlled extrapolation of the purely observational relation towards higher redshifts. The particular advantage of quasars is that most distant quasars are seen at redshifts as high as 6, and those most distant quasars do not differ from quasars closer in. In particular, their chemical composition is similar, and this fact can be observationally tested. In the case of the Supernovae Ia, the evolution of the chemical composition with redshift is a possible serious issue. Quasars would thus provide an independent test of the Supernovae Ia method of determining the dark energy distribution. This dark energy contributes about 73% to the total energy density of the Universe and its nature is currently the biggest puzzle in physics and astronomy.

Polish astronomers, including those from the Nicolaus Copernicus Astronomical Center, have secured 10% of the observing time with the 11-meter Southern African Large Telescope. We will use this opportunity to test how accurate such measurements can be in practice for a quasar at an intermediate redshifts, and the pilot observation of a single object during the period May – October 2012 has been launched.

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Engineering Sciences



Marian P. Kaźmierkowski (born 5 October 1943), Dean of PAS Division Four: Engineering Sciences.

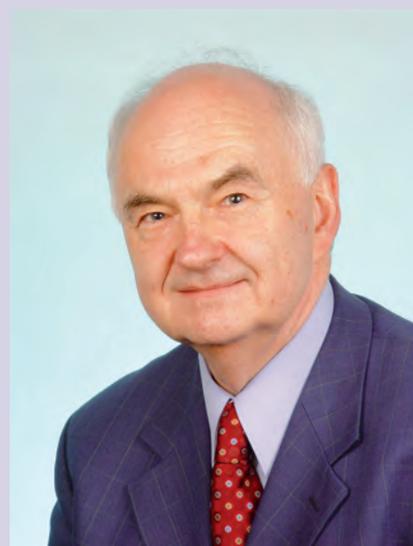
An IEEE Fellow, he received his MS, PhD, and DSc (*habilitation*) degrees in electrical engineering from the Institute of Control and Industrial Electronics (ICIE), Warsaw University of Technology, Poland, in 1968, 1972, and 1981, respectively. From 1987 to 2008, he served as ICIE's Director. Since 2003 he has been the head of the Centre of Excellence on Power Electronics and Intelligent Control for Energy Conservation – PELINCEC at ICIE. He received an honorary doctorate degree from Aalborg University in 2004; from the Institut National Polytechnique de Toulouse, France in 2010, and the University of Zielona Góra, Poland in 2012. In 2005 he received the Eugene Mittelmann Achievement Award from the IEEE Industrial Electronics Society and, in 2007, the Siemens Research Award

in Poland. In 2007 he was elected a Corresponding Member of the Polish Academy of Sciences. He was Vice President of the IEEE Industrial Electronics Society (1999-2001) and editor-in-chief of *IEEE Transactions on Industrial Electronics* (2004-2006).

Janusz Kacprzyk (born 12 July 1947), Chair of the Council of Provosts, PAS Division Four: Engineering Sciences.

He holds an MS in automatic control, PhD in systems analysis, and DSc (*habilitation*) in computer science. He is a Full Professor at the Systems Research Institute, Polish Academy of Sciences, an Honorary Professor at the Department of Mathematics, Yli Normal University, Xinjiang, China, and has been a frequent visiting professor in the USA, Italy, UK, and China. He is Ordinary Member of the Polish Academy of Sciences, Foreign Member of the Spanish Royal Academy of Economic and Financial Sciences (RACEF), Fellow of IEEE and IFSA.

His research deals with computational intelligence, notably fuzzy logic, and its applications, and his publications include 5 books, 60 volumes, and 400 papers. He is



editor-in-chief of 5 book series at Springer and 2 journals, and sits on the editorial boards of 40 journals. He is Member of the Adcom (administrative committee), Awards Committee, and Distinguished Lecturer Committee of the IEEE Computational Intelligence Society.

He has won the 2006 IEEE CIS Pioneer Award in Fuzzy Systems, the 2006 Sixth Kaufmann Prize and Gold Medal for pioneering work on soft computing in economics, the 2007 Pioneer Award of the Silicon Valley Section of IEEE CIS, and the Special 2010 Award of the Polish Neural Network Society. He is President of the Polish Operational and Systems Research Society and a past President of IFSA (International Fuzzy Systems Association).



Lucjan Pawłowski (born 10 July 1946, in Poland), Deputy Chair of the Council of Provosts, PAS Division Four: Engineering Sciences.

He is Dean of the Faculty of Environmental Engineering at the Lublin University of Technology, a Corresponding Member of the Polish Academy of Sciences, a Member of the European Academy of Science and Arts, and an honorary professor of the China Academy of Sciences. He got his PhD in 1976 and his DSc (*habilitation*) in 1980, both at the Wrocław University of Technology. He started research on the application of ion exchange for water and wastewater treatment. As a result, together with B. Bolto from CSIRO Australia, he published the book *Wastewater Treatment by Ion Exchange*, summarizing their own results and experience in the ion exchange field. In 1994 he was elected Vice President of the Polish Chemical Society and, in the same year, Deputy Chair of the PAS “Man and Biosphere” Committee. In

1999 he was elected Chair of the PAS Committee on Environmental Engineering. In 1991 he was elected Deputy Rector of the Lublin University of Technology, a post he held for two terms (1991-1996). He has published 23 books and over 128 papers, authored 98 patents, and is a member of the editorial board of numerous international and national scientific and technical journals.

The 2011 year was the first when the Academy’s Division Four: Engineering Sciences functioned in its new structure, based on the new Act on the Polish Academy of Sciences enacted on 10 April 2010. It took in 13 members of the former PAS Division VII (Earth and Mining Sciences) under the previous structure, who had expressed their desire to join the new Division Four. Thus, at the end of 2011 the Division included 73 national PAS members (39 ordinary and 34 corresponding) as well as 37 foreign members. The number of foreign fellows increased in relation to 2010, as some of them also transferred over from the former Division VII. Sadly, two or-

inary members (Prof. Stefan Węgrzyn and Prof. Jan Kaczmarek) as well as two corresponding members (Prof. Adolf Maciejny and Prof. Andrzej Weryński) passed away in 2011.

Three plenary meetings of Division Four were held during the year, in the Staszic Palace in Warsaw. The opening session for the 2011-2014 term, summoned by PAS Vice-President Prof. Marek Chmielewski, was convened on 3 February. Prof. Chmielewski presented the major modifications to the functioning of the Academy’s Divisions as imposed by the new Act on the Polish Academy of Sciences. These included the elimination of the

former division chairman and deputy chairman positions, placing each new Division under the supervision of a PAS Vice-President, and the creation of a new position – the chair of the Council of Provosts for each Division.

During the first meeting of Division Four's new Council of Provosts, immediately before the plenary session, this new position was entrusted to Prof. Janusz Kacprzyk, with Prof. Lucjan Pawłowski elected as deputy chair of the Council. At the Division's plenary session, Prof. Marian Kaźmierkowski was approved as Dean of the Division. A number of other decisions were made at the meeting in relation to the activity of the Division and the Academy itself in the new term. Prof. Krzysztof Malinowski was selected as Division Four's candidate to sit on the PAS Audit Commission, while Prof. Piotr Korcelli and Prof. Andrzej Rakowski were selected as candidates to sit on the PAS Science Promotion Council.

The Dean summoned a second plenary session on 7 April. Attendees listened to a research presentation by the Division Four Research Award winner of 2010, Prof. Elżbieta Pamuła, entitled *Bone tissue healing and regeneration supporting biomaterials*. Reports by three commissions were discussed: by the Awards Commission chaired by Prof. Romuald Będziński, by the Commission on Sections headed by Prof. Ryszard Pohorecki, and by the Commission on Committee Restructuring led by Prof. Tadeusz Chmielniak. A resolution was adopted approving the list of 21 committees affiliated with the Division in term 2011-2014. Another resolution, prompted by a motion put forward by Prof. Tadeusz Burczyński, was adopted on counteracting the depreciation of the engineering sciences in Poland – a reaction to the classification of research fields and field groups in engineering sciences that had been adopted by the Council of the National Research Center on February 10, 2011.

The autumn session was held on 10 November. Debate concentrated on approval of candidates to the Academy of Junior Scholars. The ones finally recommended were as follows: Assoc. Prof. Marcin Bizukojć (Łódź Univ. of Technology), Assoc. Prof. Dominik Dorosz (Białystok Univ. of Technology), Assoc. Prof. Sławomir Gruszczyński (AGH Univ. of Science and Technology), Dr. Adrian Kosowski (Gdańsk Univ. of Technology), Assoc. Prof. Tomasz Markiewicz (Warsaw Univ. of Technology), Assoc. Prof. Magdalena Rucka (Gdańsk Univ. of Technol-

ogy), Dr. Katarzyna A. Rutkowska (Warsaw Univ. of Technology), and Assoc. Prof. Roman Szewczyk (Industrial Research Institute for Automation and Measurements, Warsaw) – these candidates were further approved by the PAS General Assembly during its session on 15 December. A resolution was also adopted at the autumn plenary on establishing a Committee on Water Management, thus raising to 3 the number of task-force committees within the Division in the 2011-2014 (also including the already-extant Committee on Ergonomics and the Committee on Energy). In the past these commit-



From left: Prof. Marian Kaźmierkowski, Dean of Division Four, Assoc. Prof. Stanisław Czapp, Anna Tascher, Corporate Communication and Marketing Director at Siemens, Prof. Michał Kleiber, PAS President



From left: Dr. Anna Gancarczyk, Assoc. Prof. Stanisław Czapp, Assoc. Prof. Krzysztof Patan, Kinga Jabłonowska, Siemens, Assoc. Prof. Jarosław Domaradzki, Prof. Marek Chmielewski, PAS Vice-President, Anna Tascher, Siemens, Prof. Władysław Włosiński, Dr. Mariusz Zych, Prof. Marian Kaźmierkowski, Dr. Jerzy Błaszczński, Dr. Grzegorz Żywica

tees functioned under the structure of the PAS Presidium.

At the autumn plenary session the Division's research awards were granted, with their ceremonial presentation taking place at the seat of the Division on 8 December. The awards were bestowed on: Dr. Jerzy Błaszczynski of the Poznań Univ. of Technology for his PhD dissertation entitled *Rule models of ordinal classification in variable consistency rough set approaches* plus eleven other works related to the issue, Assoc. Prof. Stanisław Czapp of the Gdańsk Univ. of Technology for his *habilitation* (DSc) thesis *Residual current switches in safety prevention at distorted residual current* plus a series of studies delivered on the matter, Assoc. Prof. Jarosław Domaradzki of the Wrocław Univ. of Technology for a set of eleven papers under the general title *Methods of modification, characterization, and application of functional layers based on Ti₂O* including his *habilitation* (DSc) thesis entitled *Ti₂O based optical coating*, Dr. Anna Gancarczyk of the PAS Institute of Chemical Engineering for her PhD dissertation *Three-phase reactor dynamics under conditions of forced pulsating flow*, Assoc. Prof. Krzysztof Patan of the University of Zielona Góra for his *habilitation* (DSc) monograph *Artificial Neural Networks for the modeling and fault diagnosis of technical processes*, Dr. Mariusz Zych of the Kraków Univ. of Technology for the PhD thesis *Work analysis of reinforced concrete sinks in early phase concrete maturation in waterproofing*, and Dr. Grzegorz Żywica of the PAS Institute of Fluid-Flow Machinery for his PhD study *Analysis of supporting construction defects in respect to the dynamic state of a rotor machine*.

Since 1 January 2011, as a result of fusion with a portion of the former PAS Division VII, the number of research institutes affiliated to Division Four has risen to 13.

Last year five competition-based appointment procedures for the posts of directors of the institutes were brought to completion. Since 1 February the position of director of the PAS Maciej Nałęcz Institute of Biocybernetics and Biomedical Engineering has been held by Prof. Jan Wójcicki. Prof. Jacek Koronacki has been director of the PAS Institute of Computer Science since 1 March. Prof. Waław Dziurzyński has headed the PAS Strata Mechanics Research Institute. On 7 April the post of director of the PAS Institute of Theoretical and Applied Informatics was entrusted to Prof. Tadeusz Czachórski. For the coming 4-year term (starting on

July 1) Prof. Krzysztof Zięba will be at the helm of the PAS Institute of Metallurgy and Materials Science. Prof. Krzysztof Warmuziński has been director of the PAS Institute of Chemical Engineering since November 1. The selection and appointment procedure for the position of director of the PAS Institute of Environmental Engineering has begun.

In 2011 the Division continued to regularly publish the quarterly *Bulletin of the Polish Academy of Sciences – Technical Sciences*. The consecutive issues contained studies related to the following thematic clusters: *Artificial Intelligence, Informatics and Applied Informatics* (vol. 59, nr 1), *Electronics, Automatics* (vol. 59, nr 2), *Nanotechnology, Informatics, Automatics, Optoelectronics, Materials Engineering* (vol. 59, nr 3), *Optoelectronic Devices and Systems, Power Electronics in Smart Grids* (vol. 59, nr 4). The quarterly has been rated 41st in the world in the field of *Engineering* and it has been the only Polish periodical in technical sciences to hold a Q1 index. The Bulletin's impact factor for 2010 was 0.945.

In 2011 the Dean of Division Four collaborated with the Office of International Relations of the Chancellery of the Polish Academy of Sciences in reviewing projects to be pursued within the framework of cooperation coordinated by PAS, wherein the Polish side is represented by a research institute of the Division.

The Dean of the Division as well as the Chair of the Council of Provosts participated in consultation on draft regulations being prepared by four cabinet members: the Ministers of Science and Higher Education, of the Economy, of the Environment, and of Infrastructure.

PAS members belonging to the Division received a number of honors and distinctions in 2011. Honorary titles of *doctor honoris causa* were granted to Prof. Tadeusz Chmielniak by Silesian Technical University, to Prof. Tadeusz Kaczorek by Poznań Univ. of Technology, and to Prof. Józef Modelski by the Military Academy of Technology. Warsaw University of Technology organized a doctorate renewal ceremony for its alumnus Prof. Ryszard Pohorecki, while the European Process Engineering Federation awarded him its Jacques Villermaux medal. Polish state decorations were bestowed on: Prof. Witold Gutkowski – a Commander's Cross of the *Polonia Restituta* Order, Prof. Jan Wójcicki – a Knight's Cross of the *Polonia Restituta* Order, and Prof. Andrzej Rakowski – a Commander's Cross

of the *Polonia Restituta* Order. Prof. Rakowski was honored with a medal “in recognition of merits for the Chopin University of Music.” He also received an Award from the Association of Polish Composers as well as the Special Prize of the Polish Minister of Culture and National Heritage. Prof. Ryszard Tadeusiewicz was distinguished with a Prize of the Minister of Science and Higher Education. Prof. Romuald Będziński received the Polish Prime Minister’s collective award, as well as the first-category collective award of the Council of the Polish Federation of Engineering Associations (NOT) for outstanding achievements in technology. The Danubia Adria Society on Experimental Methods extended its honorary membership to Prof. Będziński and the Academy of Sciences in Bologna appointed him a corresponding member. Prof. Jakub Siemek was distinguished by the Lublin University of Technology with a title of honorary professor and received the AGH University of Science and Technology Rector’s first-category collective award for research achievements as well as an honorary distinction from the Polish Ministry of the Economy for “distinguished service to the natural gas industry.” The Casimir the Great University awarded Prof. Michał Kleiber with an honorary medal. He was also appointed a member of the Senate of Germany’s Leopoldina Academy, a member of the Polish UNESCO Committee, and became a knight of the Order of Merit of the French Republic. The Engineering Academy in Poland honored Prof. Władysław Włosiński with its Gabriel Narutowicz Medal. The rector of the Kielce University of Technology decorated Prof. Włosiński with a medal in recognition of long and fruitful cooperation. Prof. Marian Kaźmierkowski received a diploma and a statuette of the Warsaw University of Technology Alumni Golden Book for “outstanding achievements.” Prof. Tadeusz Burczyński earned the medal of the Olgierd Zienkiewicz Polish Association of Computer Methods in Mechanics in recognition of his “overall professional activity.” Prof. Janusz Kacprzyk was awarded a distinction and a statuette by the Mexican Association for Artificial Intelligence. The rector and the Senate of Wrocław University of Environmental and Life Sciences honored Prof. Piotr Kowalik with the Pegasus Award. Prof. Waclaw Trutwin was distinguished with an honorary decoration for “distinguished service to KGHM Polish Copper.” Prof. Jarosław Mikielwicz received a Green Phoenix distinction for scientific and research achievements in ecological power engineering.

Prof. Roman Słowiński was elected a coordinator of the European Association of Operational Research Societies (EURO) Working Group on Multiple Criteria Decision Aiding. He also became an expert of the PE6 European Research Council, an IEEE Senior Member and the President of the International Rough Sets Society. Prof. Lucjan Pawłowski was invited to present the plenary session lecture at the EurAsia Waste Management Symposium 2011. Prof. Jan Wójcicki became a founding member of the Division of Fellows of the European Alliance for Medical and Biological Engineering and Science and was appointed Vice-President for the issue of Artificial Organs and Biomaterials as well as Co-editor for Eastern Europe in the American journal *Artificial Organs* published by Wiley Periodicals.

The Council of Provosts of Division Four: Engineering Sciences began its activity with the election of Prof. Janusz Kacprzyk as Chair and Prof. Lucjan Pawłowski as his deputy on 7 April 2011. The plenary session of the Division was followed by elections, required by the relevant law, of 2 national members (excluding the provost members of Division Four) and 2 foreign members. Prof. Teresa Orłowska-Kowalska of the Institute of Electrical Machines, Drives and Measurements, the Faculty of Electrical Engineering of the Wrocław University of Technology and Prof. Tadeusz Pałko of the Institute of Precision and Biomedical Engineering, Warsaw University of Technology were selected among the pool of national members, while Prof. Milan Mareš of the Institute of Information Theory and Automation of the Academy of Sciences of the Czech Republic in Prague and Prof. Jacek Żurada, PAS foreign member, of the Electrical and Computer Engineering Department, University of Louisville, Kentucky, USA, were elected among the pool of foreign members.

The first activity of the Council of Provosts that was organized in cooperation with the Dean of Division Four was to hold official inaugurations of the activities of the newly elected scientific councils of the Division’s research institutes, participation in their opening sessions and ceremonious presentation of nominations to their members. The Council of Provosts then tackled issues related to the selection of institute directors, their functioning, etc. All uncertainties regarding the selection process for the post of director at the PAS Institute of Theoretical and Applied Informatics in Gliwice and the appointment of Prof. Tadeusz Czachórski were resolved.

With regard to the position of the director of the PAS Institute of Chemical Engineering in Gliwice, having received the PAS President's approval for a possible third term for the current director, Prof. Krzysztof Warmuziński (as the scientific council of the Institute had requested in a formal motion from the council chairman, accompanied by a transcript of the council meeting minutes), the competitive selection procedure to fill the vacancy was announced. The respective selection competition commission was formed consisting of: Prof. Bogusław Major – representative of the Council of Provosts, Prof. Ryszard Pohorecki – representative of the Council of Provosts, later elected chairman of the Commission, Prof. Tadeusz Burczyński – representative of the PAS President, Prof. Roman Krupiczka – representative of the Institute's Scientific Council, Prof. Jerzy Skrzypek – representative of the Institute's Scientific Council. This lineup was approved by the Council of Provosts. With all formal selection competition requirements fulfilled, the Commission selected Prof. Krzysztof Warmuziński as director of the PAS Institute of Chemical Engineering in Gliwice. With the PAS President's approval, the nomination was quickly signed.

The Council of Provosts dealt with the issue of supplementing the commission for the selection of a new director at the PAS Institute of Metallurgy and Materials Science in Kraków, necessitated by the passing away of one of the commission members, Prof. Adolf Maciejny, PAS corresponding member. Since this competitive selection process was based on the previous set of rules, a substitution for the demised commission member needed to be authorized at the Division's plenary session immediately following meeting of the Council of Provosts, with the candidate required to gain the approval of the whole body of Division Four.

During a visit paid by a delegation of professors from the Chinese Chongqing University of Posts and Telecommunications (led by its rector) to the Polish-Chinese Center for Dialogue of Scientists and Engineers, the conclusion was reached that it would be fruitful to develop extended and more institutionalized cooperative links between the PAS Division Four research units and Chinese partners. Therefore, the chair of the Division Four Council of Provosts, in agreement with the Center's President, Prof. Władysław Włosiński, extended a proposal to the directors of all the Division four institutes to submit suggestions for joint research

projects and exchanges of PhD students and researchers. The responses were then relayed onward to the Center and to the relevant Chinese partners.

In the first half of the year the Division's Council of Provosts began deliberating the system for evaluating the research units, in conformity with the requirement of law. This debate attracted input from members of the Council as well as all the Division members and institute directors. There was common support for a system of evaluation under which, apart from a point system based on the universal set of parameters introduced by the Ministry of Science and Higher Education, the Division Four evaluation commissions would have at their disposal 20% of overall point totals to assign freely according to their own judgment, taking into consideration such criteria as international reputation and activity, esteemed publications, support for young researchers, etc. These ideas were approved at the autumn meeting of the Council of Provosts and at the Division Four plenary on 10 November 2011.

At the request of Prof. Mirosława Marody, PAS Vice-President, and Dr. Urszula Wajcen, Director of the PAS Office of International Relations, opinions were presented on the relevance of remitting membership fees to research associations and other organizations.

In reference to the evaluation of scientific committees planned for the second half of 2013, an original proposal of evaluation rules was prepared and presented to Prof. Mirosława Marody.

A competitive selection procedure for the post of director at the PAS Institute of Environmental Engineering in Zabrze was initiated. The commission was set up consisting of Prof. Jerzy Klamka – representative of the Council of Provosts, Prof. Waław Trutwin – representative of the Council of Provosts, Prof. Bogdan Ney – representative of the PAS President, later elected chairman, Prof. Czesława Rosik-Dulewska – representative of the Institute Scientific Council, and Prof. Eugeniusz Mokrzycki – representative of the Institute Scientific Council; it was approved by the Council of Provosts. The commission began its work in early 2012 with the objective of bringing the selection process to completion by the end of March 2012.

The passing away of a foreign member of the Council of Provosts, Prof. Milan Mareš, prompted the Council to vote on a candidate to take his place. During the Council meeting before the Division's plenary on 11 November 2011, in concordance with

the regulations, Prof. Vladimir Soldatov, a fellow of the National Academy of Sciences of Belarus was elected a new foreign member.

In November and December 2011, Chair of the Council of Provosts, the Deputy Chair, and the the Dean of Division Four participated in inaugural meetings of the scientific committees affiliated with the Division, presenting the new structure of the Polish Academy of Sciences and the Division, the committees' scope of jurisdiction, obligations, and tasks ahead, and the requirement for their evaluation.

The presentation of the Division Four institutes was a new important item on the agenda of every Council of Provosts meeting. On April 7 two pre-

sentations were delivered: by Prof. Czesława Rosik-Dulewska, acting Director of the PAS Institute of Environmental Engineering in Zabrze, and by Prof. Andrzej Nowicki, PAS corresponding member, Director of the PAS Institute of Fundamental Technological Research in Warsaw – they described the institutes under their direction, highlighted their major achievements in research and applications, and stressed their efforts to enhance young researchers' knowledge and experience. This idea of hosting such presentations of institutes, in spite of their necessarily brief form due to the time limits of the meetings, was much appreciated the Council of Provosts members and will be continued in future.

Transducer Protection Device

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The transducer protection device is an original mechanical device designed to protect the measuring heads of scanning devices against damage as a result of colliding with an object being examined (a massive material sample, a structural element, etc.). The device has been constructed at the Department of Anisotropic Structures, PAS Institute of Metallurgy and Materials Science, and its prototype is shown in Fig. 1. At present, the transducer protection device is undergoing the patent protection procedure.

The operation of the transducer protection device has been verified in practice with great success, proving that the device efficiently protects the transducer of the EVO II acoustic microscope used in the re-



Fig. 1. Transducer protection device (prototype) ready for use (for the purpose of device testing at the KSI company laboratory, it was named *Transducer Protection Device*)

search laboratory at the Institute (Fig. 2). The efficiency of the transducer protection device was also confirmed during sophisticated operational tests, directly at the premises of a manufacturer of acoustic microscopes (Kraemer Sonic Industry, Germany).

The transducer protection device takes advantage of the collision energy of material objects to trigger a mechanism that removes one of the objects participating in the collision (the ultrasound transducer in this case) to a safe distance, thus preventing the object from being damaged. This action is performed automatically and does not require any additional power supply or external control. It is triggered the moment a protected object (e.g. a measuring head) comes into contact with an obstacle. The direction of protected element removal is always the same, along the longitudinal axis of the transducer protection device. For an acoustic microscope transducer, for instance, the removal distance is about 10 mm, which suffices to protect such a head from being damaged from colliding with a massive object (the sample). The transducer protection device with a mounted scanning head and a fastening grip (Fig. 1) weighs about 0.5 kg.

All elements comprising the device are made of corrosion-proof materials (18-9 grade steel), making it suitable for operation in a humid environment. The device is equipped with controls to adjust its

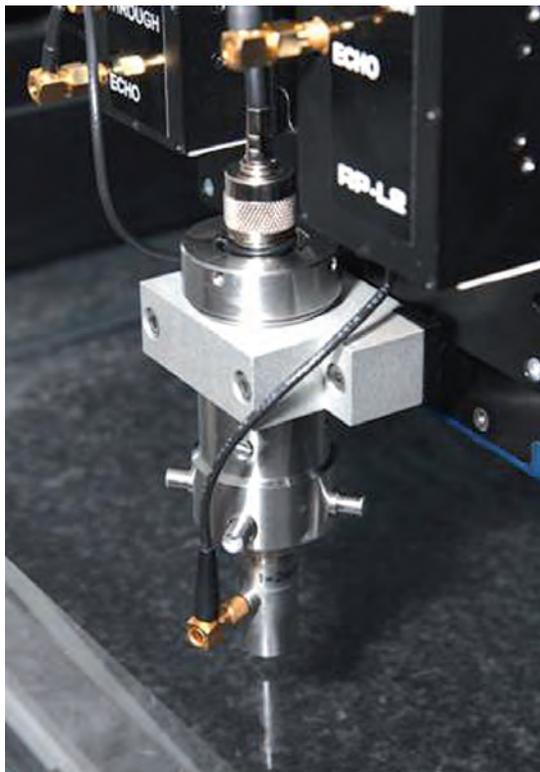


Fig. 2. Prototype of the transducer protection device mounted on an EVO II acoustic microscope (manufactured by KSI) to protect the scanning head

parameters of operation (removal distance, reaction sensitivity, range of transmitted loads). When mounted on a movable structural element, the device withstands a load factor of up to 3g. Restoring operational status after a collision is very easy, only requiring the operator to perform an adjusting operation taking several seconds, without any need to disassemble the head. Moreover, it is not necessary to perform additional adjustment of the settings, as the original (pre-collision) position of the scanning

head is restored with a precision of 10 μm in each available direction of head movement.

In terms of its overall functionality, the presented transducer protection device is most similar to advanced anti-collision systems used in the automotive, aeronautical, and transport sectors (“advanced” here meaning: expensive, requiring a power supply, and needing more advanced instrumentation).

The device can also be implemented for use with other types of scanning microscopes. Although the presented design solution is not of universal applicability, with appropriate modification for a particular application it can also be used with other types of scanners, e.g. varnishing or printing scanners, etc. The transducer protection device has a potential domain of application in various structures/devices where certain specified elements need to be especially protected against being damaged through collision with other objects. The term “especially protected” refers to parts that should not get damaged by collision because of their significance/cost. Each particular application of the transducer protection device requires adjustment according to its pre-defined conditions of operation.

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Thermal combustion of coal mine ventilation air methane – Research and industrial development studies

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The methane released during coal mine exploitation is not only a greenhouse gas but also a valuable energy carrier. Ventilation Air Methane (VAM) is emitted together with mine ventilation air at con-

centrations of about 0.1 to 1.0 CH_4 vol.%. VAM comprises up to approx. 70% of the methane contained in a coal seam. Such a lean mixture can be considered as an alternative fuel for energy produc-

tion by applying modern combustion technologies such as Flow Reversal Reactors (FRRs). The paper Gosiewski, Matros et al. (2008) discusses both catalytic (CFRR) and thermal (TFRR) methods for VAM utilization. Simulations and experimental studies carried out at the PAS Institute of Chemical Engineering in 2000-2003 revealed that CFRR technology is both too expensive and too fraught with the risk of rapid destruction of expensive catalyst to be practically attractive for coal mines. Thus, TFRR seemed to be a more promising method for industry, and this prediction has been fully confirmed by further studies.

When mathematical simulations and laboratory experiments (Gosiewski, Matros et al. 2008) revealed that TFRR may be feasible as a VAM utilization technology, a larger research and demonstration TFRR plant was built at the Institute (Gosiewski, Pawelczyk et al. 2011). A general view of the plant is shown in Fig. 1, and a simplified flowsheet of the plant is given in Fig. 2. The main unit of the plant, a thermal flow reversal reactor (TFRR), consists of two parts – Section I and Section II, connected by a duct at the top. Part of the hot gas can be withdrawn from this duct to the heat recovery exchanger. Both sections are packed with ceramic monolith blocks with a large number of straight and parallel channels (3×3 mm), resulting in low pressure drop. The concentration of methane was varied in the experiments from 0.1 to 1 vol.% by mixing natural gas with air. Electric heaters mounted at the top of the TFRR were used only for preheating the monoliths to enable the start of normal operation. Gas flowrate was varied from 200 to 400 m³_{STP}/h. Experimental results for a flowrate of 400 m³_{STP}/h are presented in Table 1. For methane concentrations equal or higher than 0.22 vol.% the operation was autothermal (i.e. no supplementary heating was necessary), but a reasonable heat recovery is only possible above 0.4 vol.%. Along with this experimental research, a mathematical model of such a reactor was developed and validated. The mathematical description of the reaction kinetics is fundamental for the model of any chemical reactor, therefore appropriate kinetic studies were also undertaken (Gosiewski, Pawelczyk et al. 2009). Every flow reversal reactor (FRR) is subject to heat loss, which is difficult to precisely capture in the model. When the reactor is small the heat loss may be so significant that its validation becomes practically worthless. A study carried out on a fairly large dem-



Fig. 1. General view of the research & demonstration TFRR plant

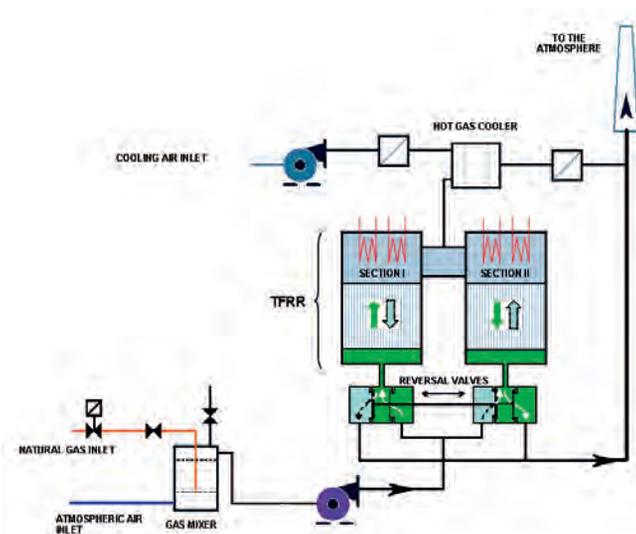


Fig. 2. Simplified flowsheet of the research & demonstration TFRR plant

onstration plant enabled us to estimate the share of heat losses for the model proposed; the validation revealed that the model agrees with the experiments quite satisfactorily (Gosiewski, Pawelczyk et al. 2011) and may therefore be used in designing an industrial pilot plant, processing real coal-mine ventilation air. Since the results of the experiments were very promising, the next projected step is to construct an industrial pilot plant.

In April 2011 the patent application No. P-394701 was filed with the Polish Patent Office, covering original elements of the technology and plant, together with registration with the PCT (*Patent Cooperation Treaty*) office.

In June 2011, under the auspices of the European Parliament, a seminar was organized for Polish coal

Table 1. TFRR parameters averaged for experiments carried out in the present study

Summary of results for flowrate of approx. 400 m ³ _{STP} /h						
VAM	Reversal half-cycle period	CH ₄ Conversion	Hot gas withdrawal flowrate	Hot gas temp.	Heat recovery efficiency	Expected heat recovery ^{*)}
vol.%	[s]	%	m ³ _{STP} /h	°C	%	MW _t
0.1	10	reactor extinguishes				
0.22	20	86.4	0	-	0	0
0.35	20	85.7	0	-	0	0
0.43	90	90.7	9.2	865	14	4.3
0.53	90	96.2	14.2	884	19	7.2
0.77	120	96.1	39.6	908	36	20.2
1.03	240	96.1	69.6	950	50	36.7

^{*)} recalculated for an average ventilation shaft gas flowrate of 720 000 m³_{STP}/h

mine specialists, presenting the Institute's VAM utilization demonstration plant. The seminar resulted in the signing of a Letter of Intent with the Coal Mining Company in Katowice (the largest such company in Europe) and then, in February 2012, the signing of a Consortium Agreement providing a basis for future R&D pilot plant and joint industrial research. An application was filed for an INNOTECH grant to support the cost of the industrial pilot plant construction. The plant processing 25 000 m³/h of ventilation air supplied by a real ventilation shaft is to be built in the Brzeszcze coal mine in 2013 and is to be investigated in 2014 and 2015.

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Secret sharing

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Secret sharing refers to methods for distributing a secret (a *password*, etc.) among a group of n participants, each of whom is allocated a *share* of the

secret. The secret can be reconstructed if a sufficient number of shares are combined together. A smaller number of shares do not give any information about

the secret (we speak of a (k, n) -threshold secret sharing scheme if, to reconstruct the secret, it suffices to know any k , but not less than k , of the n shares). An elegant idea for using certain mathematical methods in the theory of secret sharing was presented in 1979 by the Israeli mathematician Adi Shamir from the Weizmann Institute. Using similar methods, the American mathematician George Blakley also investigated the same problem in 1979, independently of Shamir. Both are regarded as founders of the modern theory of secret sharing. Our contribution to the theory was the discovery of a wealth of access structures related to a slight modification of Shamir's classical secret sharing scheme. We started by placing the secret as any coefficient of a scheme polynomial, based on C.-P. Lai's and C. Ding's concept reported in their 2004 paper. The shares were still the values of the scheme polynomial for appropriate arguments. This small change gave us an avalanche of new access structures, which are not necessarily threshold secret sharing schemes. We called them *Shamir's access structures* in honor of the discoverer of the classical method.

Shamir's brilliant and simple idea was based on the well-known Lagrange method of interpolation of polynomials over a finite (in this case) field, and Blakley's approach was its geometric interpretation. The secret in Shamir's method was the constant term of a randomly chosen polynomial over a finite field, and the shares were the values of the scheme polynomial for appropriate arguments. Combining k shares (where k is the scheme polynomial degree plus one) allows determination of its constant term (the secret). A smaller (than k) number of shares do not give any relevant information about the secret. Since 1979, hundreds of papers have been published on secret sharing methods and, more generally, on access structures that are not necessarily threshold schemes. This theory has turned out to be closely related to the theory of linear codes, graphs, and matroids, among other theories.

Shamir's access structures are either threshold secret sharing schemes with threshold k , or they allow for the construction of so-called privileged coalitions of less than k users. We have investigated all possible Shamir's access structures, estimating

the number of privileged coalitions over finite fields. We have given some conditions for the existence of privileged coalitions of any number of users in these structures.

In 2009-2012 we wrote five papers on this subject (see references). Four of them are already published, and the fifth was submitted for publication at the beginning of this year. Investigations on Shamir's access structures were conducted at the PAS Institute of Computer Science, in cooperation with the PAS Institute of Mathematics and with the participation of some PhD students from Warsaw University and the CWI institute in Amsterdam.

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Sources of ferromagnetics in topsoils of urban parks in the Upper Silesian agglomeration (Southern Poland)

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Previous research on Polish soils showed significant enhancement of magnetic susceptibility in the Upper Silesian area. The results of work focusing on forest and arable soils in detail (omitting the soils of urban parks) showed that the main reason for this magnetic susceptibility enhancement in topsoil horizons was industrial dust fall characterized by various magnetic susceptibility values (Tab.1). Moreover, the magnetic susceptibility of forest soils was found to be higher than that of arable soils, as a consequence of dust pollution trapping by tree leaves. In terms of their ability to capture dust pollutions, a difference was ascertained between lawns (1.5 - 5t of dust / 2.469 acre / year) and trees (32 - 68t of dust / 2.469 acre / year) in urban parks. The fact that the urban parks of the Upper Silesian Agglomeration have yet to be studied in this regard is particularly unfortunate, given their role as a recreational areas.

The specific goal of this study, therefore, was to measure and to identify the role of factors that influence the topsoil magnetic susceptibility. Pollutant accumulation in topsoil horizons resulted in increased magnetic susceptibility values as well as heavy metal concentrations. These results suggest a different approach to evaluating the recreational role of urban parks in industrial areas.

Industrial imissions (metallurgy, power plants, coking and cement industry), Fe-bearing dust fall, low emissions, and traffic pollution have all been reported as major reasons for topsoil magnetic susceptibility enhancement. Magnetic particles composed of magnetite, maghemite, or pyrrhotite exert an influence on techno-, pedo-, and geogenic magnetic susceptibility. Relations between magnetic susceptibility of soils and heavy metal concentrations in industrial dusts and soils as well as parameters of imissions and emissions are demonstrated

Table 1. Magnetic susceptibility of industrial dusts and fly ashes

Kind of dust	Number of samples	Magnetic susceptibility ($10^{-8} \cdot \text{m}^3 \cdot \text{kg}^{-1}$)		
		minimum	maximum	mean
Metallurgical	12	21	45816	13776
Cement	18	9	1620	363
Fly ash (hard coal burning)	35	666	3605	2006
Fly ash (lignite burning)	7	508	1602	1047
Coking	43	80	1165	368

Table 2. Characteristic of research objects

Urban park	Area [ha]	Grid dense [m^2]	Number of sampling points	Mean value of κ [$\times 10^{-5}$ SI]	Mean value of χ [$\times 10^{-8} \cdot \text{m}^3 \cdot \text{kg}^{-1}$]	Number of soil samples
Katowice	72.0	150 × 150	55	161.6	344.3	15
Dąbrowa Górnicza	67.0	200 × 200	56	103.8	260.7	21

by high Pearson correlation coefficients. Such relations were also observed in soils of urban parks.

Studies were conducted in two urban parks of the Upper Silesian Agglomeration: Tadeusz Kościuszko Park in Katowice and Zielona Park in Dąbrowa Górnicza. The methods included taking measurements of volume magnetic susceptibility κ , mass magnetic susceptibility, and determining heavy metal concentrations in soil samples (Tab. 2, 3).

Measurements of volume magnetic susceptibility κ [$\times 10^{-5}$ SI] were performed in field, using a MS2D Bartington loop sensor (penetration depth 7 cm). On the basis of median value of κ for every field point, maps of magnetic susceptibility distribution for each urban park were made using SURFER 8 (Fig. 1, 2). In field points where magnetic susceptibility was higher than mean park values, soil samples from A horizon were taken for further analysis: mass specific magnetic susceptibility χ measurements using a MS2B Bartington sensor, determination of heavy metal concentrations using a Perkin-Elmer 1100B Flame Atomic Absorption Spectrophotometer after *aqua regia* extraction, and topsoil pH measurements.

The highest mean values of κ and χ magnetic susceptibility were measured in Tadeusz Kościuszko Park (Katowice), the lowest in Zielona Park (Dąbrowa Górnicza) (Tab. 2). In the topsoil horizons of both urban parks, the mean heavy metal

concentrations (Zn, Pb, Cd) exceeded the threshold values set by a Regulation of the Polish Ministry of the Environment*. The highest concentrations of Fe and heavy metals were found in the Zielona urban park (Tab. 3).

Higher correlations between mass magnetic susceptibility χ and heavy metal concentrations were observed for soil samples from Zielona Park than for the park in Katowice (Tab. 3). The main reason for this result is emissions from the vicinity of the park in Dąbrowa Górnicza: the Lagisza power plant, the ArcelorMittal steelworks, and the Przyjaźń coking plant all being situated within 4 km from urban park. For the park in Katowice, the main sources of ferromagnetics and heavy metals are the Halemba power plant and numerous other industrial plants (steelworks, hard coal mines). Moreover, a significant role in the discharge of air pollution may be played by traffic sources and so-called low emissions from the Zgrzebniok and Paderewskiego housing developments.

The heterogeneity of soil pollution in two urban parks reflects the high variation coefficients (V) noted for magnetic susceptibility and heavy metal concentrations (Tab. 3). Given such soil diversification, time and cost play an important role in research and environmental monitoring. Magnetic susceptibility measurements offer a fast and cost-effective method for identifying topsoil contamina-

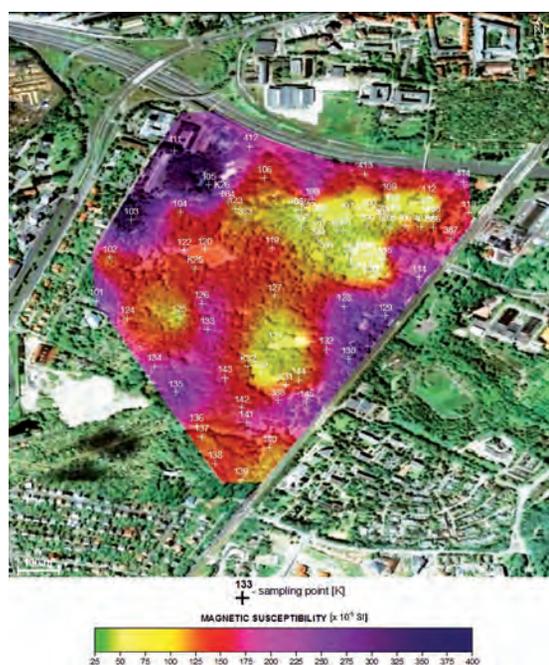


Fig. 1. Spatial distribution of κ value [$\times 10^{-5}$ SI] for the park in Katowice

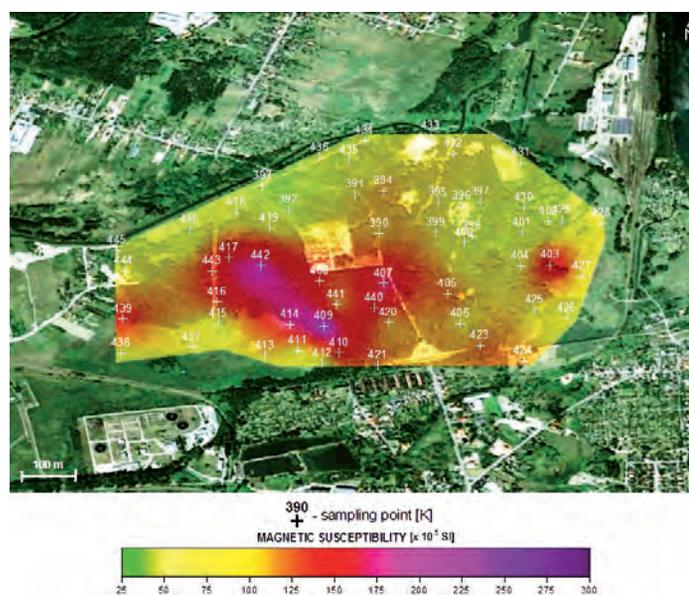


Fig. 2. Spatial distribution of κ [$\times 10^{-5}$ SI] for the park in Dąbrowa Górnicza

Table 3. Heavy metal concentrations and correlation coefficient (r) between magnetic susceptibility χ and some heavy metals in soil samples from urban parks

Park		mg · kg ⁻¹								χ [$\times 10^{-8} \cdot \text{m}^3 \cdot \text{kg}^{-1}$]
		Fe	Mn	Zn	Pb	Cd	Cu	Cr	Ni	
Katowice	Mean	17827	673.5	640.0	317.8	6.0	32.4	10.9	14.6	344.3
	Max	25200	1280	2060	700	14.3	51	18	26	850.8
	Min	6060	153	210	98	1.6	13	5	4	73.8
	V[%]	28	48	68	51	60	33	30	41	62
	r	0.50	0.68	0.28	0.36	0.91	0.62	0.15	0.11	
Dąbrowa Górnicza	Mean	22845	528.2	795.0	335.2	9.2	27.5	9.4	11.2	260.7
	Max	48350	1300	2115	1120	28.3	63	21	21	672.7
	Min	800	102	220	101	1.9	11	4	<1	82.0
	V[%]	57	65	60	71	71	54	42	41	69
	r	0.54	0.42	0.81	0.85	0.87	0.94	0.72	0.71	
Threshold values*		-	-	300	100	4.0	150	150	100	

* Threshold values as set by the Regulation of the Polish Ministry of the Environment dated 9 September 2002 (*Dz. U.* Nr 165, item 1359, from 4 October 2002)

tion as a result of industrial immissions. Topsoil contamination in urban parks and the cumulative role of vegetation (lawns, scrubs, trees) in the presence of air pollution may pose a threat to park visitors in terms of secondary emission. Despite the fivefold to sevenfold drop in dust fall witnessed within the years 1981-2001, in the areas of Katowice and Dąbrowa Górnicza, an ecological hazard still exists in park areas due to acid reactions of soils (pH in KCl ranged from 3.90 to 5.53 for the park in Katowice and from 3.53 to 5.64 for the park in Dąbrowa Górnicza).

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Geothermal water treatment – A pilot project

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Compared to other European countries, Poland has scarce drinking water resources and exhibits significant variation in annual runoff. Shortages are reflected in the absence of groundwater reservoirs in some regions and the significant quantitative and qualitative anthropogenic pressure to which major aquifers are often subject. On the other hand, the geothermal water resources present in sedimentary/structural basins, mostly in the Polish Lowlands and the Podhale geothermal system (Podhale Basin), not only offer a valuable source of renewable energy (which is being harnessed, albeit only to a limited extent) but can also be used for many other purposes. Waters may be produced by pump, and artesian flows occasionally occur.

However, elevated salinity levels and the presence of microelements such as boron, fluoride, barium, strontium, bromides, and heavy metals often lead to difficulties related to the disposal of spent (cooled) water. Spent geothermal water may be discharged, e.g. into surface waters, or reinjected into the reservoir. In both cases, it is treated as a waste product of the energy extraction process. Water reinjection prevents its excessive extraction, which could result in a decreased formation pressure. However, the injection process poses numerous technical challenges and requires additional consumption of energy to drive the pumps.

A partial solution to this problem may lie in the deployment of water treatment technologies, enabling its further use. Drinking water shortages in many regions of the world have driven research into effective water treatment technologies. Simple treatment methods such as filtration, coagulation, sedimentation, and high performance membrane and thermal desalination technologies have been gradually modified and upgraded since the mid-20th century. Hybrid systems that combine the advantages of multiple desalination technologies are also increasingly coming into focus. They have become a widely used method of producing water for drinking and household purposes.

Membrane-based water desalination processes and hybrid technologies that combine membrane processes are widely used to produce drinking water

in many regions of the world. They are also considered a technologically and economically viable alternative for desalinating water (mainly seawater), often with the use of renewable (solar, wind, geothermal, photovoltaic) energy. In these processes, the membrane can be viewed as a barrier between contaminated and purified water streams.

A pilot geothermal water desalination project was carried out by the Geothermal Laboratory, Mineral and Energy Economy Research Institute, Polish Academy of Sciences (PAS MEERI), using a dual-hybrid process combining ultrafiltration and two independent stages (RO-1 and RO-2) connected in series (Fig. 1). Membrane separation performance was assessed in short and long-term tests, at a semi-production scale (ca. 1 m³/h of desalinated water production).



Fig. 1. The Geothermal Laboratory of the Mineral and Energy Economy Research Institute, Polish Academy of Sciences (PAS MEERI)

Waters from three different geothermal areas were tested: the Podhale basin (GT-1), Polish Lowlands (GT-2) and Western Carpathian Mountains (GT-3).

The water desalination facility includes the following components (Fig. 2-4):

- a water pretreatment facility: mechanical filter, iron removal stage and ultrafiltration module (UFC M5, X-Flow, with hydrophilic capillary polyether-sulfone membranes),

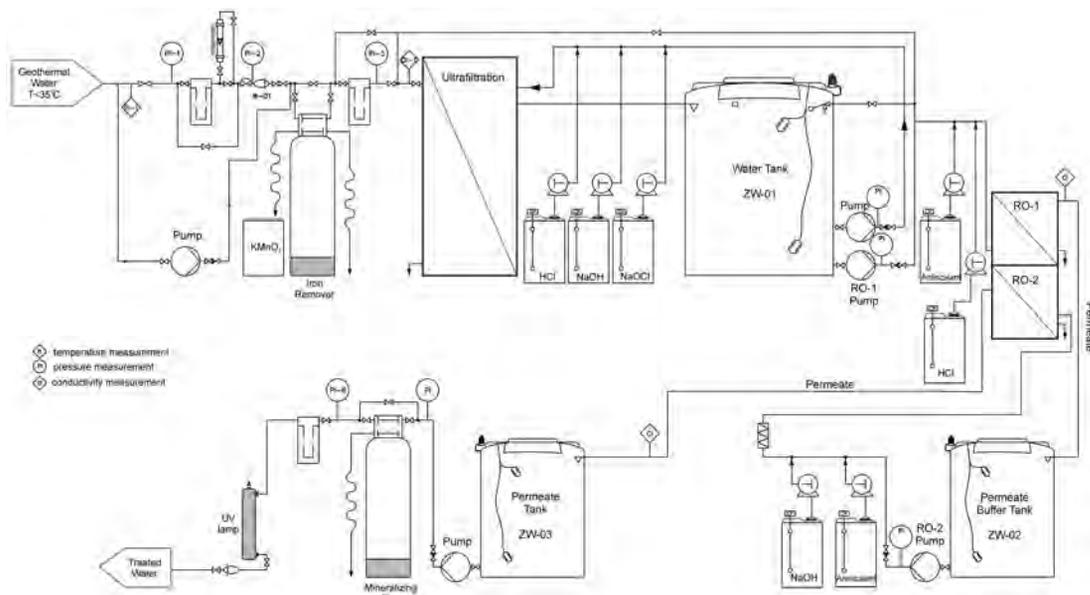


Fig. 2. Process diagram of the geothermal water desalination facility

- a two-stage reverse osmosis setup with NaOH dosing before stage two (spiral wound DOW FILMTEC BW30HR-440i reverse osmosis membranes, designed for brackish water with increased silica, boron content),
- final treatment to achieve drinking water parameters (mineralization, disinfection).

To bring the boron concentration below its maximum level for drinking water (1 mg/L) desalination was carried out in a two-step process. The system was fitted with typical industrial plant components.

Tests conducted using the UF-RO system fitted with low-pressure BWRO membranes (ca. 1.1 MPa)

showed that favorable retention ratios for key ingredients were obtained from geothermal waters with a TDS of up to 7 g/L (Fig. 5) and boron



Fig. 3. Pilot geothermal water desalination facility at the PAS MEERI Laboratory. Water pre-treatment stage: control panel and iron removal stage (left), ultrafiltration module and chemical dosage equipment for ultrafiltration (right) (B. Tomaszewska)



Fig. 4. Pilot geothermal water desalination facility at the PAS MEERI Laboratory. Two-stage reverse osmosis arrangement with high-pressure pumps (center) (B. Tomaszewska)

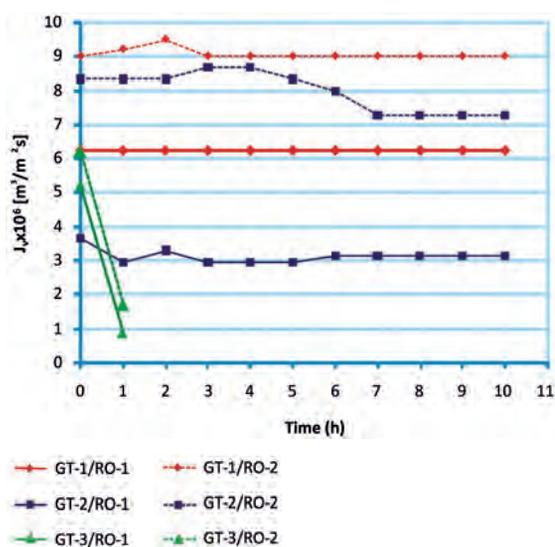


Fig. 5. Changes in the volume water flux (J_v) during the filtering of geothermal waters from the GT-1, GT-2 and GT-3 intakes through RO-1 and RO-2 membranes

concentrations of up to ca. 10 mg/L. The desalinated geothermal waters exhibited high quality, allowing them to be used for drinking, technological, or household purposes.

Geothermal energy is being harnessed for heating purposes to an ever greater extent nowadays. In many cases, subsequent use of the cooled waters for drinking purposes may be considered as an alternative disposal method. The tests and analyses conducted have demonstrated that geothermal water (with TDS of up to 3 g/L) treated using membrane processes can also be used to replenish water losses in heating circuits and to fill such circuits. This may

be of special significance in areas where there is a deficit of fresh water. One such area is the Podhale Basin, where the facility discussed in the article is situated. It uses geothermal water sourced by the largest Polish geothermal heating installation.

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Investigating CO₂/CH₄ exchange sorption on coal

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One way of reducing the concentration of carbon dioxide (CO₂) in the atmosphere involves injecting it into deep, unexploited coal beds. The phenomenon of CO₂/CH₄ exchange sorption is closely linked to the process of carbon dioxide sequestration in coal deposits, occurring simultaneously with the recovery of methane (CH₄) as an energetic gas (known as ECBM, for Enhanced Coal Bed Methane Recovery). During this process, CO₂ is injected into a coal bed

so as to induce desorption of CH₄. The CO₂ molecules reveal greater sorption affinity in coal than the molecules of CH₄, which is why they locate themselves in sorption sites originally occupied by CH₄.

This process of CO₂/CH₄ exchange sorption has been investigated at the PAS Strata Mechanics Research Institute under laboratory conditions, using bituminous coal briquettes and a specially constructed research system, allowing measurements of

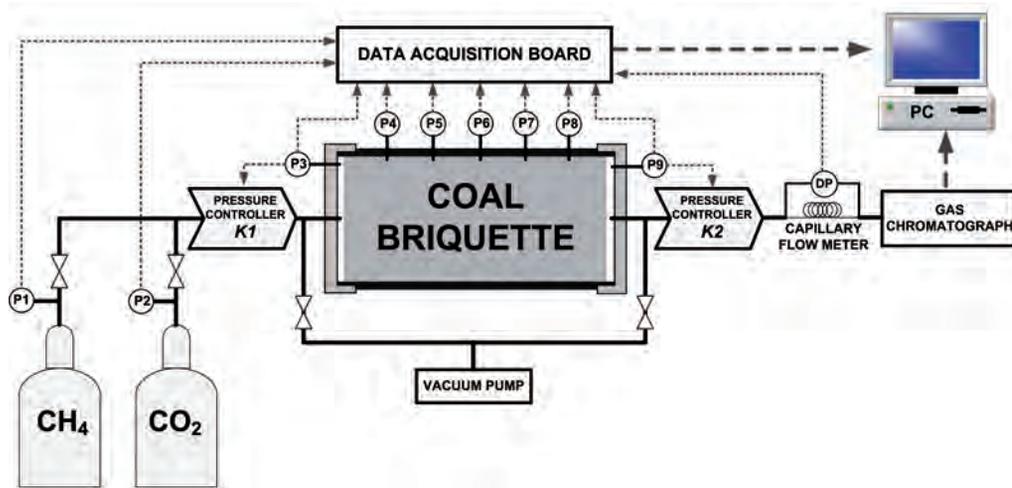


Fig. 1. A schematic diagram of the research system for investigating the CO₂/CH₄ exchange sorption process on a coal briquette

exchange sorption under isobaric and isothermic conditions (Fig. 1). This research system makes it possible to balance the amounts of gases participating in the exchange sorption, as well as to analyze the pressure changes and the concentration of the gas mixture while the process is occurring.

Measurements are performed with this research system by saturating a coal briquette with CH₄ until the sorption equilibrium pressure (P_{CH_4}) is reached. Then, CO₂ is injected onto the input of the briquette using a *K1* pressure controller, under a pressure (P_{CO_2}) higher than that of the CH₄ previously sorbed into the briquette ($P_{CO_2} > P_{CH_4}$). The molecules of CO₂ locate themselves in sorption sites previously occupied by the molecules of CH₄. The mass of the displaced CH₄ is measured at the output of the briquette by means of a capillary gas flow meter. During the exchange sorption process, the pressure of CO₂ at the input of the coal briquette (*P3*) and the pressure of the gas mixture at its output (*P9*) are stabilized by means of the controllers *K1* and *K2*, and conditions $P3 > P9$ are maintained.

The registered changes in the values of pressures *P4-P8* on the briquette side, occurring during the exchange sorption process, revealed the existence of a distinctly separate area moving along the briquette, where the exchange CO₂/CH₄ occurs. A suggested method of describing this observed phenomenon was then presented. During the exchange sorption process, the briquette is divided into three separate areas: the CH₄ zone, the exchange zone, and the CO₂ zone (Fig. 2). The CH₄ zone is that part of the briquette which, at a given moment, has not yet been influenced by the exchange process, and which

contains pure CH₄: sorptive bonded on the coal's sorption sites and filling the briquette pores. The exchange zone is the area of the briquette where CH₄ is being displaced by CO₂. In this zone, there are sorptive bonded CH₄ and CO₂, and the briquette pores are filled with the mixture of these two gases. The CO₂ zone is the area of the briquette where the exchange sorption process has been completed, the briquette pores are filled with CO₂, and

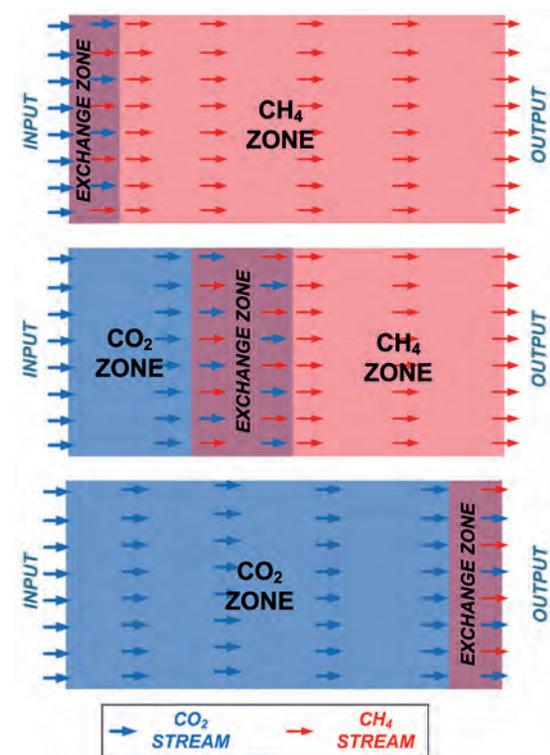


Fig. 2. A schematic depiction of the CO₂/CH₄ exchange zone moving along the coal briquette

the sorptive bonded CH_4 has been displaced by CO_2 . On the basis of the conducted experiments, the velocity and the width of the exchange zone for various measurement results were established. The experiments differed with respect to the CO_2 injection pressure onto the input of the briquette ($DP=P3-P9$). It was ascertained that the velocity of the exchange zone depends on the difference in pressures DP on both briquette ends. It was also proven that the width of the exchange zone increases as it moves along the briquette.

The existence of the exchange zone described above is also confirmed by chromatographic analysis of the concentration of the CO_2 - CH_4 mixture at the output of the briquette (Fig. 3). CO_2 appears at the output of the briquette only after almost all the sorbed CH_4 has been displaced. Before that, only pure CH_4 , displaced by CO_2 in the course of the exchange sorption, appears at the output of the briquette.

Measurements of the mass of CO_2 injected into the coal briquette and the mass of CH_4 displaced at the output of the briquette were used to determine the balance of CO_2/CH_4 exchange sorption. After twice as much CO_2 was injected into the briquette as there was originally sorbed CH_4 , the entire mass of CH_4 was displaced (Fig. 4). The results confirmed coal's greater sorption capacity for CO_2 than for CH_4 .

The study results presented in this paper address part of the complex issues involved in one of the methods of CO_2 sequestration. Further work now underway involves developing a numerical model for performing simulations of the exchange sorption process, based on the experimental results already obtained.

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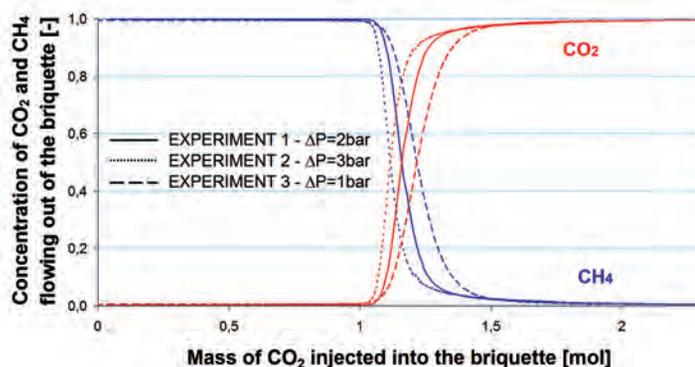


Fig. 3. Concentration of CO_2 and CH_4 at the output of the briquette

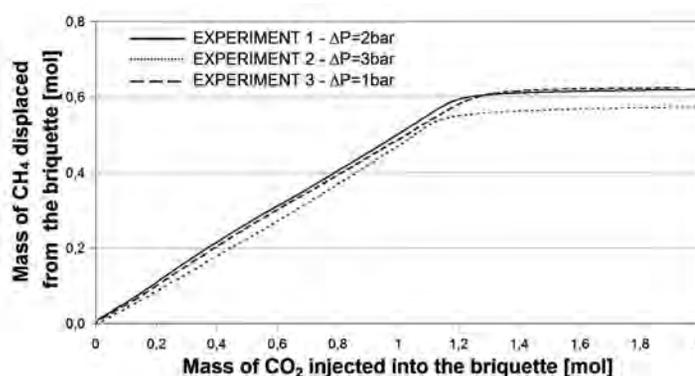


Fig. 4. The balance of CO_2/CH_4 exchange sorption

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Medical Sciences



Prof. **Jacek S. Zaremba** MD (born 18 July 1936), Dean of PAS Division Five: Medical Sciences.

Corresponding Member of the Academy, a specialist in neurology and clinical genetics. Main field of interest: genetics of neurodegenerative and neuromuscular disease; prenatal diagnosis of the genetic disease. A member of the Presidium of the Polish Academy of Sciences. Completed medical studies at the Medical University of Warsaw and received professorship title at the Institute of Psychiatry and Neurology (1992). For long period (until recently) head of the Genetics Department at the Institute.



Prof. **Jan Albrecht** (born 22 June 1944), Chair of the Council of Provosts of PAS Division Five: Medical Sciences.

PhD in Biochemistry, University of Leiden (1970), Professor and head, Department of Neurotoxicology, PAS Mirosław Mossakowski Medical Research Center (since 1996). Major fields of interest: molecular mechanisms underlying hepatic encephalopathy and ammonia neurotoxicity, roles of glutamine in central nervous system function and dysfunction, and the biochemical pathology of astrocytes. His h index = 25 (Web of Science, 1.06.2012). Editorial board memberships: *Neurochemical Research* (Associate Editor), *Neurochemistry International*, *Journal of Neuroscience Research*, *Frontiers in Neuroenergetics*. Corresponding Member of the Polish Academy of Sciences, and Full Member of the Polish Academy of Arts and Sciences (PAU) – Deputy Director of the Medical Section).

Prof. Ewa Szczepańska-Sadowska MD, Deputy Chair of the Council of Provosts of Division Five: Medical Sciences.

PhD, Professor at Medical University of Warsaw (MUW), Chairwoman of the Department of Experimental and Clinical Physiology of the first and second Medical Faculty of MUW. British Council fellowship (1972-1973); Humboldt Foundation Fellowship (1981-1990); visiting professor at the Medical College of Wisconsin, Milwaukee, USA (1991-1992). Original publications in the field of the cardiovascular physiology, water-electrolyte physiology, neuroendocrinology and stress. Co-editor of 5 scientific monographs. Supervisor of 16 doctoral theses and 2 DSc (*habilitation*) theses. Corresponding Member of the Polish Academy of Sciences; Full Member of the Polish Academy of Arts and Sciences (PAU).



Division Five: Medical Sciences represents the medical scientific and academic community in Poland (including universities, institutes, and the respective academic schools), promotes research in medicine, pharmacy, physical training, and health education, and supervises research activity at the PAS institutes affiliated with the Division. The Division's Dean is Prof. Jacek Zaremba (Corresponding Member of the Academy), a neurologist and geneticist. Prof. Jan Albrecht (Corresponding Member of the Academy), a neurobiologist, is Chair of the Division's Council of Provosts.

At the end of 2011 the Division had 37 national members (19 full members and 18 corresponding members) as well as 24 foreign members. One foreign member of the Division passed away (Prof. Nathan Sharon) in 2011.

Three plenary sessions of the Division were held in 2011. At the 10 February session, Prof. Jacek Zaremba was elected Dean and selected as the Division's candidate to sit on the Presidium of the Academy. Prof. Janusz Komender was reelected as chairman of the Division's Awards Commission. Prof. Andrzej Januszewicz and Prof. Jerzy Vetulani became the Division's representatives on the Science Promotion Council.

At the second session on 7 April, the Division's network of 12 scientific committees was established. The Committee on Neurobiology, which had been

previously affiliated with the Division of Biological Sciences, decided to join the Division of Medical Sciences under the new Academy structure. The Division established the Prof. Jan Steffen Prize for the best doctoral thesis in the field of oncology; this prize is sponsored by a private firm, New Technologies Enterprise.

On 10 November the Division developed opinions concerning 16 medical candidates for the newly established Academy of Junior Scholars, with the four highest evaluations being attained by Prof. Tomasz Guzik, Dr. Bartosz Karaszewski, Prof. Jarogniew Łuszczki, and Dr. Łukasz Małek.



Prof. Janusz Sadowski from the PAS Mirosław Mossakowski Medical Research Center in Warsaw, receiving the Jędrzej Śniadecki Medal



Hanna Sobczak and Marcin Derwich, students from the Medical University of Gdańsk, received the Doctor Waclaw Mayzel Medical Laurel

At the same session the Division gave awards to outstanding scientists. The 21st Jędrzej Śniadecki Medal went to Prof. Janusz Sadowski from the Mirosław Mossakowski Medical Research Center for outstanding achievements in his research on humoral and nervous regulation of renal function and for his important contribution to the introduction of a parametric evaluation system for scientific efforts in medicine and biology. The Division's Jędrzej Śniadecki Scientific Prize went to a research team from the Maria Skłodowska-Curie Memorial Cancer Center and Institute of Oncology in Warsaw, consisting of Magdalena Chechlińska MD, Magdalena Kowalewska MD, and Radosława Mikke-Nowak, for a series of publications on biomarkers in malignant diseases. The Collective Scientific



This research team from the Maria Skłodowska-Curie Memorial Cancer Centre and Institute of Oncology in Warsaw – Magdalena Chechlińska MD, Magdalena Kowalewska MD, and Radosława Mikke-Nowak – won with the Division's Jędrzej Śniadecki Scientific Prize in 2011

Awards of the Division went to the team of Agnieszka Słowik MD, PhD, Aleksandra Klimkiewicz-Mrowiec MD, Joanna Pera MD, and Tomasz Dziedzic MD, from the Department of Neurology, Collegium Medicum, Jagiellonian University, Kraków for a series of publications on prognostic factors in the age related diseases of the nervous system.

Four special honorary prizes for medical students – the Doctor Waclaw Mayzel Medical Laurel – were awarded to the following persons: 1) Kamil Bojarczuk (University of Agriculture, Warsaw); 2) Michał Grąt (Medical University of Warsaw); 3) Karolina Kupczyńska (Medical University of Łódź); 4) Marcin Derwich and Hanna Sobczak (Medical University of Gdańsk).

There are five research institutes affiliated with the Division Five: the Mirosław Mossakowski Medical Research Center in Warsaw, the Ludwik Hirsztfeld Institute of Immunology and Experimental Therapy in Wrocław, the Institute of Pharmacology in Kraków, the Institute of Human Genetics in Poznań, and the Institute of Medical Biology in Łódź.

Four scientific journals are published by the medical institutes: *Archivum Immunologiae et Therapiae Experimentalis*, *Folia Neuropathologica*, *Polish Journal of Pharmacology*, and *Postępy Higieny i Medycyny Doświadczalnej* (Advances in Hygiene and Experimental Medicine). The Division also supports the *Polish Journal of Food and Nutrition Sciences*, co-edited by the Committee on Human Nutrition Science affiliated with the Division.

The Division supervises the activity of 12 scientific committees (with a total of over 300 members), representing the medical sciences in Poland. The chairpersons of the committees, mostly non-members of the Academy, participate in plenary sessions of the Division, and enjoy equal rights with the Academy's members except with regards to electing candidates to become the Academy's new members.

The Division organizes the international representation of medical and biomedical disciplines in Poland via national committees of the Polish Academy of Sciences, representing medical and other international bodies. Prof. Wojciech Kostowski, represents the Academy on the Council of International Organizations of Medical Sciences (CIOMS), whereas Prof. Sławomir Majewski represents the Academy on the European Academies Science Advisory Council (EASAC). Prof. Anna Członkowska

represents the Polish Academy of Sciences on the European Medical Research Councils' Standing Committee of the European Science Foundation (EMRC ESF). Prof. Andrzej Trzebski is a member of the Executive Committee of the International Medical Panel (IAMP), while Prof. Janusz Komender is a chairman of the Polish National Committee for Cooperation with the PUGWASH Conferences on Science and World Affairs.

There are 7 national committees affiliated with the Division: the National Committee for Cooperation with the International Union of Physiological Sciences (IUPS), the National Committee for Cooperation with the International Union of Pharmacology (IUPHAR), the National Committee for Cooperation with the International Union of Immunological Societies (IUIS), the National Committee for Cooperation with the International Union of Nutrition Sciences (IUNS), and the National Committee for Cooperation with the International Council of Medical Societies (ICOMS); the Academy is also represented by the National Committee for Cooperation with the International Council on Laboratory Animal Science (ICLAS),

which also represents Polish scientists at the International Federation of Societies of Electron Microscopy (IFSEM).

Members of Division Five published a total of 156 papers in 2011, primarily in international scientific journals, and they organized and actively participated in many meetings and conferences. For example, Prof. Andrzej Górski, representing Poland at the 3rd meeting of the European Council International Dialogue, delivered a lecture on "The protection of fundamental ethical principles in international research and innovation programmes." Prof. Stanisław Konturek organized and developed the scientific program for the 6th International Symposium: Biological Clocks, Pathophysiology and Clinical Aspects, in Kraków. Prof. Andrzej Januszewicz was a member of the scientific committees of the International Symposium on Pheochromocytoma and Paraganglioma (Paris) and of the 4th International Conference on Fixed Combination in the Treatment of Hypertension, Dyslipidemia and Diabetes Mellitus (Paris). Division members also participated in the 14th Festival of Science in Jabłonna.

Complexity of genetics in keratoconus

J.A. Karolak | D.M. Nowak | M. Gajecka | Institute of Human Genetics | Polish Academy of Sciences

Keratoconus (KTCN) is non-inflammatory thinning and anterior protrusion of the cornea that results in steepening and distortion of the cornea (Figure 1), altered refractive powers, and altered visual acuity. KTCN is the most common ectatic disease and is a major cause of corneal transplantations in developed countries. Symptoms are highly variable and depend on the stage of progression of the disorder. There is a large variance in the reported prevalence of KTCN, ranging from 8.8 to 54.4 per 100,000. This variation is in part due to the different diagnostic criteria used in various studies. KTCN afflicts males and females in all ethnic groups.

Genetic disorders can be divided into Mendelian and multifactorial diseases. In Mendelian diseases, a mutation in a single gene can cause a disease that is inherited according to Mendel's laws. Mendelian disorders are rare and occur in a population with frequencies lower than 0.05%. In contrast, in com-

plex or multifactorial diseases, changes in numerous genes and environmental factors are responsible for the disease development and progression. KTCN is

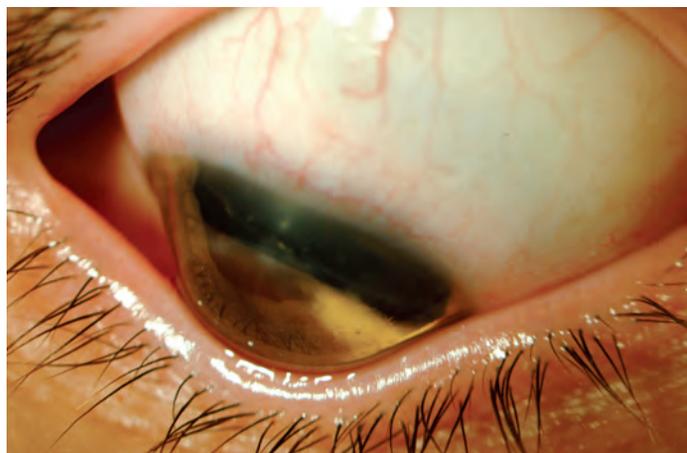


Fig. 1. Keratoconus of left eye. Note bulging of inferior lid on downgaze (Munson sign) [source: Elias I. Traboulsi, MD]

a complex condition with multifactorial etiology. Both genetic and environmental factors are associated with KTCN. Evidence of genetic etiology includes familial inheritance, discordance between dizygotic twins, and its association with other known genetic disorders. Environmental factors include contact lens wear, chronic eye rubbing, and atopy of the eye.

Table 1. Chromosome loci reported for significant linkage with keratoconus

Locus	Authors	Identification date
2p24	Hutchings H et al.	2005
3p14-q13	Brancati F et al.	2004
5q14.3-q21.1	Tang YG et al.	2005
5q21.2	Bisceglia L et al.	2009
5q32-q33	Bisceglia L et al.	2009
9q34	Li X et al.	2006
13q32	Gajecka M et al.	2009
14q11.2	Bisceglia L et al.	2009
15q2.32	Bisceglia L et al.	2009
15q22.33-24.2	Hughes AE et al.	2003
16q22.3-q23.1	Tynnismaa H et al.	2002
17p13	Hameed A et al.	2000
20q12	Fullerton J et al.	2002

Although the majority of patients presenting with KTCN to ophthalmologists have a sporadic form of the disease, there is growing evidence of familial

KTCN and the involvement of genetic factors. Previous prospective studies revealed that relatives of patients with KTCN had a high prevalence of undiagnosed KTCN. Numerous loci have been mapped in KTCN families (Table 1) and research is ongoing to identify causative genes involved in KTCN development and progression. Family ascertainment, including both affected and unaffected individuals, is a complicated and time-consuming process in which each study participant undergoes a complete ophthalmic evaluation. In KTCN, sub-clinical forms of the disease may exist; hence, accurate inclusion criteria should be established prior to the linkage analysis to minimize misclassification. Currently, computerized videokeratography (Figure 2) allows the detection of early forms of KTCN, to some extent solving the problem of phenotype misclassification.

In 2009 we mapped a 13q32 locus in a multi-generational Ecuadorian family. Our mutation screening of candidate genes from this chromosomal region identified one mutation in *DOCK9* (Q754H) and three sequence variants in *DOCK9*, *IPO5*, and *STK24* (c.717+43A>G, c.2380-134A>C and c.1089+29G>C, respectively) showing 100% segregation under a dominant model with KTCN phenotype in the Ecuadorian family in genes *DOCK9*, *IPO5*, and *STK24* at 13q32 locus. To our knowledge, this is the first report presenting four sequence variants in three different genes from one susceptibility locus. Furthermore, the sequence variants identified in *DOCK9*, *IPO5*, and *STK24* have never been described to be associated with KTCN. Next, analysis by RT-PCR was performed

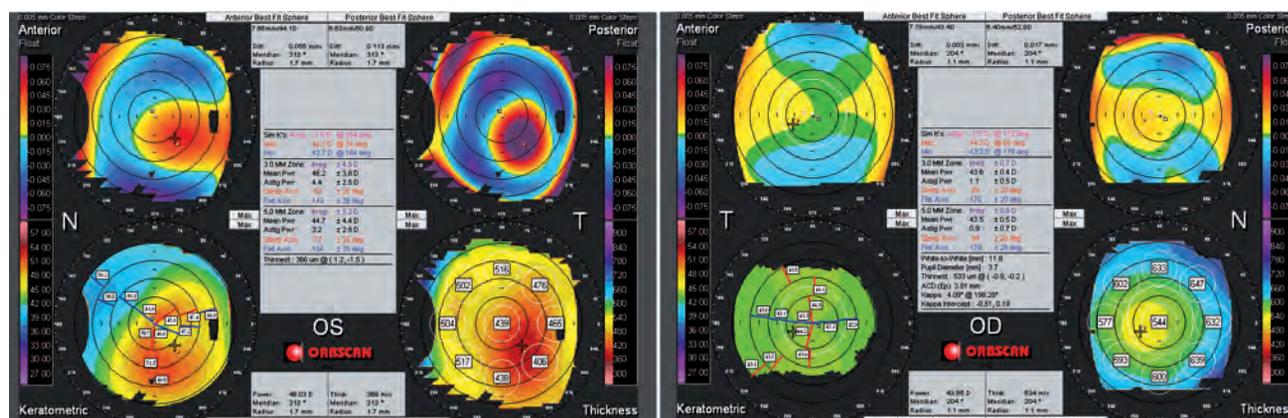


Fig. 2. Features of keratoconus in Orbscan examination – corneal maps performed with Orbscan IIz: from the left side topography of anterior and posterior surface, in the lower part of the image keratometrical and pachymetrical maps, respectively. A. Affected individual, B. unaffected individual [source: Jacek P. Szaffik, MD]

to study the qualitative expression pattern of *DOCK9*, *IPO5*, and *STK24* genes in human corneas and in lymphoblastoid cell lines. Specific amplification products of the expected sizes were detected in all three cDNAs – *DOCK9*, *IPO5*, and *STK24* – in KTCN and non-KTCN corneas and in lymphoblastoid cell lines extracted from both affected and unaffected individuals of the examined Ecuadorian family. Again, this is the first report describing expression of *IPO5* and *STK24* genes in human corneas.

However, the 13q32 locus as well other keratoconus loci and the identified sequence variants are specific to the studied families and populations. Together, our results and the literature data indicate the existence of numerous genetic factors involved in the disease etiology. We have confirmed that hypothesis by identifying different candidate gene loci in other Ecuadorian families. At present, we are investigating other genomic features identified at keratoconus loci, including variation in miRNA and long intergenic non-coding RNA (lincRNA).

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Glycine-containing structures of bacterial lipopolysaccharides as potential substrates for synthetic vaccines

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The occurrence of glycine in the endotoxic lipopolysaccharides (LPS) of Gram-negative bacteria is already well documented, as an integral constituent of the core region. However, the biological role of bacterial polysaccharide aminoacylation is poorly understood, although it might be relevant in infection and immunity. The possible function of such non-carbohydrate ester-linked substituent in bacterial antigens is thought to participate in epitope formation, thus such a structure may be considered for potential use in the construction of a vaccine with broad specificity. Due to their lability, such groups usually escape detection during routine structural investigation.

Lipopolysaccharide (LPS) is an integral component of the outer membrane of Gram-negative bacteria which potently activates the immune system.

The LPS molecule consists of three main regions: an O-specific polysaccharide, a core region, and a lipid part (lipid A) (Fig. 1). These three structural elements differ in genetic determination, biosynthesis, and architecture. The lipid A domain is responsible for most endotoxic properties of LPS. The polysaccharide part is a structure determining the serological specificity of LPS. The core oligosaccharide part of LPS spans lipid A with O-antigen. The highly conserved structure of the endotoxin core justifies the search for a common epitope within this part of LPS.

The early history of research on the occurrence of non-sugar substituents in bacterial lipopolysaccharides dates back to the 1960s and 1970s, and consisted of a few reports on alkali- or acid-labile components in the core oligosaccharide from LPS

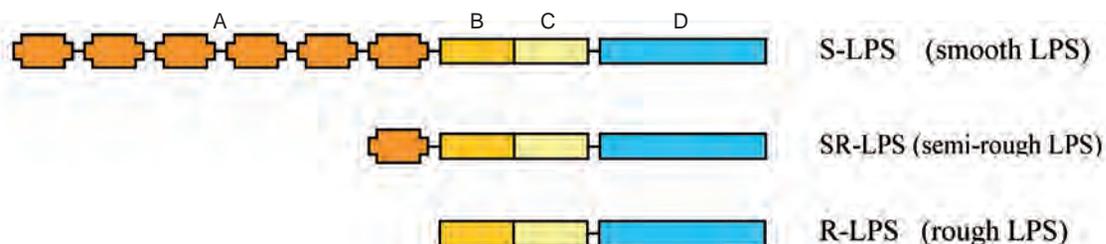


Fig. 1. General structure of lipopolysaccharide of Gram-negative bacteria, with O-specific polysaccharide antigen (A), outer (B) and inner core (C) oligosaccharides and lipid A (D)

of *Salmonella* and *Shigella* strains. The first extensive studies were reported in 1996 by Gamian and co-workers, who presented their data on the occurrence of glycine in the LPS of over 30 strains of different bacterial species, including such genera as *Escherichia*, *Salmonella*, *Hafnia*, *Citrobacter* and *Shigella*. The experiments revealed that isotope-labeled (^{14}C) glycine added to bacterial culture medium was incorporated into the core oligosaccharide of LPS. Mild acid and alkali-treatment caused the release of glycine from the LPS, proving that this amino acid is linked by a labile covalent bond (Fig. 2). This amino acid was then identified by others in the core oligosaccharide of the LPS of *Haemophilus influenzae*, *H. somnus*, *Neisseria meningitidis*, *Campylobacter jejuni*, and *Yersinia pestis*. The position of the glycine in oligosaccharides was determined using capillary electrophoresis with electrospray ionization mass spectrometry (CE-ESI-MS/MS).

Despite 35 years of research on the occurrence of glycine in LPS, its biological function still needs

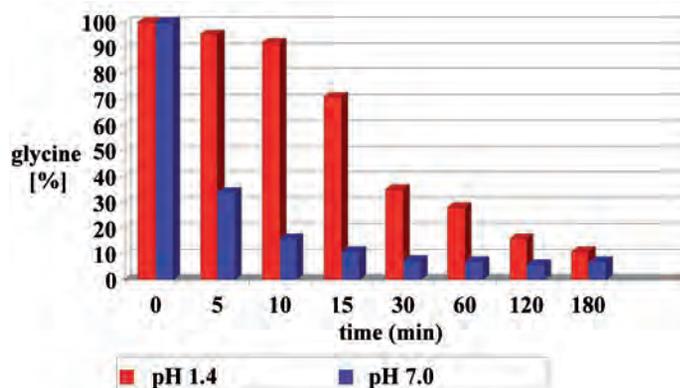


Fig. 2. Releasing of glycine from LPS of *E. coli* K12 during its heating in 80°C at different conditions of pH

clarification. So far, the mechanism of this amino acid's incorporation into the LPS molecule is unknown. Glycine most likely plays a role in protecting the core region against host glycosidases during infection or may modify the charge of LPS molecules. It is thought that antibodies against conservative

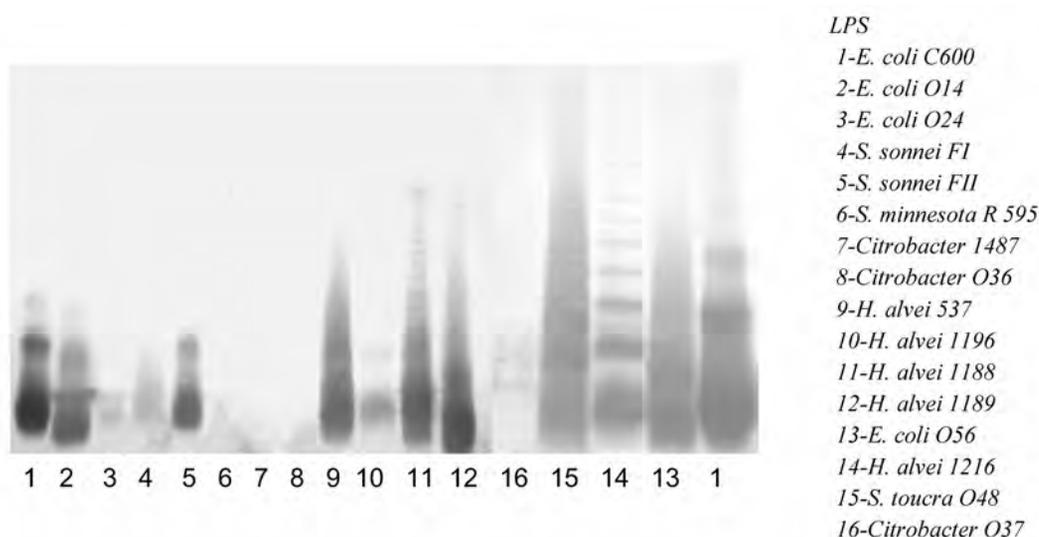


Fig. 3. Immunoblotting of enterobacterial lipopolysaccharides with rabbit serum against *E. coli* K12 C600 LPS core oligosaccharide conjugated to bovine serum albumin

epitopes of the endotoxins core are commonly present in human serum and neutralize endotoxins circulating in blood. This opinion is in line with our conclusions of the existence of a glycine epitope in this part of endotoxins. To obtain specific antibodies, the isolated glycine-containing core oligosaccharide from the *E. coli* K12 strain has been conjugated with a protein carriers, type 1 and type 3 *Klebsiella fimbriae* and bovine serum albumin. The sera obtained showed strong cross-reactivity with LPS from different Gram-negative bacteria (Fig. 3). The recognition of heterologous LPS by these sera correlated with the content of glycine in the LPS. These sera recognize the core oligosaccharide of both the rough and smooth LPS. Molecular modeling could also be helpful in the chemical synthesis of the epitope and such studies have been performed in our laboratory. The lability of ester-linked glycine and its possible migration on a sugar ring make the theoretical calculations, in addition to structural data, very useful for further chemical syntheses. The data on glycine in bacterial polysaccharides were recently reviewed by Gamian and coworkers.

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Charcot-Marie-Tooth disease with an autosomal recessive mode of inheritance caused by a new missense mutation in the *GDAP1* gene

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Charcot-Marie-Tooth (CMT) disease with an autosomal recessive mode of inheritance (AR-CMT) is a severe peripheral neuropathy with onset at an early age, characterized by muscle weakness and wasting resulting in loss of ambulatory as early as by the second decade of life. Currently, there is no efficient therapy for AR-CMT. In recent years, molecular genetics has opened the door to the prevention of AR-CMT by detecting causative mutations. Moreover, with studies on the neurobiology of genes associated with AR-CMT, new ideas regarding experimental

therapy for this devastating disease have been put forward. The most common form of AR-CMT is associated with mutations in the ganglioside-induced differentiation-associated protein 1 (*GDAP1*) gene. Mutations in the *GDAP1* gene are associated with a wide spectrum of CMT phenotypes, ranging from an early-onset polyneuropathy with a severe clinical course to a mild form of CMT beginning in the 5th decade of life. Due to the marked clinical variability of AR-CMT and numerous "private" *GDAP1* mutations occurring in isolated families or sporadic

cases, little is known about the phenotype-genotype correlations in AR-CMT disorders. A newly identified missense mutation Gly327Asp in the *GDAP1* gene in a Polish family has been associated with a surprising extremely severe AR-CMT2 phenotype, hitherto described in families with nonsense mutations. Two sisters affected with AR-CMT had a similar course of the disease. Initial symptoms were noted at the age of 2 years, by about 5 years of age they could not stand or walk without an orthopedic equipment, and they stopped walking at the age of 13. Clinically, both sisters presented with a severe motor-sensory polyneuropathy with flaccid tetraparesis and marked skeletal deformities (kyphoscoliosis, spina bifida, S1-S2 malformation) (Fig. 1).

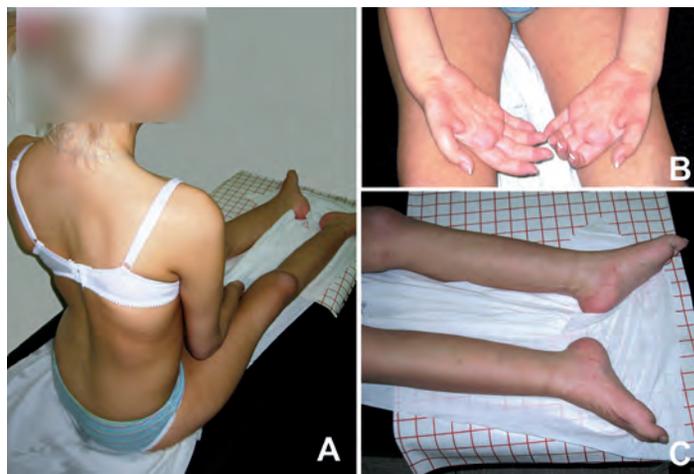


Fig. 1. A sister of the proband at the age of 21 years. The patient was wheelchair-bound since 13 years of age. Marked thoracic scoliosis can be seen

In the electroneurographic examination, no responses from the investigated nerves could be elicited, with the exception of the axillary nerve, where compound muscle action potential amplitudes were markedly reduced (0.28 mV) but with normal nerve conduction velocity (axonal neuropathy). Sural nerve biopsy revealed axonal degeneration and signs of demyelination indicated a mixed nature (axonal and demyelinating) of the neuropathy. *GDAP1* is a 358-aminoacid protein (44 kDa) anchored at the outer mitochondrial membrane (MOM), with two domains (GST-N and GST-C) described in glutathione-S-transferases (GST) but showing no GST activity *in vitro*. *GDAP1* is involved in the maintenance of mitochondrial dynamics and plays an important role in mitochondrial fission, and probably also in the regulation of mitochondrial

energetics and removal of free radicals. However, the *GDAP1* protein has been poorly characterized (Fig. 2). The C-terminal transmembrane domain of the *GDAP1* protein (318-341 aa) includes a

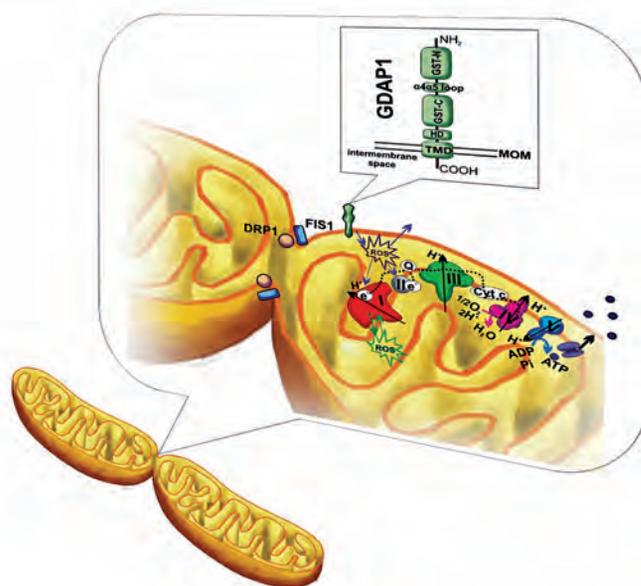


Fig. 2. Domains and topology of the mitochondrial fission protein *GDAP1*. *GDAP1* is located within the MOM, anchored through its transmembrane domain. The mutated *GDAP1* protein increases reactive oxygen species (ROS) level which has a deleterious effect on protein regulation and oxidation of complex I and II on lipid peroxidation. The mutated *GDAP1* protein causes a mitochondrial dynamics defect directly or through alterations of bioenergetics

mitochondrial targeting signal. A shorter protein without the C-terminal tail-anchor is located in the cytoplasm instead of MOM or is barely detected. So far, all missense mutations described and analyzed at the cellular level were associated with a reduction of mitochondrial fission activity and proper *GDAP1* integration within the MOM. The Gly327Asp mutation is localized precisely in the middle of the tail-anchor region and the observed severe phenotype likely results from mitochondrial mislocalization, weaker membrane integration, and decreased fission activity. We showed that the phenotype-genotype discrepancy observed in our patients is more likely related to the cellular effect caused by the Gly327Asp mutation than to the mutation type (missense/nonsense). The mutated *GDAP1* protein showed disturbed mitochondrial targeting (Fig. 3) and insertion to the MOM. Surprisingly, this alteration did not influence mito-

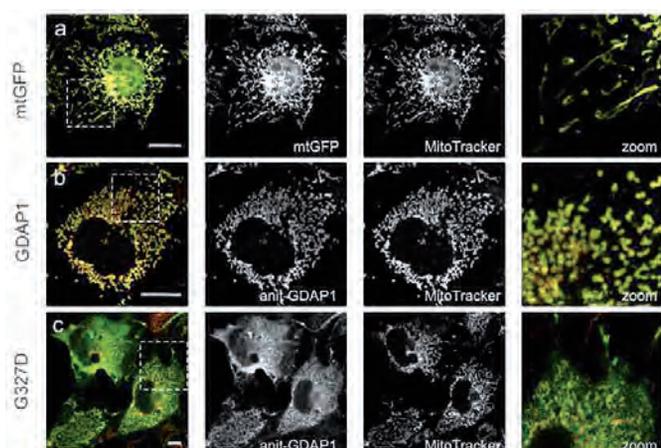


Fig. 3. The GDAP1 Gly237Asp mutant is localized in the cytosol in transfected COS-7 cells. The mtGFP signal (a) and the signal for wild-type GDAP1 (b) colocalize with the mitochondrial marker Mito Tracker Red, but the signal for the Gly237Asp-mutated form of GDAP1 shows a strong cytosolic staining and only partially overlaps with the Mito Tracker Red signal (c). Scale bars, 10µm

chondrial morphology and mitochondrial network dynamics (Fig. 4), in contrast to other missense mutations localized outside the C-terminal tail-anchored region. The observed lack of mitochondrial morphology alteration could be a result of unaltered activity of two other fission factors, mitochondrial fission protein 1 (FIS1) and dynamin-related protein 1 (DRP1), despite the absence of the GDAP1 protein in the MOM. Thus, pathogenetic mechanisms of the mutation leading to no integration of the GDAP1 protein to the MOM are related not to the lack of GDAP1 fission activity but to other functions of this protein. In our study, we have shown that the clinical course of AR-CMT-GDAP1 disease does not correspond to the *GDAP1* mutation type (missense/nonsense) as has been previously hypothesized, but is rather associated with the cellular effects of *GDAP1* mutations (mitochondrial mislocalization of the GDAP1 protein).

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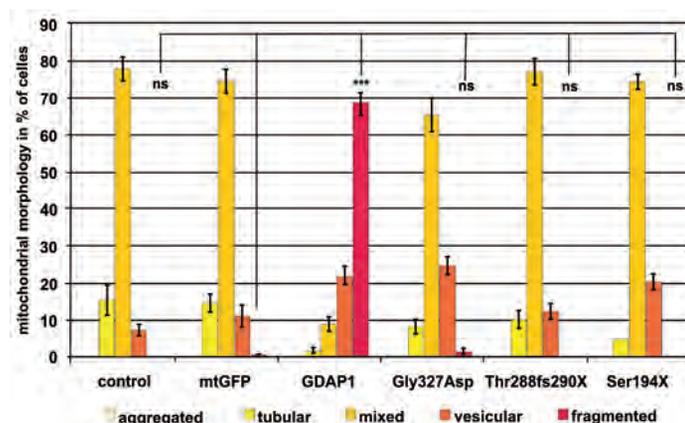


Fig. 4. The Gly327Asp mutation does not alter the mitochondrial morphology

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The International Relations of the Polish Academy of Sciences

Celebration of “Russian Science Days” in Poland

The “Russian Science Days in Poland” event was held on 17-21 Oct. 2011, organized as a collaborative effort of the Polish Academy of Sciences and three Russian Academies (the Russian Academy of Sciences, the Russian Academy of Medical Sciences, and the Russian Academy of Agricultural Sciences). The program for the event included a central kickoff (19 Oct. 2011, Warsaw) with around 100 individuals from Russia and Poland in attendance, featuring speeches by representatives of the Polish and three Russian Academies, the signing of Research Cooperation Protocols between the Polish and three Russian Academies for 2011-2013, an address delivered by

the Ambassador Extraordinary and Plenipotentiary of the Russian Federation to the Republic of Poland, a research session (featuring lectures thematically related to ecological chemistry, nanotechnology, bioethics, and the advancement of agriculture, including in the context of harnessing European funding), and a ceremony to honor the winners of awards granted every three years by the Polish and Russian Academies for outstanding research achievements resulting from joint work by scholars from both countries (the 2010 competition).

The further agenda for the “Russian Science Days” included several Polish-Russian research events, including a seminar on nanotechnology, a session of the Commission of Historians of Poland and Russia combined with a conference on “Polish and Russian Academies of Sciences, Universities, Higher-Education Schools, Research Institutes, and Scientific Societies: Polish-Russian Relations in the Field of Science,” a session of the Polish-Russian Working Executive Group in the field of basic space research, a research seminar on “Modern Soil-Science for Agriculture and the Environment,” and a session of the Polish-Russian Commission of Economists plus a conference on “Challenges for Poland and Russia Stemming from Opposing Trends of Economic Regulation Mechanism Transformations.”

Held in parallel to the event was an exhibition on “Women in Science” prepared in collaboration with the Archives of the Polish and Russian Academies of Sciences, showcasing the scientific achievements of Polish and Russian female scientists in various fields as well as Polish-Russian research links.

Within the collaborative relations between the Polish and Russian Academies, one can find many reasons to take great pride and feel satisfaction, as well as certain fields – such as the currently dynamic exchange of research personnel – where our ambition in the future should be to focus on joint European grant applications and joint involvement in international research programs.

A review of the topics and research projects that were put forward by the institutes of the PAS and



“Women in Science” symposium



Nicole Moreau beside the “Women in Science” exhibition

three Academies for the 2011-2013 collaboration agenda justifies the hope that the scope and level of Polish-Russian research cooperation will achieve an even higher caliber and take on even better organizational shape. Ahead there lie both significant re-

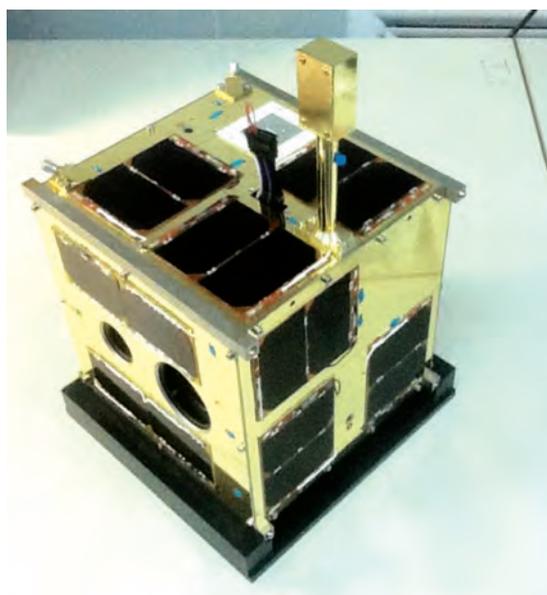
search challenges, and real opportunities to tackle those challenges successfully.

Annual Report staff

BRITE-PL

T. Zawistowski and BRITE-PL Team | Space Research Center | Polish Academy of Sciences

The Bright Target Explorer (BRITE) is a project developed under Canadian-Austrian-Polish cooperation. The consortium plans to launch a constellation of micro-satellites (20 cm x 20 cm x 20 cm, 7 kg) into Low Earth Orbit. This is the first scientific satellite to be developed in Poland between 2010 and 2013. Costing in excess of 14 million PLN, the project will be helpful in furthering our understanding of the stellar oscillations and internal structure of the biggest stars in our galaxy (brighter and hotter than the Sun).



BRITE-PL 1 "LEM" after integration

The idea of the BRITE project was put forward by Prof. Slavek Rucinski of the University of Toronto. After the successful MOST mission, also based on his concept, he suggested that the idea of photometric observations of stars could be expanded through the use of small satellites, and thus the

BRITE mission took shape. He suggested that Poland join Austria and Canada to develop the BRITE project.

The international consortium involved in the BRITE mission now comprises the following institutes from 3 countries: the University of Toronto and University of Montreal from Canada, the University of Vienna and Technical University of Graz from Austria, the PAS Space Research Center, PAS Nicolas Copernicus Astronomical Center, and University of Wroclaw from Poland.

Each country will deliver two satellites; thus the BRITE constellation will consist of 6 spacecraft. Every satellite pair will have telescopes covered with different optical filters: one will have a telescope equipped with a blue filter to look at hot stars, while the other will feature a red filter for observing cold stars.

The scientific arm of the project, BEST (Brite Executive Science Team), meets twice a year and is responsible for laying out the scientific plan of the BRITE mission. Bi-weekly conferences of the



BRITE mission poster



First Day Cover Envelope with BRITE-PL stamp

BRITE international team help to coordinate activities among all participating teams and prepare the ground for the final stage – when all 6 BRITE satellites are to be operational in space. BEST will make data available to scientists participating in the BRITE investigation and will expect data processing and analysis results in the form of reports to BEST.

At present, the two Austrian satellites are being readied for common launch, scheduled for the latter half of 2012. The first of the two Polish satellites, LEM, is ready to be launched in late 2012. LEM's integration was finally completed on 24 November 2011, after which the satellite underwent functional, vibration, and environmental tests to the specifications of the DNEPR launch vehicle that will carry it into orbit in autumn 2012. The second satellite, Heweliusz, will carry an additional Polish-defined technological load, which will distinguish it from all the other 5 BRITE satellites.

Heweliusz will be launched together with the first of two Canadian satellites in the latter half of 2012. The Canadian pair of nanosatellites (BRITE-Toronto & BRITE-Montreal), funded by the Canadian Space Agency, are identical to BRITE-AT. They are now undergoing functional tests.

Young Polish scientists recently visited the UTIAS (University of Toronto Institute of Aerospace Studies) Micro-Satellite Laboratory and participated in training to boost their knowledge regarding the commissioning of the BRITE spacecraft in orbit. There is another visit planned shortly to investigate the ground station operation scheme in Vienna and Graz.

The Polish contribution to the BRITE project, apart from delivering two satellites, included a

ground control station located at the Nicolaus Copernicus Astronomical Center. This ground station will support other satellite missions in the future. It will be one of 3 primary stations for the BRITE project, the others being: one at the Technical University of Graz, and one at Space Flight Laboratory in Toronto. There will be a secondary station at the University of Vienna, and a station at the University of British Columbia is under consideration.

The BRITE workshops, ground-based complementary activities (mainly spectroscopic – performed when data are acquired from BRITE satellites), will be essential for the full exploitation of the BRITE-Constellation science.

As soon as the first scientific data have been analyzed during the commissioning phase (expected to last not more than 3 months after launch) they will become available and there are plans to organize a workshop. This workshop shall provide the BRITE Community with real data, test results, quality assessments, etc., and will serve as input in preparing a decision by BEST on the observation strategy for the BRITE Constellation. The latter will be based on all accepted proposals, which has resulted in the BRITE Candidate Target Star Catalog with more than 6400 entries for nearly 5000 individual stars. This catalogue is being continuously updated.

Several promotional events marked the development of the BRITE-PL project. In September, the Polish Minister of Science and Higher Education, Prof. Barbara Kudrycka, officially bestowed the name “LEM” on the first Polish scientific satellite, after the Polish philosopher and science fiction writer Stanisław Lem. In November the Polish Post Office issued a stamp commemorating the construction of the first Polish scientific satellite. A Poland-wide popular science competition on space research was held and the main prize winners named the second of two BRITE-PL satellites, Heweliusz, in the official ceremony in April. The Polish Post office is planning to issue a stamp bearing an image of the Heweliusz satellite in 2013.

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Educational and Promotional Activity within the Polish Academy of Sciences

PhD studies at ICS PAS: 'Information technologies: research and their interdisciplinary applications'

W. Penczek | Institute of Computer Science | Polish Academy of Sciences

This PhD studies project is carried out by the PAS Institute of Computer Science in partnership with the PAS Systems Research Institute and the PAS Institute of Biocybernetics and Biomedical Engineering, within the framework of the Human Capital National Cohesion Strategy under priority IV 'Higher education and science.' Candidates to become PhD students should have a master's degree or equivalent, which is a prerequisite for acquiring advanced knowledge in a specific area of science.

The project offers two full 3-year doctoral study tracks with courses taught in English. Twenty PhD students are admitted to each track. The first track started in October 2011, the second is about to start in October 2012. PhD students are provided with state-of-the-art and very well equipped laboratories as well as Internet and intranet access.

The program as a whole spans several disciplines and therefore is divided into two separate subject groups. The first subspecialty covers intelligent computing and Internet technologies, which nowadays form one of the most rapidly developing fields of computer science and are believed to contribute most substantially to the advancement and growth

of the knowledge-based society. This field of computer science has as its core the development of secure and suitably verified distributed and concurrent systems, computer architectures and technologies, e.g. based on service-oriented architecture (SOA), multi-agent systems, semantic WEB, as well as distributed computations, including the latest achievements such as cloud computing. The program owes its unique character to a general approach which covers all paradigms used in the field, in particular mathematical modeling of concurrent information processing, business processes, intelligent environment, security (cryptography), correctness (verification) and cooperation in multi-agent systems.

The second subspecialty covers data mining (DM) and computer modeling. Within these interdisciplinary fields, various methods and approaches of computer science (databases, machine learning, genetic and other biologically inspired optimization algorithms, graphical models), mathematical and statistical models, as well as tools stemming from engineering (pattern and shape recognition, neural networks, signal processing) are widely applied. DM is mainly devoted to the analysis of large data sets





and aims at discovering useful patterns, interdependencies and other characteristics of interest. In particular methods using dependence analysis, prognostic systems, model selection and averaging as well as computer intensive approaches, metaheuristics and algorithms based on them will be thoroughly discussed. The demand for highly qualified specialists with practical skills in advanced DM methods and computer modeling is obvious, given that the amount of automatically collected information of diverse kinds is constantly on the rise.

In addition to the doctoral studies, the project offers: scholarships for PhD students (3500 PLN/month), scholarships for visiting professors from

Poland and abroad, scholarships for young PhD holders up to 35 years of age (up to 3500 PLN/month), domestic and international internships for PhD students and postdocs, and e-learning courses. The financial support is up to 4500 PLN/month from national scholarships and 6000 PLN/month from foreign ones.

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Education and promotion of Earth Science by the PAS Institute of Geophysics

A. Goździk | Institute of Geophysics | Polish Academy of Sciences

The PAS Institute of Geophysics is a scientific institution representing the mainstream of Polish basic research in Earth sciences. It is the only institution in Poland that performs monitoring of geophysical fields in seismology, geomagnetism, and selected areas of atmospheric physics. The Institute participates in many international projects, e.g. EPOS and GLISN.

The Institute's research broadly covers the following scientific fields: seismology, geomagnetism, Earth's interior dynamics, physics of the atmosphere, hydrology and environmental hydraulics, and polar research. Another central activity of the Institute is

related to its statutory obligation to record global geophysical phenomena, whose results are transmitted to World Data Centers. The Institute manages ten observatories in Poland and one at Spitsbergen.

Popularization of Earth sciences among society and school students has always been an important aspect of the Institute's activity. The Institute has taken part in many scientific events, like the Warsaw Science Festival or the Science Picnic organized by Polish Radio and the Copernicus Science Center. Its scientists are often asked by the media to comment on current events related to the Earth's activity, like earthquakes, tsu-

namis, or volcano eruptions. They also take part in popular science talk-shows or radio broadcasts.

For many years the Institute has been offering classes in the “Geophysics at school” project. The project’s primary goal is to popularize geophysics (geography, geology, and physics) by providing engaging lectures, presentations, and workshops for students of lower and upper secondary schools. The classes are organized at no cost and held at the school’s premises. Academic tutors share their knowledge and present their accomplishments and skills, using a language easily understood by young people. Presentation topics include the work of seismologist, polar researcher, or hydrologist. Some example lectures are: “The seismologist’s job,” “How the Earth shakes,” “The Natural Environment of Spitsbergen.”



The Institute of Geophysics is also the leader of the project “Developing students’ competence in the range of mathematics, natural science, and IT with the usage of innovative methods and technology – EDUSCIENCE,” financed by the European Social Fund. It is Poland’s largest innovative project in the field of education, carried out under the Human Capital Operational Programme (2007-2013).

The main aim of the project is to boost interest in mathematical-natural sciences among schoolchildren, ultimately leading to increased numbers of young people deciding to study subjects related to those sciences. This is also very important from the point of view of Poland’s economy, which needs more young specialists educated in those fields. This aim will be achieved by design, development, pilot implementation, and promotion of innovative school syllabuses involving the use of an interactive e-learning platform.

The platform contains lessons and materials on geography, biology, chemistry, polar research, atmospheric physics, seismology, and magnetism, prepared by scientists of a recently established collaborative center of the Polish Academy of Sciences: the Center of Earth and Planetary Sciences GeoPlanet (i.e. researchers from the PAS Institute of Geophysics,



Polish Polar Station at Spitsbergen (J. Jania)



GeoPlanet at the Science Picnic organized by Polish Radio and the Copernicus Science Center (G. Lizurek)



Hands-on approach to learning science (J. Krawczyk-Borkowska)



The research vessel "Horyzont II" (A. Goździk)



Scientists at work: tracer test on the Narew river (top, E. Barczyk); Spitsbergen (bottom, A. Nawrot)

Institute of Geological Sciences, Institute of Oceanology, and Space Research Center, as well as Gdynia Maritime University). The work of these scientists is supported by teachers and methodologists.

Lessons at Polish schools are generally not innovative, conducted traditionally, often without any individual approach to pupils and their interests and talents. A new methodology invoking the multiple intelligences approach, using IT technologies and tapping into the research passion of Polish Academy of Sciences researchers, offers a chance to change this situation diametrically.

With the help of PAS Institutes, schoolchildren will be able to benefit from the knowledge of scientists who deal with natural science on an everyday

basis and achieve worldwide success. For instance, young people taking part in the project will also have an opportunity to participate in direct satellite transmissions from the Polar Research Station at Spitsbergen. Moreover, pupils will have the chance to participate in classes taking place at the geophysical Observatories in Książ, Racibórz, Ojców, Belsk, and Świder. Additional classes will be conducted at the Observatory in Borowiec, the laboratories of the PAS Institute of Oceanology, and at the Museum of the Earth in Kraków. Part of the lessons will be transmitted from onboard the research vessels "Horyzont II" or "Oceania," putting the schoolchildren into unique, first-hand contact with science in the making. To date, there has not been any educational project in Poland offering such exciting opportunities to experience the fascinating world of science "live."

In addition to the above, 12 Science Festivals and 64 Eduscience picnics will be organized in various parts of Poland. The festivals will be open to the public, offering the opportunity to witness and even perform scientific experiments and to get involved in the world of science in an entertaining way.

The project targets students and teachers from 250 randomly-chosen schools in Poland, on all levels of education. This project implementation stage at schools will take two school years (September 2012 – June 2014). After evaluation, the resulting e-platform, containing all the educational tools and materials created during the project, will be made available to all Polish schools on-line at no cost.

The project is being carried out in cooperation with three partners: Education Pro Futuro and American Systems from Poland, plus a British partner, Accelerated Learning Systems Ltd.

More information is available on the project's website: www.eduscience.pl.

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The Graduate School for Social Research at the Institute of Philosophy and Sociology

A. Rychard | J. Fells | Graduate School for Social Research | Institute of Philosophy and Sociology | Polish Academy of Sciences

The Graduate School for Social Research (GSSR) was created in 1992 at the PAS Institute of Philosophy and Sociology by a group of scholars, philosophers, sociologists, lawyers, economists, psychologists, and political scientists from the Polish Academy of Sciences and other institutions of higher education, among them Prof. Stefan Amsterdamski, who served as its first Director. Currently the School offers a postgraduate program validated by a leading British university, its own doctoral program, and collaborative programs, and is about to launch a post-doctoral program. All of these programs are interdisciplinary, with a strong international component, fostering strong links between research and education.

The teaching activity of the Graduate School for Social Research takes the form of some fifty seminars and lecture courses, the great majority of which are offered in English. They are attended by doctoral students and students of the School's postgraduate program.

The doctoral program is a four-year interdisciplinary track aimed at students who plan to defend doctoral theses in the social sciences and humanities. To date, more than eight hundred alumni of the school have successfully completed the program.

Doctoral program courses are offered in thematic blocks including: Contemporary Philosophy; Culture and Communication; Ideologies and Identities; Methodology; Politics and Civil Societies; Social Structures, Institutions and Social Change and others.

The School also offers a Dual PhD program with Lancaster University, one of the UK's top ten universities and among the top one per cent in the

world. Students following the program spend up to eighteen months in the UK and receive doctoral diplomas from both IFiS PAN and Lancaster University on successful defense of their theses. Individual students have also benefited from *co-tutelle* arrangements with leading French institutions.

In addition the GSSR currently offers a twelve-month postgraduate program (or two years part-time) in its Centre for Social Studies, taught exclusively in English by guest lecturers from the United States, Australia, plus Poland and other EU countries. The program is offered in three tracks: *Society and Politics*, *Economy and Society*, and *Media, Culture and Society*. Students successfully completing this program are awarded the British degree of Master of Arts by Lancaster University. So far a total of some five hundred alumni have successfully completed the program.



Professor Mach and his students at the Graduate School for Social Research

In any given year the School has students from fifteen to twenty countries, and more than double that number of countries have been represented in the student body at some point over the years. Of the one hundred and thirty four doctoral students currently enrolled, half are non-Poles and two-thirds of the twenty four students following the postgraduate program were recruited from outside Poland.

The GSSR has since its founding in 1992 been generously supported by the Open Society Institute's Higher Education Support Program (HESP). Overall in recent years some ninety percent of the School's finances have been received from this source. It is a particular feature of HESP program support that annual funding of stipends for thirty five students from the former Soviet Union, Mongolia, and Nepal has been agreed for the next few years. The GSSR is also supported by the Polish Ministry of Science and Higher Education, funding stipends this year for an additional sixteen students selected by competition, and research grants for the best three students, again chosen by competition.

The School's international character is also underlined by its participation in student and faculty exchange under the auspices of the Erasmus, Fulbright, and Visegrad programs.

In 2012 the School is celebrating its twentieth anniversary. Events to mark the anniversary include international conferences on *War and Memory* (in collaboration with Queen's University, Belfast) and a panel discussion with leading Polish politicians and public intellectuals.

It is a feature of the School's outlook that in addition to the usual national arrangements, it welcomes the review procedures of its various collaborators and sponsors. These include evaluators acting on behalf of HESP, course consultants from Lancaster University, and regular evaluation of students' performance (and, to an extent, of teaching) by external examiners from leading institutions (SSEES/University College London, Essex, Warwick, Kent, Leicester). The School has also therefore been subject to scrutiny during reviews of Lancaster University by the UK authorities (the Quality Assurance Agency with an external assessor from a leading UK university). Given that they are all aimed at the achievement of quality and the emulation of best practice, the various review procedures complement rather than conflict with one another. Guidance concerning good practice gained in this way is applied as appropriate throughout the GSSR.

In addition to the teaching activities described above the GSSR also participates in the interdisciplinary doctoral studies program operated in conjunction with the Academy's Institutes of Economics, Law and Psychology.

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The FNP Prizes for 2011

This year's prizes of the Foundation for Polish Science (FNP) were won by Prof. Tomasz Giaro, Prof. Jan Potempa, Prof. Maciej Lewenstein, and Prof. Elżbieta Frąckowiak. The FNP awards have a reputation as the top-ranking and most prestigious scientific prizes in Poland. They are awarded in four

separate areas to Polish scholars for their achievements and discoveries in the preceding four years, making a significant contribution to Poland's spiritual life and the advancement of civilization, as well as ensuring Poland a significant position in world science.



Tomasz Giaro is Professor of Roman Law and European Legal History at the Law Faculty of Warsaw University. In 1984-85 he was a fellow of the Humboldt Foundation at the University of Bonn, Germany, and in 1990-2006 a researcher at the Max Planck Institute of European Legal History in Frankfurt am Main, Germany. In 2006-2008 he was a visiting professor at the Law Faculty of Katowice, Poland, and in 2010 at the University of Florida Levin College of Law, Gainesville, USA. Since 2008 he has been Deputy Dean for Legal Research and International Cooperation and since 2009 Head of the Department of European Legal Tradition at the Warsaw Law Faculty.

In his work *Römische Rechtswahrheiten. Ein Gedankenexperiment* (Roman Legal Truths – A Mental Experiment), published in Frankfurt am Main in 2007, Giaro examines the traditional problem of legal philosophy: whether legal rules and propositions of legal dogmatics may be cat-

egorized as true or false. This problem, usually solved through pure speculation, is analyzed by Giaro through the historical corpus of Roman legal sources. He assumes that in these texts, which are the core of European legal tradition, *verum est* and similar expressions mean “it is true.” In this way, a simulation of legal dogmatics based upon truth values is created.

Giaro's monograph may be subjected to a threefold reading. At the level of ancient law, it focuses on a system of decentralized lawmaking through the juristic discourse which stabilizes the validity of certain rules, distinguishing them as legal truths. At the level of European legal history, the monograph shows how the codification of the 19th century helped to discern a truth-based legal historiography from legal dogmatics. At the level of legal theory, Giaro supplies arguments against the existence of a particular juristic truth of legal rules and interpretive statements of legal dogmatics.



The career of **Prof. Jan Potempa** has been closely linked with Jagiellonian University, where he earned his master's in biology in 1979, defended his doctorate in 1983, earned his DSc (*habilitation*) degree in 1983, and gained the title of professor in 1998. Since 1999 he has held a professorship post at Jagiellonian University's Fac-

ulty of Biotechnology, where he leads the Department of Microbiology. Since the beginnings of his career, Prof. Potempa has been interested in proteolytic enzymes and their inhibitors, meaning substances that regulate proteolytic activity, in terms of their involvement in pathological processes. He is the author of nearly 200 research publications, including 140 original experimental papers and 9 patents. His work has been often cited by other authors (gaining more than 3,500 citations). He is a member of the editorial board of three international journals (*Thrombosis and Haemostasis*, *Biological Chemistry* and *Current Protein and Peptide Science*) and a member of the scientific council of the International Proteolysis Society (IPS). For years he has been collaborating with several research centers abroad (including regular collaboration with the University of Georgia in Athens), he is a member of an international research consortium ANTISTAPH funded by the EU, and he leads research projects funded by the Polish Committee for Scientific Research. Prof. Potempa has won numerous prizes for his research work, including the Polish Prime Minister's Award for his overall career achievements (Warsaw, 2001), the prize of the Rector of Jagiellonian University (on several occasions), and a professorship grant from the Foundation for Polish Science (Warsaw, 2004).



Prof. Maciej Lewenstein is one of the top figures in modern quantum optics and atomic physics. He obtained his PhD under the supervision of K. Rzażewski and Fritz Haake at Essen University and the PAS Institute of Physics. He was a faculty member of the PAS Centre for Theoretical Physics for 14 years, earning his DSc (*habilitation*) in 1986 and becoming a professor in Poland in 1993. In 1994 he joined the Service de Photons, Atoms et Molécules of CEA in Saclay, and in 1998 he became C4 professor in Hannover. Since 2005 Lewenstein has been a professor at Institució Catalana de Recerca i Estudis Avançats at the newly formed ICFO - Institut de Ciències Fotòniques.

Lewenstein specializes in quantum physics, statistical physics, intense laser atom interactions, ultra-cold quantum gases and quantum information. He is the author of about 400 papers that have been cited over 17,500 times, with an H-index of 66. He has made several seminal and breakthrough contributions to the modern AMO physics. Together with Prof. Glauber (Nobel 2005) he formulated the quantum optical theory

of linear media. He has pioneered attosecond physics, and in 1994 he formulated what is known as Lewenstein's model, which is the basis for modern attosecond physics. In quantum information theory, Lewenstein has made important contributions to the theory of quantum entanglement, quantum networks, the role of entanglement in quantum cryptography, and the nature of quantum correlations.

Of particular importance is his work on ultracold atoms, like those on dark solitons and phase fluctuations in Bose condensates, and more recent work on strongly correlated systems of ultracold atoms in optical lattices. Such systems may serve as quantum simulators, i.e. special-purpose quantum computers that can mimic condensed matter or high energy physical systems. The research on quantum simulators culminated in 2012 with Oxford University Press's publication of the book *Ultracold Atoms in Optical Lattices: Simulating Quantum Many-Body Physics* by M. Lewenstein, A. Sanpera, and V. Ahufinger. existence of a particular juristic truth of legal rules and interpretive statements of legal dogmatics.



Prof. Elzbieta Frąckowiak from Poznan University of Technology (Faculty of Chemical Technology) is involved in research strictly connected with energy storage/conversion, mainly studying electrochemical capacitors, Li-ion batteries, and fuel cells. She investigates the practical application of carbon nanotubes in these power sources. In cooperation with Prof. François Béguin (France) she has discovered the unique role of nanotubes in composites with nitrogenated carbons, conducting polymers (polyaniline, polypyrrole, polythiophene derivative), and metal oxides as electrode materials for supercapacitors. Carbon nanotubes serve as an extraordinary three dimen-

sional network for the dispersion of pseudocapacitive materials and catalyst. Her pioneering study showed that the excellent electrical conductivity of nanotubes as well as their resiliency play a crucial role in good capacitor performance and cycling. The role of ion solvation in double layer charging has been defined for various ordered carbons. She has devoted a lot of research to hydrogen electrosorption into activated carbons, showing that carbon-hydrogen bonding has a chemical character. Understanding the hydrogen electrosorption mechanism appears to be a great breakthrough for the practical application of carbon reversibly storing hydrogen as a negative capacitor electrode. Furthermore, a novel concept of redox active electrolyte based on iodine and vanadium species has been introduced by her research group to greatly enhance supercapacitor energy. She was the first to report data on the negative effect of mesopores in charge/discharge characteristics of Li-ion cells and determine the type of Li-C bonding.

She has published over 150 papers, cited ca. 6000 times (17 papers cited > 100 times), with H=36.

She serves as a Chair of Division 3 “Electrochemical Energy Conversion and Storage” of the International Society of Electrochemistry (2009-2014).

She was decorated with the Order of Polonia Restituta in 2011.

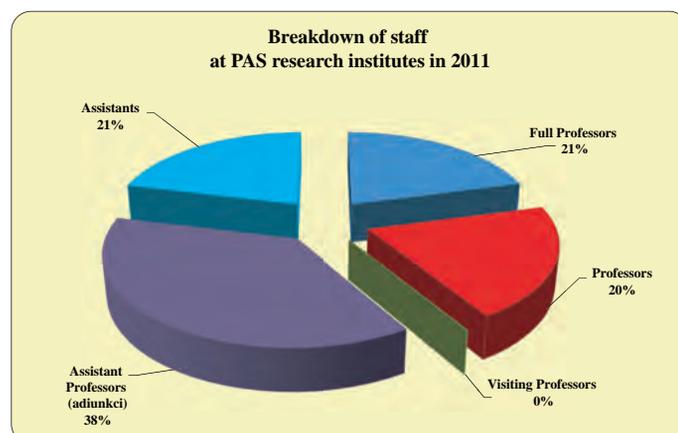
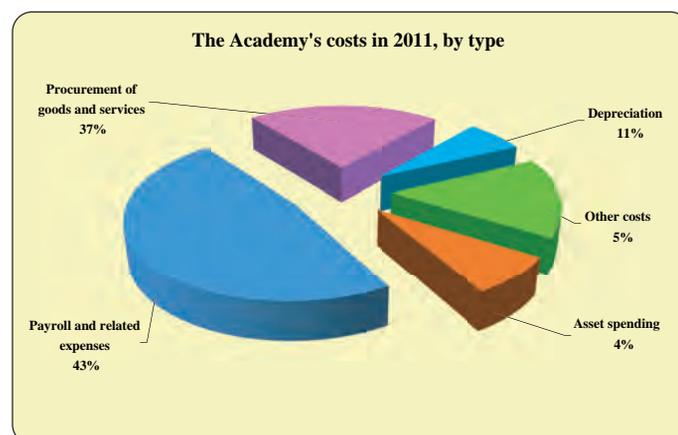
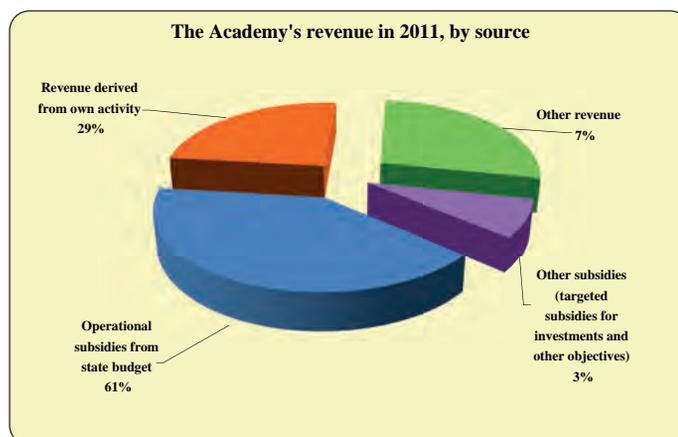
Polish Academy of Sciences in 2011

Sources of funding for the Academy and its organizational units

The basic source of funding for the activity of the Polish Academy of Sciences and its various organizational units in the year 2011 was state budgetary funding – an overall total of just above 561.4 million PLN awarded as an operational subsidy, supporting the statutory operations of both the Academy itself and the various PAS research institutes. The operational subsidy funding contributed to the PAS budget itself was nearly 76.7 million PLN, allocated to supporting the Academy's various bodies, its corporation (elected body) of Academy members, and maintaining the auxiliary research units and other organizational units. The state budgetary funding channeled directly to the research institutes, in turn, was allocated to the pursuit of their statutory objectives and research projects underway through the end of 2011.

Employment at the Academy

There were a total of approx. 9,400 individuals employed by the Polish Academy of Sciences in 2011. More than 8,500, or 90%, of them were employed at PAS research institutes, including approx. 3,800 research staff members. Another approx. 900 individuals, or the remaining 10%, were employed at other PAS organizational units, including independent research libraries, archives, the Museum of the Earth, research units without autonomous legal status, and experimental facilities.



Activities of the PAS committees in 2011

Conferences	367
Conference participants	42 234
Lectures, conference reports, articles	14 275
Expert's reports and opinions	156
Journal titles	131

Scientific degrees and titles granted in the units of PAS in 2011 (by PAS division)

	Scientific degrees and titles		
	Doctorate degrees	DSc (<i>habilitation</i>) degrees	Professorship nominations
Division I	22	13	9
Division II	24	20	15
Division III	57	31	21
Division IV	30	5	7
Division V	17	8	4
Total	150	77	56

Didactic activity of PAS scholars in institutions of higher education in 2011 (by PAS division)

	The number of people teaching in universities
Division I	406
Division II	252
Division III	269
Division IV	206
Division V	81
Total	1 214

Foreign Scientific Centers

■ CENTER FOR HISTORICAL RESEARCH IN BERLIN

ZENTRUM FÜR HISTORISCHE
FORSCHUNG BERLIN DER POLNISCHEN
AKADEMIE DER WISSENSCHAFTEN

Majakowskiring 47, 13156 Berlin
phone: 49 30 486 285 40
fax: 49 30 486 285 56
e-mail: info@panberlin.de
www.cbh.pan.pl
Director: Robert Traba

■ SCIENTIFIC CENTER IN MOSCOW

ПОСТОЯННЫЙ ПРЕДСТАВИТЕЛЬ
ПОЛЬСКОЙ АКАДЕМИИ НАУК В
МОСКВЕ

Klimaszkina 4, 123557 Moskwa
phone: 7 495 23 11 710
fax: 7 495 23 11 711
e-mail: PAN.Moskwa@mail.ru
www.panmoskwa.pl
Acting Director: Kazimierz Waćkowski

■ SCIENTIFIC CENTER IN PARIS

CENTRE SCIENTIFIQUE DE L'ACADÉMIE
POLONAISE DES SCIENCES À PARIS

74 rue Lauriston, 75116 Paris
phone: 33 156 90 18 34
fax: 33 147 55 46 97
e-mail: sekretariat.parispan@free.fr
www.academie-polonaise.org
Director: Zbigniew T. Kuźnicki*

■ SCIENTIFIC CENTER IN ROME

ACCADEMIA POLACCA DELLE SCIENZE
– BIBLIOTECA E CENTRO DI STUDI
A ROMA

vicolo Doria 2, Palazzo Doria, 00187 Roma
phone: 39 06 679 21 70
fax: 39 06 679 40 87
e-mail: accademia@accademiapolacca.it
www.accademiapolacca.it
Director: Leszek Kuk

■ SCIENTIFIC CENTER IN VIENNA

WISSENSCHAFTLICHES ZENTRUM
DER POLNISCHEN AKADEMIE
DER WISSENSCHAFTEN IN WIEN

Boerhaavegasse 25, 1030 Wien
phone: 431 713 59 29
fax: 431 713 59 29 550
e-mail: office@viennapan.org
www.viennapan.org
Director: Bogusław Dybaś

■ POLISH SCIENCE CONTACT AGENCY

“POLSCA” – PAS SCIENTIFIC CENTER
IN BRUSSELS

Rue du Trône 98, B-1050 Bruxelles
phone: 00 32 22134160
fax: 00 32 22134169
e-mail: polsca@skynet.be
www.polsca.eu
Director: Jan Krzysztof Frąckowiak

* Zbigniew T. Kuźnicki has been director of the PAS Scientific Center in Paris since 1 September 2012, prior to which Jerzy Pielaszek was its director.

Research Units and Branches of the Polish Academy of Sciences



Research Units

Division One: Humanities and Social Sciences

- **Institute of Archaeology and Ethnology** (Warszawa)
e-mail: director@iaepan.edu.pl
www.iaepan.edu.pl
- **Institute of Art** (Warszawa)
e-mail: ispan@ispan.pl
www.ispan.pl
- **Institute of Economic Sciences** (Warszawa)
e-mail: inepan@inepan.waw.pl
www.inepan.waw.pl
- **Institute of Legal Studies** (Warszawa)
e-mail: inp@inp.pan.pl
www.inp.pan.pl
- **Institute of Literary Research** (Warszawa)
e-mail: ibadlit@ibl.waw.pl
www.ibl.waw.pl
- **Institute of Mediterranean and Oriental Cultures** (Warszawa)
e-mail: zaspan@zaspan.waw.pl,
csnec@zkppan.waw.pl
www.iksio.pan.pl
- **Institute of Philosophy and Sociology** (Warszawa)
e-mail: secretar@ifspan.waw.pl
www.ifspan.waw.pl
- **Institute of Political Studies** (Warszawa)
e-mail: politic@isppan.waw.pl
www.isppan.waw.pl
- **Institute of Psychology** (Warszawa)
e-mail: sekretariat@psych.pan.pl
www.psych.pan.pl
- **Institute of Rural and Agricultural Development** (Warszawa)
e-mail: irwir@irwirpan.waw.pl
www.irwirpan.waw.pl
- **Institute of Slavic Studies** (Warszawa)
e-mail: ispan@ispan.waw.pl
www.ispan.waw.pl
- **Institute of the Polish Language** (Kraków)
e-mail: ijp@ijp-pan.krakow.pl
www.ijp-pan.krakow.pl
- **Ludwik and Aleksander Birkenmajer Institute of the History of Science** (Warszawa)*
e-mail: ihn@ihnpan.waw.pl
www.ihnpan.waw.pl
- **Tadeusz Manteuffel Institute of History** (Warszawa)
e-mail: ihpan@ihpan.edu.pl
www.ihpan.edu.pl

* On 17 May 2011 the Institute of the History of Science changed its name into the Ludwik and Aleksander Birkenmajer Institute of the History of Science.

Auxiliary research units supervised by Division One

- **PAS Archives in Warsaw**
(Warszawa)
e-mail: archiwum@apan.waw.pl
www.apan.waw.pl
- **The Gdańsk Library of the Polish Academy of Sciences**
(Gdańsk)
e-mail: bgpan@bgpan.gda.pl
www.bgpan.gda.pl
- **The Kórnik Library of the Polish Academy of Sciences**
(Kórnik)
e-mail: bkpan@amu.edu.pl
www.bkpan.poznan.pl

Division Two: Biological and Agricultural Sciences

- **Bohdan Dobrzański Institute of Agrophysics** (Lublin)
e-mail: agrof@demeter.ipan.lublin.pl
www.ipan.lublin.pl
- **European Regional Centre for Ecohydrology** (Łódź)
e-mail: erce@erce.unesco.lodz.pl
www.erce.unesco.lodz.pl
- **Franciszek Górski Institute of Plant Physiology** (Kraków)
e-mail: ifr@ifr-pan.krakow.pl
www.ifr-pan.krakow.pl
- **Institute of Agricultural and Forest Environment** (Poznań)
e-mail: sprzyjem@man.poznan.pl
www.isrl.poznan.pl
- **Institute of Animal Reproduction and Food Research** (Olsztyn)
e-mail: institute@pan.olsztyn.pl
www.pan.olsztyn.pl
- **Institute of Biochemistry and Biophysics** (Warszawa)
e-mail: secretariate@ibb.waw.pl
www.ibb.waw.pl
- **Institute of Bioorganic Chemistry** (Poznań)
e-mail: ibch@ibch.poznan.pl
www.ibch.poznan.pl
- **Institute of Dendrology** (Kórnik)
e-mail: idkornik@man.poznan.pl
www.idpan.poznan.pl
- **Institute of Genetics and Animal Breeding** (Jastrzębiec)
e-mail: sekretariat@ighz.pl
www.ighz.edu.pl
- **Institute of Nature Conservation** (Kraków)
e-mail: okarma@iop.krakow.pl
www.iop.krakow.pl
- **Institute of Plant Genetics** (Poznań)
e-mail: office@igr.poznan.pl
www.igr.poznan.pl
- **Institute of Systematics and Evolution of Animals** (Kraków)
e-mail: office@isez.pan.krakow.pl
www.isez.pan.krakow.pl
- **Jan Kielanowski Institute of Animal Physiology and Nutrition** (Jabłonna)
e-mail: office@ifzz.pan.pl
www.ifzz.pl
- **Mammal Research Institute** (Białowieża)
e-mail: mripas@zbs.bialowieza.pl
www.zbs.bialowieza.pl
- **Museum and Institute of Zoology** (Warszawa)
e-mail: sekretariat@miiz.waw.pl
www.miiz.waw.pl

- **Nencki Institute of Experimental Biology**
(Warszawa)
e-mail: dyrekcja@nencki.gov.pl,
sek@nencki.gov.pl
www.nencki.gov.pl
- **Roman Kozłowski Institute of Paleobiology**
(Warszawa)
e-mail: paleo@twarda.pan.pl
www.paleo.pan.pl
- **Witold Stefański Institute of Parasitology**
(Warszawa)
e-mail: iparpas@twarda.pan.pl
www.ipar.pan.pl
- **Władysław Szafer Institute of Botany**
(Kraków)
e-mail: iboffice@ib-pan.krakow.pl,
ibpan@botany.pl
www.botany.pl

Auxiliary research units supervised by Division Two

- **PAS Botanical Garden – Center for Biological Diversity Conservation in Powsin**
(Warszawa)
e-mail: ob.sekr@obpan.pl
www.ogrod-powsin.pl
- **PAS Center for Ecological Research in Dziekanów Leśny**
(Dziekanów Leśny)
e-mail: cbe@cbe-pan.pl
www.cbe-pan.pl
- **PAS Department of Antarctic Biology in Warsaw**
(Warszawa)
e-mail: zba@arctowski.pl
www.arctowski.pl
- **PAS Institute of Anthropology in Wrocław**
(Wrocław)
e-mail: zapan@antro.pan.wroc.pl
www.antro.pan.wroc.pl
- **PAS Institute of Ichthyobiology and Aquaculture in Gołysz**
(Gołysz)
e-mail: zigr@golysz.pan.pl
www.golysz.pan.pl
- **PAS Research Station for Ecological Agriculture and Preservation of Native Breeds in Popielno**
(Popielno)
e-mail: popielno@pan.pl
www.turysta.net.pl/atrakcje/pan

Division Three: Mathematics, Physics, Chemistry, and Earth Sciences

- **Center for Molecular and Macromolecular Studies (Łódź)**
e-mail: cbmm@bilbo.cbmm.lodz.pl
www.cbmm.lodz.pl
- **Center for Theoretical Physics (Warszawa)**
e-mail: cft@cft.edu.pl
www.cft.edu.pl
- **Center of Polymer and Carbon Materials (Gliwice)**
e-mail: secretariat@cmpw-pan.edu.pl
www.cmpw-pan.edu.pl
- **Henryk Niewodniczański Institute of Nuclear Physics (Kraków)**
e-mail: dyrektor@ifj.edu.pl
www.ifj.edu.pl
- **Institute of Geological Sciences (Warszawa)**
e-mail: ingpan@twarda.pan.pl
www.ing.pan.pl
- **Institute of Geophysics (Warszawa)**
e-mail: sn@igf.edu.pl
www.igf.edu.pl

- **Institute of High Pressure Physics** (Warszawa)
e-mail: sylvek@unipress.waw.pl
www.unipress.waw.pl
- **Institute of Mathematics** (Warszawa)
e-mail: im@impan.gov.pl
www.impan.gov.pl
- **Institute of Molecular Physics** (Poznań)
e-mail: office@ifmpan.poznan.pl
www.ifmpan.poznan.pl
- **Institute of Oceanology** (Sopot)
e-mail: office@iopan.gda.pl
www.iopan.gda.pl
- **Institute of Organic Chemistry** (Warszawa)
e-mail: icho-s@icho.edu.pl
www.icho.edu.pl
- **Institute of Physical Chemistry** (Warszawa)
e-mail: sekn@ichf.edu.pl
www.ichf.edu.pl
- **Institute of Physics** (Warszawa)
e-mail: director@ifpan.edu.pl
www.ifpan.edu.pl
- **International Laboratory of High Magnetic Fields and Low Temperatures** (Wrocław)
e-mail: intl@alpha.ml.pan.wroc.pl
http://alpha.mlspmint.pan.wroc.pl
- **Jerzy Haber Institute of Catalysis and Surface Chemistry** (Kraków)*
e-mail: ncwitko@cyf-kr.edu.pl
www.ik-pan.krakow.pl
- **Nicolaus Copernicus Astronomical Center** (Warszawa)
e-mail: camk@camk.edu.pl
www.camk.edu.pl
- **Space Research Center** (Warszawa)
e-mail: cbk@cbk.waw.pl
www.cbk.waw.pl
- **Włodzimierz Trzebiatowski Institute of Low Temperature and Structure Research** (Wrocław)
e-mail: intibs@int.pan.wroc.pl
www.int.pan.wroc.pl

Auxiliary research units supervised by Division Three

- **PAS Museum of the Earth in Warsaw** (Warszawa)
e-mail: muzeumziemi@mz-pan.pl,
sekretariat@mz-pan.pl
www.mz-pan.pl

Division Four: Engineering Sciences

- **Aleksander Krupkowski Institute of Metallurgy and Materials Science** (Kraków)
e-mail: office@imim-pan.krakow.pl
www.imim.pl
- **Institute of Chemical Engineering** (Gliwice)
e-mail: secret@iich.gliwice.pl
www.iich.gliwice.pl
- **Institute of Computer Science** (Warszawa)
e-mail: ipi@ipipan.waw.pl
www.ipipan.waw.pl
- **Institute of Environmental Engineering** (Zabrze)
e-mail: ipis@ipis.zabrze.pl
www.ipis.zabrze.pl

* On 1 January 2011 the Institute of Catalysis and Surface Chemistry changed its name into the Jerzy Haber Institute of Catalysis and Surface Chemistry.

- **Institute of Fundamental Technological Research** (Warszawa)
e-mail: director@ippt.gov.pl
www.ippt.gov.pl
- **Institute of Hydroengineering** (Gdańsk)
e-mail: sekr@ibwpan.gda.pl
www.ibwpan.gda.pl
- **Institute of Theoretical and Applied Informatics** (Gliwice)
e-mail: office@iitis.gliwice.pl
www.iitis.gliwice.pl
- **Maciej Nałęcz Institute of Biocybernetics and Biomedical Engineering** (Warszawa)
e-mail: ibib@ibib.waw.pl
www.ibib.waw.pl
- **Mineral and Energy Economy Research Institute** (Kraków)
e-mail: centrum@min-pan.krakow.pl
www.min-pan.krakow.pl
- **Robert Szewalski Institute of Fluid-Flow Machinery** (Gdańsk)
e-mail: imp@imp.gda.pl
www.imp.gda.pl
- **Stanisław Leszczycki Institute of Geography and Spatial Organization** (Warszawa)
e-mail: igipzpan@twarda.pan.pl
www.igipz.pan.pl
- **Strata Mechanics Research Institute** (Kraków)
e-mail: biuro12@img-pan.krakow.pl
www.img-pan.krakow.pl
- **Systems Research Institute** (Warszawa)
e-mail: ibs@ibspan.waw.pl
www.ibspan.waw.pl

Division Five: Medical Sciences

- **Institute of Human Genetics** (Poznań)
e-mail: igcz@rose.man.poznan.pl
www.igcz.poznan.pl
- **Institute of Medical Biology** (Łódź)
e-mail: aobidowska@cbm.pan.pl
www.cbm.pan.pl
- **Institute of Pharmacology** (Kraków)
e-mail: ifpan@if-pan.krakow.pl
www.if-pan.krakow.pl
- **Ludwik Hirsfeld Institute of Immunology and Experimental Therapy** (Wrocław)
e-mail: secretary@iitd.pan.wroc.pl
www.iitd.pan.wroc.pl
- **Mirosław Mossakowski Medical Research Center** (Warszawa)
e-mail: sekretariat@cmdik.pan.pl
www.cmdik.pan.pl

Branches

- **The Gdańsk Branch of the Polish Academy of Sciences** (Gdańsk)
e-mail: office@opan.gda.pl
www.gdansk.pan.pl
- **The Kraków Branch of the Polish Academy of Sciences** (Kraków)
e-mail: krakow@pan.pl
<http://krakow.pan.pl>
- **The Katowice Branch of the Polish Academy of Sciences** (Katowice)
e-mail: katowice@pan.pl
www.katowice.pan.pl
- **The Lublin Branch of the Polish Academy of Sciences** (Lublin)
e-mail: pan-ol@hektor.umcs.lublin.pl
www.pan-ol.lublin.pl

■ **The Łódź Branch of the Polish Academy of Sciences** (Łódź)

e-mail: oddzial@pan.lodz.pl
www.pan.lodz.pl

■ **The Poznań Branch of the Polish Academy of Sciences** (Poznań)

e-mail: opan@man.poznan.pl
www.pan.poznan.pl

■ **The Wrocław Branch of the Polish Academy of Sciences** (Wrocław)

e-mail: kontakt@oddz.pan.wroc.pl
www.pan.wroc.pl

Other Units

■ **Henryk Frąckiewicz Center for Laser Technology of Metals of Kielce University of Technology and the Polish Academy of Sciences** (Kielce)

e-mail: zbigwes@eden.tu.kielce.pl
www.tu.kielce.pl

■ **International Institute of Molecular and Cell Biology** (Warszawa)*

e-mail: secretariat@iimcb.gov.pl
www.iimcb.gov.pl

Scientific and Task Force Committees

Task Force Committees

Committees affiliated with the Presidium of the Academy

- **The Committee on Bioethics**
ul. Krakowskie Przedmieście 3,
00-927 Warszawa,
Instytut Filozofii, Uniwersytet Warszawski
e-mail: j.rozynska@uw.edu.pl
- **The Committee on Spatial Economy and Regional Planning**
Pałac Kultury i Nauki, 00-901 Warszawa,
e-mail: kpzk@pan.pl
- **The Committee on Polar Research**
ul. Księcia Janusza 64, 01-452 Warszawa,
Instytut Geofizyki PAN
e-mail: kbp@igf.edu.pl
- **The “Poland 2000 Plus” Forecast Committee**
Pałac Kultury i Nauki, 00-901 Warszawa,
e-mail: komprog@pan.pl
- **The Committee for Research on Water-Related Threats**
ul. Bukowska 19, 60-809 Poznań,
Instytut Środowiska Rolniczego i Leśnego PAN
e-mail: matczak@amu.edu.pl
- **The Council for Scientific Societies**
Pałac Kultury i Nauki, 00-901 Warszawa,
e-mail: rtn@pan.pl
- **The Committee on Space and Satellite Research**
ul. Bartycka 18A, 00-716 Warszawa,
Centrum Badań Kosmicznych PAN
e-mail: bpop@cbk.waw.pl
- **The Council for the Polish Language**
ul. Nowy Świat 72, 00-330 Warszawa,
e-mail: rjp@rjp.pl
- **The Council for the Promotion of the Public Understanding of Science**
ul. Pawińskiego 5a, 02-106 Warszawa,
Instytut Biochemii i Biofizyki PAN
e-mail: m.fikus@ibb.waw.pl

Committees affiliated with Division One

- **The Committee on Agricultural Economy and Rural Development**
ul. Nowoursynowska 166, 02-787 Warszawa,
Szkoła Główna Gospodarstwa Wiejskiego
e-mail: dwne@sggw.pl
- **The Committee on Ethics in Science**
ul. Krakowskie Przedmieście 3,
00-927 Warszawa,
Instytut Filozofii, Uniwersytet Warszawski
e-mail: kenpan.wfs@uw.edu.pl

- **The Committee on Human Migration Research**
ul. Banacha 2B, 02-097 Warszawa,
Szkoła Wyższa Psychologii Społecznej

- **The Committee on Science Studies**
ul. Fosa Staromiejska 1a, 87-100 Toruń,
Instytut Filozofii,
Uniwersytet Mikołaja Kopernika
e-mail: zeglen@uni.torun.pl

Committees affiliated with Division Four

- **The Committee on Energy**
ul. Konarskiego 18, 44-100 Gliwice,
Instytut Maszyn i Urządzeń Energetycznych,
Politechnika Śląska
e-mail: tadeusz.chmielniak@polsl.pl
- **The Committee on Water Management**
ul. Podleśna 61, 01-673 Warszawa,
Instytut Meteorologii i Gospodarki Wodnej
e-mail: maciej.maciejewski@imgw.pl
- **The Committee on Ergonomics**
ul. Grzegorzeczka 20, 31-531 Kraków,
Collegium Medicum, Uniwersytet Jagielloński
e-mail: mmpokors@cyf-kr.edu.pl

Scientific Committees at the Divisions of the Academy

Division One: Humanities and Social Sciences

- **The Committee on Ancient Culture**
ul. Nowy Świat 72, 00-330 Warszawa,
Instytut Historii Nauki PAN
e-mail: Jerzy_Danielewicz@poczta.onet.pl
- **The Committee on Ethnological Sciences**
ul. Św. Marcina 78, 61-809 Poznań,
Uniwersytet im. A. Mickiewicza
e-mail: vorbrich@amu.edu.pl
- **The Committee on Art Studies**
ul. Długa 26/28, 00-950 Warszawa,
Instytut Sztuki PAN
e-mail: knos@onet.eu
- **The Committee on Financial Sciences**
Pałac Kultury i Nauki, 00-901 Warszawa,
skr.poczt. 24
e-mail: Andrzej.Gospodarowicz@ae.wroc.pl
- **The Committee on Cultural Studies**
Pałac Kultury i Nauki, 00-901 Warszawa,
skr.poczt. 24
e-mail: l.kolankiewicz@uw.edu.pl
- **The Committee on Historical Sciences**
Rynek Starego Miasta 29/31,
00-272 Warszawa,
Instytut Historii im. T. Manteuffla PAN
e-mail: jrudzinska@ihpan.edu.pl
- **The Committee on Demographic Studies**
al. Niepodległości 162, 02-554 Warszawa,
Instytut Statystyki i Demografii,
Szkoła Główna Handlowa
e-mail: ewaf@sgh.waw.pl
- **The Committee on History of Science and Technology**
ul. Nowy Świat 72, 00-330 Warszawa,
Instytut Historii Nauki PAN
e-mail: ihn@ihnpan.waw.pl
- **The Committee on Economic Sciences**
Pałac Kultury i Nauki, 00-901 Warszawa,
skr.poczt. 24
e-mail: emagda@inepan.waw.pl
- **The Committee on Labor and Social Policy Sciences**
ul. Bellottiego 3b, 01-022 Warszawa,
Instytut Pracy i Spraw Socjalnych
e-mail: lucma@it.com.pl

- **The Committee on Legal Sciences**
Pałac Kultury i Nauki, 00-901 Warszawa,
skr.poczt. 24
e-mail: wydzial1@pan.pl
- **The Committee on Linguistics**
Pałac Kultury i Nauki, 00-901 Warszawa,
skr.poczt. 24
e-mail: wydzial1@pan.pl
- **The Committee on Literature Studies**
ul. Nowy Świat 72, 00-330 Warszawa,
Instytut Badań Literackich PAN
e-mail: sobieska@o2.pl
- **The Committee on Organizational
and Management Sciences**
ul. Madalińskiego 31/33, 02-544 Warszawa,
Katedra Zarządzania w Gospodarce,
Szkoła Główna Handlowa
e-mail: sylwester.gregorczyk@gmail.com
- **The Committee on Oriental Studies**
ul. Krakowskie Przedmieście 26/28,
00-927 Warszawa,
Instytut Orientalistyczny,
Uniwersytet Warszawski
e-mail: m.kozłowska@uw.edu.pl
- **The Committee on Pedagogical Sciences**
ul. Mokotowska 16/20, 01-561 Warszawa,
Wydział Pedagogiczny,
Uniwersytet Warszawski
e-mail: boguslawliwerski@gmail.com
- **The Committee on Philosophical Sciences**
ul. Nowy Świat 72, 00-330 Warszawa,
e-mail: Adam_Grobler@interia.pl
- **The Committee on Political Sciences**
ul. Polna 18/20, 00-625 Warszawa,
Instytut Studiów Politycznych PAN
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- **The Committee on Prehistoric
and Protohistoric Sciences**
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- **The Committee on Psychology**
ul. Chodakowska 19/31, 03-815 Warszawa,
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- **The Committee on Slavic Studies**
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- **The Committee on Sociology**
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- **The Committee on Statistics
and Econometrics**
ul. Bogucicka 14, 40-226 Katowice,
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- **The Committee on Theological Sciences**
al. Raclawickie 14, 20-950 Lublin,
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Uniwersytet Lubelski Jana Pawła II
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Division Two: Biological and Agricultural Sciences

- **The Committee on Agricultural Engineering**
ul. Balicka 104, 30-149 Kraków,
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- **The Committee on Animal Sciences**
ul. Oczapowskiego 5, 10-719 Olsztyn,
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- **The Committee on Agrophysics**
ul. Doświadczalna 4, 20-290 Lublin,
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- **The Committee on Anthropology**
ul. Ingardena 6, 30-060 Kraków,
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- **The Committee on Biochemistry and Biophysics**
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- **The Committee on Biotechnology**
ul. Stefanowskiego 4/10, 90-924 Łódź,
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e-mail: STANB@p.lodz.pl
- **The Committee on Botany**
ul. Lubicz 46, 31-512 Kraków,
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- **The Committee on Cell Biology**
ul. Pasteura 3, 02-093 Warszawa,
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- **The Committee on Ecology**
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- **The Committee on Evolutionary and Theoretical Biology**
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- **The Committee on Food Sciences**
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e-mail: knoz_pan@sggw.pl
- **The Committee on Forestry Sciences**
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- **The Committee on Horticultural Sciences**
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- **The Committee on Land Reclamation and Agricultural Environment Engineering**
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- **The Committee on Management of Mountain Regions**
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- **The Committee on Microbiology**
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- **The Committee on Nature Conservation**
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- **The Committee on Parasitology**
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e-mail: pnowosad@ump.edu.pl
- **The Committee on Plant Cultivation**
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- **The Committee on Plant Physiology, Genetics and Breeding**
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- **The Committee on Plant Protection**
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- **The Committee on Soil Science and Agricultural Chemistry**
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- **The Committee on the Biology of Domestic Animal Reproduction**
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- **The Committee on Veterinary Sciences**
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- **The Committee on Wood Technology**
ul. Nowoursynowska 159, blok 34,
02-776 Warszawa,
Zakład Tworzyw Drzewnych,
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- **The Committee on Zoology**
ul. Sienkiewicza 21, 50-335 Wrocław,
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Division Three: Mathematics, Physics, Chemistry and Earth Sciences

- **The Committee on Analytical Chemistry**
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- **The Committee on Astronomy**
ul. Bartycka 18, 00-716 Warszawa,
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- **The Committee on Chemistry**
ul. Kasprzaka 44/52, 01-224 Warszawa,
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e-mail: komitet.chemii@icho.edu.pl
- **The Committee on Crystallography**
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Instytut Niskich Temperatur i Badań
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- **The Committee on Geographical Sciences**
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- **The Committee on Geological Sciences**
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- **The Committee on Geophysics**
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- **The Committee on Maritime Research**
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e-mail: office@iopan.gda.pl
- **The Committee on Mathematics**
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- **The Committee on Mineralogical Sciences**
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- **The Committee on Physics**
al. Lotników 32/46, 00-668 Warszawa,
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- **The Committee on Quaternary Research**
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Division Four: Engineering Sciences

- **The Committee on Acoustics**
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- **The Committee on Architecture and Urban Planning**
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- **The Committee on Automatic Control and Robotics**
ul. Nowowiejska 15/19, 00-665 Warszawa,
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Stosowanej, Politechnika Warszawska
e-mail: k.malinowski@ia.pw.edu.pl
- **The Committee on Biocybernetics and Biomedical Engineering**
ul. Trojdena 4, 02-019 Warszawa,
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- **The Committee on Chemical and Process Engineering**
ul. Wólczańska 213/215, 90-924 Łódź,
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- **The Committee on Civil Engineering and Hydroengineering**
ul. Armii Ludowej 16, 00-637 Warszawa,
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szawska
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- **The Committee on Electrical Engineering**
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- **The Committee on Electronics and Telecommunications**
ul. Nowowiejska 15/19, 00-665 Warszawa,
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- **The Committee on Environmental Engineering**
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- **The Committee on Geodesy**
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- **The Committee of Informatics**
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- **The Committee on Machine Building**
Al. Jana Pawła II 37, 31-864 Kraków,
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e-mail: kbm-pan-sekr@m6.mech.pk.edu.pl
- **The Committee on Management of Mineral Resources**
ul. Wybickiego 7, 31-261 Kraków,
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i Energią PAN
e-mail: mark@min-pan.krakow.pl
- **The Committee on Materials Science**
ul. Krasieńskiego 8, 40-019 Katowice,
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Politechnika Śląska
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- **The Committee on Mechanics**
ul. Pawińskiego 5b, 02-106 Warszawa,
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e-mail: bblach@ippt.gov.pl
- **The Committee on Metallurgy**
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- **The Committee on Metrology and Research Equipment**
ul. Prusa 53/55, 50-317 Wrocław,
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- **The Committee on Mining**
ul. W. Reymonta 27, 30-059 Kraków,
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- **The Committee on Production Engineering**
ul. Ozimska 75, 45-370 Opole,
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- **The Committee on Thermodynamics and Combustion**
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Instytut Maszyn Ciepłych
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- **The Committee on Transport**
ul. J. Chłopickiego 50, 04-275 Warszawa,
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Division Five: Medical Sciences

- **The Committee on Clinical Sciences**
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- **The Committee on Public Health**
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e-mail: jzejda@sum.edu.pl
- **The Committee on Human Development**
al. Dzieci Polskich 20, 04-730 Warszawa,
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Centrum Zdrowia Dziecka
e-mail: w.kawalec@czd.pl
- **The Committee on Human Genetics and Molecular Pathology**
ul. Strzeszyńska 32, 60-479 Poznań
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e-mail: slomski@up.poznan.pl
- **The Committee on Human Nutrition Science**
ul. Nowoursynowska 159c, 02-776 Warszawa,
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- **The Committee on Immunology and Etiology of Human Infections**
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Zakład Immunologii Klinicznej,
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- **The Committee on Medical Physics, Radiobiology, and X-Ray Imaging**
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- **The Committee on Neurobiology**
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e-mail: nfvetula@cyf-kr.edu.pl
- **The Committee on Neurological Sciences**
ul. Jaczewskiego 8, 20-090 Lublin,
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- **The Committee on Physiological and Pharmacologica Sciences**
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- **The Committee on Rehabilitation, Physical Education and Social Integration**
al. Paderewskiego 35, 51-612 Wrocław,
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- **The Committee on Therapy and Drug Research**
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