

Annual
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Report

2011

POLISH ACADEMY of SCIENCES

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Address by PAS President Professor Michał Kleiber

The year 2010 marked a significant moment in two periods of activity for the Polish Academy of Sciences (PAS) – the end of the previous, 2007-2010 term of office for the Academy authorities, and the start of reforms changing the way Polish science is organized and funded, as initiated by the *Acts of 30 April 2010 on the Polish Academy of Sciences, on the National Science Center, on the National Research and Development Center, on Research Institutes, and on the Principles for Research Funding*. The Academy has faced a challenging task: during the legislative process provisions optimal from the Academy's standpoint needed to be secured within a relatively short period of time, and after this package of laws was enacted the Academy has had to launch the appropriate procedures to adapt its own structure in line with the new legal framework.

The key elements of the organizational changes include the creation of a new structure and new tasks for the Divisions of the Academy. Starting on 1 January 2011, the divisions are now as follows: Division I – Humanities and Social Sciences, Division II – Biological and Agricultural Sciences, Division III – Exact Sciences and Earth Sciences, Division VI – Technical Sciences, and Division V – Medical Sciences. Management roles in these divisions are held by deans, chairmen, and deputy chairmen of the council of provost. Another important change is the presence on the superintendent councils of outstanding representatives of foreign scientific communities, as well as Polish scholars who are not members of the Academy. The duties of the four vice presidents of the Academy, overseeing the activity of the Divisions in line with their own specializations, have been adapted to fit the new statutory framework. The new position of Chancellor has been added to the Academy's governing bodies. The *Act on the Polish Academy of Sciences* expanded the structure of the elected body of Academy members, additionally introducing – alongside its existing elements – an academy of junior scholars, a committee for issues of ethics in science, and an audit committee. The status of “senior member” has been introduced for national members of the Academy over 70 years of age. The basic research unit of the Academy is now the institute. The above *Act* introduces the category of PAS research center, as a strongly interdisciplinary unit that pursues large-scale research programs and draws



K. Raimka

together contributions from PAS as well as non-PAS institutions – research and research-supporting establishments from Poland and abroad. The category of supplementary PAS research unit, in turn, includes: archives, libraries, museums, botanical gardens, and foreign research centers – as well as research centers without autonomous legal status, which have not yet completed the process of restructuring and have not been transformed into institutes. A process of internal reorganization of the Academy has also begun, with the aim of ascertaining the proper affiliation of the various Academy members, committees, and research units to the respective Division under the new framework.

Elections were held for PAS vice presidents for the 2011-2014 term. In making these decisions, the members of the Academy were guided by the criteria of research specialization (in order to ensure the necessary capacity to oversee the work of the Divisions), the need to maintain territorial representation, and the principle of having the higher-education community represented among the PAS management. The vice presidents were elected as follows (with affiliations according to new framework in force as of 1 Jan 2011): Mirosława Marody (corresponding member of the

Academy, Division I – Humanities and Social Sciences), Ryszard Górecki (corresponding member of the Academy, Division II – Biological and Agricultural Sciences), Marek Chmielewski (corresponding member of the Academy, Division III – Exact Sciences and Earth Sciences), and Andrzej Górski (corresponding member of the Academy, Division V – Medical Sciences).

When I presented the tenets for the Academy's program of activity for the years 2011-2014 after myself

being reelected as PAS president for another term, I pointed out the need to continue the activities begun during the previous term, in specific the efforts to strengthen the role of the Academy as a state research institution, to bolster the position of the PAS institutes as the country's leading research establishments, and to strengthen the status of the Academy's elected body of scientists distinguished by their achievements and the authority they hold among the scientific community.

Michał Kleiber

President of the Polish Academy of Sciences

Presidium of the Polish Academy of Sciences

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- **Wojciech J. Stec**,
Full Member of the Academy

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- Professor **Marian Truszczyński**,
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- Professor **Stanisław Waltoś**,
Full Member of the Academy
- Professor **Jan Węglarz**,
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- Professor **Stefan Węgrzyn**,
Full Member of the Academy
- Professor **Władysław Włosiński**,
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Markiewicz | Władysław Markiewicz |
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Social Sciences

Division I – Social Sciences embraces a wide range of both the social sciences and the humanities. The Division consists of 14 institutes and 25 scientific committees. The institutes and the committees publish their own journals and book series. During the current term of office, the Division has been headed jointly by its chairman, Prof. Stanisław Mosakowski, and by two deputy chairs: Prof. Mirosława Drozd-Piasecka and Prof. Andrzej Wiatrak.

As of the end of 2010 the Division had 50 national members (27 full members and 23 corresponding members), plus 37 foreign members of Academy. It is with deep sorrow that we note that full members of the Academy Juliusz Bardach and Gerard Labuda and corresponding members of the Academy Krzysztof Skubiszewski and Wiesław Sadowski passed away in 2010.

Two plenary sessions of the Division and one election meeting to select national and foreign members of the Academy were held in 2010.

During the first plenary session, held on March 11, the activities of three institutes were evaluated: the Institute of Psychology (reviewers Jerzy Brzeziński, full member of the Academy, and Edward Nęcka, corresponding member of the Academy), the Institute of Legal Studies (reviewers Zbigniew Radwański and Stanisław Waltoś, full members of the Academy) and the Institute of Political Studies (reviewers Karol Modzelewski, full member of the Academy, and Janusz Reykowski, corresponding member of the Academy). During the same session the candidacy of Prof. Jerzy Kolendo to be an honorary chairman of the Scientific Committee on Ancient Culture was considered, a discussion was held on a report presented by Ewa Łętowska, full member of the Academy, concerning the work of a team evaluating progress on the Polish Biographical Dictionary project, and a report was delivered on the 2010 budgetary funding for statutory activity of the institutes.

During the election meeting, held on April 22, four candidates for full membership (Jacek Fisiak, Ewa Łętowska, Karol Modzelewski, Hubert Orłowski) and seven candidates for corresponding membership (Jerzy Axer – classical philology, Stanisław Gajda – linguistics, Slavic studies,

Mirosława Marody – sociology, Ryszard Nycz – literary studies, Jerzy Strzelczyk – history, Bogdan Wojciszke – psychology, Jan Woleński – philosophy) were elected. Maurice Aymard, a French historian, was elected to become a foreign member of the Polish Academy of Sciences.

At the second plenary meeting held on November 25, the chairman of Division I summed up the Division's work; the evaluation of the research institutes' activity in the 2007-2010 term was also summed up; the candidacies of Academy members to sit on the research councils of the institutes, libraries and archives in 2011-2014 term were approved; the Division's structure and tasks as laid forth in the new Act on the Polish Academy of Sciences were discussed; a resolution on preparing a necessary commentary to the new Act on the Polish Academy of Sciences was voted through; and a candidate to represent Division I in the PAS Presidium was appointed. The Division granted its annual research awards to the following individuals: the Fryderyk Skarbek Award in economics went to Assoc. Prof. Michał Majsterek at the University of Lodz for the work *Wielowymiarowa analiza kointegracyjna w ekonomii* (Multidimensional Cointegrational Analysis in Economics); the Tadeusz Kotarbiński Award in philosophy to Assoc. Prof. Tadeusz Szubka at the University of Szczecin for the work *Filozofia analityczna. Koncepcje, metody, ograniczenia* (Analytic Philosophy – Concepts, Methods, Limitations); in art history to Assoc. Prof. Grażyna Jurkowlaniec at the University of Warsaw for the work *Epoka nowożytna wobec średniowiecza. Pamiątki przeszłości, cudowne wizerunki, dzieła sztuki* (Modern Period vs. Middle Ages – Memorabilia, Wonderful Images, Works of Art); the Władysław Witwicki Award in psychology to Prof. Paweł Boski from the Institute of Psychology, Polish Academy of Sciences, and the Warsaw School of Social Sciences and Humanities for the work *Kulturowe ramy zachowań społecznych. Podręcznik psychologii kulturowej* (Cultural Frames of Social Behavior – A Cultural Psychology Textbook); the Ludwik Krzywicki Award in sociology to Assoc. Prof. Krzysztof Czekał at the Katowice School of Economics, for the work *Socjologia szkoły*

chicagowskiej i jej recepcja w Polsce (Sociology of the Chicago School and Its Reception in Poland).

The Research Center for Mediterranean Archaeology and the Center for Studies on Non-European Countries of the Polish Academy of Sciences were dissolved on August 31, 2010. The two centers formed the basis for establishing the new Institute of Mediterranean and Oriental Cultures, which began operations on September 1, 2010.

The competition to fill the post of director of the Institute of Literary Research of the Polish Academy of Sciences ended with the appointment of Prof. Mikołaj Sokołowski by the Academy's President.

Members of Division I received numerous awards and distinctions in 2010. The title of *doctor honoris causa* was bestowed upon the following members of the Division: Jerzy M. Brzeziński by the University of Gdańsk, Stanisław Gajda by the Pedagogical University of Kraków, Franciszek Gruzca by Tongji University (the largest and oldest university in Shanghai), Henryk Olszewski by the Jagiellonian University, and Henryk Samsonowicz by the Jan Długosz University in Częstochowa. Jacek Fisiak was appointed a member of the Presidium of the European Academy of Sciences, Arts and Letters and Andrzej K. Kozmiński was appointed a member of the National Development Council at the office of the President of Poland. The Warsaw Literary Premiere Award, granted by Klub Księgarza and Pen-Club, went to Michał Głowiński for the work *Kręgi obcości* (Circles of Strangeness) and Andrzej Walicki for the work *Idee i ludzie. Próba autobiografii* (Ideas and People – An Attempt at Autobiography). Other awards, distinctions, and honors were granted to the following individuals: Maria Janion received the II Women's Congress Special Prize and Ghetto Fighters Medal conferred by the Association of Jewish Ex-Combatants and Victims of the Second World War in Poland; Henryk Markiewicz won the Kazimierz Wyka Special Honor Award; Karol Myśliwiec received the 'Honorary Pearl' Award conferred by the Polish magazine *Market* for outstanding archaeological discoveries found during Polish excavations in Egypt, he was also distinguished by the Austrian Academy of Sciences by being elected its foreign member; Aleksander Posern-Zieliński was appointed a corresponding member of the Polish Academy of Arts and Sciences; Zbigniew Radwański was distinguished by the Minister of Justice with a "*Lex Veritas Justitia*" Medal; Andrzej Rottermund received the annual award of the Minister of Culture

and National Heritage; Zdzisław Sadowski won the Waclaw Szubert Medal conferred by the Committee on Labor and Social Policy Sciences of the Polish Academy of Sciences; Jerzy Strzelczyk was awarded by the Minister of Science and Higher Education in the category of Research for Social Development for his lifetime achievements; Jerzy Szacki celebrated the republication of his doctorate at Warsaw University; Piotr Sztompka won the Allianz Insurance Association Award for his research achievements in the 2000-2010 period; Andrzej Walicki received the Tadeusz Boy-Żeleński Medal for his contributions in popularizing secular culture; Stanisław Waltoś was granted the Edward Wende Award and Gold Medal of the University of Wrocław; Franciszek Gruzca was appointed an Honorary President of the International Association of German Studies Specialists; Stanisław Gajda won the 1st rank Award of the President of Opole University; Henryk Samsonowicz was distinguished with the Order of the White Eagle by the President of Poland during the celebration of the republication of his doctorate at Warsaw University; Jan Woleński received the Award of the President of the Jagiellonian University for his research activity and the "*Honoris Gratia*" Medal for his service to the city of Kraków.

Overall, 933 members participated in the work of the 25 committees of Division I in 2010. At their plenary sessions the committees discussed scientific and organizational matters, drew up expert reports, and discussed presented papers.

The Committee on the History of Science and Technology held four plenary sessions. Members of the Commission on the History of Social Sciences participated in three meetings, which focused mainly on editorial and publishing matters. The Commission on the History of Technology met at five sessions during which research papers were presented. The Commission on the History of the Natural Sciences participated in the meeting of the Botany History Section which was held as a part of the 55th Convention of the Polish Botanical Society in Warsaw.

The Committee on Linguistics met at four plenary sessions. Its Commissions on Dialectology, Phraseology, Onomastics, Stylistics, Language Theory, Ethnolinguistics, Language Culture, and Applied Linguistics held 25 meetings with research papers. The Committee organized the following conferences: "Stylistics 2010 – Balance and Perspec-

tives” in Kamień Śląski near Opole, the International Onomastics Conference “Chrematonymy as a Modern Phenomenon” in Olsztyn, and the 43rd Meeting of the Council on European Languages (*Rada Atlasu Językowego Europy*) in Kraków. The Committee published the following magazines: *Onomastica*, *Stylistyka* (Stylistics), and *Etnolingwistyka* (Ethnolinguistics).

The Committee on Demographical Sciences organized three plenary sessions. The first was a joint session of the Committee on Labor and Social Policy and Committee on Demographical Sciences. The second plenary session was devoted to E. Gołata’s paper on “The Statistics of Small Areas in the 2011 Census,” and the third was devoted to J. Kordos’ paper on “Methods in Examining Census Quality.” The Section on Demographical Analyses met only once, while members of the Historical Demography Section held four plenary sessions. The Regional Demography Section actively participated in a session entitled “Information, National Census, and Methodology of Demographical Research,” which was organized during a Scientific Conference of Demographics Specialists in Kleczkowo.

The Committee on Economic Sciences held 3 plenary sessions and 5 meetings of its Presidium, during which matters of the *Ekonomista* (Economist) magazine were discussed.

The 20th Session of the Standing Joint Commission of Economists of the Polish Academy of Sciences and Russian Academy of Sciences and a research conference entitled “Development of Polish and Russian Economy after the Global Financial Crisis” were held in Moscow on 22-26 June 2010. The Russian papers delivered during the conference addressed the following issues: multidimensional diagnosis of the state of Russian economy after the crisis and recommendations for how to recover from crisis. Polish papers focused on the challenges for the Polish economy in times of critical change. The *Ekonomista* (Economist) magazine continued to be published.

The Committee on Ethnological Sciences held two plenary sessions, one in Cieszyn and the other in Poznań. The first session was devoted to discussing the state of the ethnological sciences, such analysis being necessary for further synthetic evaluation of the Polish humanities as such. The second meeting focused on research centers, science reform, and a report on the grant “Beginnings of Polish Ethnology and Cultural Anthropology” (Z. Jasie-



The 20th Conference of the Standing Joint Commission of Economists of the Polish Academy of Sciences and Russian Academy of Sciences, entitled “Development of the Polish and Russian Economy after Global Crisis”



Prof. Joanna Kotowicz-Jawor and Prof. Lew W. Nikiforow at the conference opening

wicz). The Committee was a co-organizer of two conferences, namely “Development vs. Culture – Cognitive and Practical Perspectives” and “University Life.”

At its two plenary sessions the Committee on Philosophical Sciences discussed the following topics: a proposal for the Prime Minister’s Award, the method of proposing candidates for corresponding membership in the Academy, and preparations for the 2012 Philosophical Convention. The Committee co-organized two conferences: “Analysis and Existence – Two Styles of Doing Philosophy” and “Timeliness of Kant’s Philosophy of State and Law.”



From left: Prof. Leszek Jaśniński, director of the PAS Institute of Economic Sciences and Prof. Juliusz Kotyński from the Academy of Finance in Warsaw and Institute for Market, Consumption, and Business Cycles Research

The committee continued to publish *Przegląd Filozoficzny* (Philosophical Review).

The Committee on Historical Sciences held two Presidium meetings and one plenary session devoted to discussing the Museum of the Polish History, which is currently under construction. Under the patronage of the Committee and with the help of the Institute of History at Adam Mickiewicz University in Poznań a methodological-theoretical conference in Otwock (Mądralin) was organized. The Committee published the following journals: *Wiadomości Numizmatyczne* (Numismatological News), *Acta Poloniae Historica*, and *Studia Maritima* (Maritime Studies).

The Committee on Financial Sciences held two plenary sessions. During the first session two papers were delivered: “Microstructural Determinants of Volatility of Stock Market Mechanisms – Interdisciplinary Approach” by M. Kicia and “Prospects for Cooperative Bank Competitiveness” by G. Woźniewska. The second session was devoted to A. Walasik’s lecture on the “Redistributional Function of Public Finances in the Theoretical Perspective.” The *Finanse* (Finances) journal was published.

The Committee on Cultural Studies held four meetings. During the first one the Committee members discussed Stanisław Mossakowski’s letter on a “Strategic Program for the Development of Humanities,” including activities aiming at gaining state support for the Fund for the Humanities. The second meeting focused on the progress of work on a document concerning cultural studies policy (E. Rewers).

At the next meeting members of the Committee worked on drafting a document constituting the Committee’s manifestation against the draft Act on Higher Education. During the last meeting Stanisław Mossakowski presented work progress on establishing the National Program for the Development of the Humanities. The Committee co-hosted the International Conference “Grotowski – Narrations” in Warsaw. The journal *Przegląd Kulturoznawczy* (Cultural Studies Review) was published.

Members of the Scientific Committee on Ancient Culture during its eight plenary sessions listened to the following papers: “Roman Empire during the Rule of the Flavians – Main Directions of Development and Threats” by L. Morozewicz, “Discovering Colors in Ancient Sculpture” by B. Iwaszkiewicz-Wronikowska, “The Cylinder Seal in Northern Mesopotamia in the Times of Sumerian Civilization: Functions and Iconography – Examples from Tell Arbid” by P. Bieliński. The Committee co-hosted an International Conference “Rome, Constantinople and Younger Europe: Archaeological and Historical Evidence.” The *Meander* journal was published.

The Committee on Literature Studies during its four plenary sessions dealt with the following matters: preparation of a report addressed to Philosophical Sciences Team, a letter to the Ministry of National Education concerning organizational aspects of thematic competitions (especially the Competition on Literature and Polish Language). The Committee co-organized a conference within the Polish-Israeli Research Meetings cycle, entitled “The Jews and Poles in 1944-1950.” The Committee provided patronage for publication of the journal *Rozprawy Literackie* (Literary Treaties).

The Committee on Labor and Social Policy Sciences organized three plenary sessions. At the first session, members of the Committee discussed a paper entitled “Models of Family Policy – Division Strengthening or Convergence Process?” At the second session they distinguished Zdzisław Sadowski and Wojciech Musiałski with the Waclaw Szubert Medals. The last session was held with the participation of the Committee’s representatives active in the Regional Employment Councils. The Committee co-hosted two conferences: “Geographic Variation of Social Problems” in Ustroń and “Social Integration through Work – Macroeconomic and Regional Aspects” in Augustów. Another volume of *Social Policy Problems – Studies and Discussions* was published.

The Committee on Organizational and Management Sciences met at three Presidium and plenary meetings, during which the issues discussed included: "Presentation of the Present State, Achievements, and Developmental Perspectives of Management Researchers at the University of Economics in Katowice" (J. Pyka and E. Gatnar) and establishing a distinction between the Statistics and Econometrics discipline from Economic Sciences (A. Barczak). The Committee co-organized and provided patronage for the following conferences: "Challenges and Perspectives of Management Sciences Development," the 8th Conference on Management entitled "The Lesson of the Crisis," the Conference "Strategic Breakthrough in the Company," and "Determinants of Entrepreneurship – Diversity and Unity." The *Organizacja i Kierowanie* (Organization and Management) journal was jointly published by the Committee and the Warsaw School of Economics.

During three plenary meetings of the Committee on Oriental Studies the following papers were presented: "The Mongolian Buddhist Master Zanabazar (1635-1723) – His Life and Work" by A. Bareja-Starzyńska, "The Idea of God and Cognizability of the World in the Natural Philosophy of Ancient India" by P. Balcerowicz, "The First Period of Proto-Bulgarian Presence in the Balkan Peninsula" by J. Tyszkiewicz. The Committee held three Presidium meetings and co-hosted the 2nd International Conference of Oriental Studies "Oriental Studies – Past and Present." The journal *Rocznik Orientalistyczny* (Oriental Studies Yearbook) was published.

The Committee on Art Studies held three plenary sessions with research papers by: S. Żerańska-Kominek – "Music in the Symbolic Structure of Cupid's Garden," G. Korpala – "Aesthetic Situation of a Work of Art in the Conservation Process: Concerning Neocreation," T. Kłys "The Reds: Image of the Communists in the Weimar and Nazi Movies." The *Rocznik Historii Sztuki* (History of Art Yearbook) was published.

The Committee on Pedagogical Sciences organized three meetings at which the following issues were presented: the concept of a National Qualifications Framework, description of the effects of teaching at a faculty of pedagogy, cooperation between the Committee and the pedagogical community, and a program entitled "Examining Quality and Productivity of Education and Institutionalization." The Committee co-hosted the following conferences: "Quality Orientations in Pedagogical Re-

search" in Ustroń-Cieszyn, "Education with Regard to Challenges and Present and Future Tasks" in Suchedniów, "Pedagogical Sciences in the Perspective of Knowledge and Work Society" in Ciechocinek, "Education – Leadership – Management" in Łódź, "Quality of Academic Education in Pedagogical Sciences vs. Multi-Stage Education" in Lublin-Kazimierz. The *Rocznik Pedagogiczny* (Pedagogical Yearbook) was published.

The members of the Committee on Political Sciences met at three plenary sessions, at which they discussed the following matters: the methods for holding competitions on social studies, the main tenets of the new Act on Higher Education, and the paper "Political Advisor – Supporter or Guiding Light?" presented by G. Rydlewski. The Committee co-organized two conferences: "Poland in the European Parliament – Experiences, New Challenges and Tasks" and "Germany, Ukraine, and Poland towards the Process of Building Eastern Partnership in the European Union."

The Committee on Prehistoric and Protohistoric Sciences held three plenary meetings during which the following issues were discussed: archaeological conservation, research results from Bronze and Early Iron Age archaeological excavation sites, preparation of the publication entitled *Badania nad przeszłością społeczną. Podstawy konceptualizacji w perspektywie archeologicznej* (Research on the Social Past: Fundamentals of the Conceptualization in the Archaeological Perspective). The Committee's commissions worked on the following papers: "Art and Rituals – Relations and Contexts," "Geographical Organization of the Settlement of Lusatian Culture from the Beginning of the Iron Age in Stary Śleszów" by A. Buchner, "The Prehistory of Units of Length – Cognitive and Interpretational Opportunities" by T. Gralak. The Commission on Medieval and Early Modern Period Archeology co-hosted a conference entitled "20th Century Archeology: Goals and Methods" in Warsaw.

The members of the Committee on Legal Sciences met at three meetings devoted to the state of the following sciences: historical and legal sciences (H. Olszewski), constitutional law sciences (P. Sarnecki), civil law sciences (A. Mączyński). The Committee published the monthly journal *Państwo i Prawo* (State and Law).

The two sessions of the Committee on Psychology discussed: S. Bedyńska's paper "Consequences of the Threat of Stereotype – Original Research

Findings in the Context of the Most Important Theoretical Concepts,” Maria Dymnikowa’s letter “Does Psychology Deal with the Musical Ear Phenomenon as an IQ Component?”, and critical analysis of the Ministry of Science and Higher Education’s method of introducing changes in the rules for evaluating research centers. The Committee organized the 19th Psychological Colloquium “Human Behavior Determinants – From Genes to Personality” in Małdralin near Warsaw. The *Polish Psychological Bulletin* (in an electronic version) and *Studia Psychologiczne* (Psychological Studies) were issued.

The Committee on Theological Sciences organized two plenary sessions during which candidates for corresponding members of the Academy were discussed. The Committee co-hosted a conference “*Via Pulchritudinis* – Biblical Motifs in Polish Literature and Culture” in Kraków. Another issue of *Studia Nauk Teologicznych PAN* (PAS Studies on Theological Sciences) was published.

The first meeting of the Committee on Science Studies mainly focused on data prepared by J. Jabłecka-Pryślopska on the development strategy for higher education in 2010-2020. The second meeting was a conference on “Higher Education within the Human Capital Operational Program – Experiences and Perspectives.” The second meeting was devoted to discussions on draft legislation. The Committee co-organized two conferences “Constructivism in Social Sciences” and “Higher Education within the Human Capital Operational Program – Experiences and Perspectives.” The journal *Zagadnienia Naukoznawstwa* (Problems of Science Studies) was published.

The Committee on Slavic Studies held five meetings during which numerous papers were delivered, including: “On Polish Science’s Discovery of Macedonia” by K. Wrocławski, “Presentation of Opole Slavic Studies” by J. Czaplińska, and “Methods of

Colloquial Vocabulary Enrichment in Czech and Croatian” by P. Fałowski. The Committee co-organized the following conferences: “Twilight of the Herder – The Philological Foundations of Slavic Studies” in Opole, “Distance – Symbiotics – Assimilation? South Slavic Cultures and Languages in the Balkan Non-Slavic Context” in Łódź, and “Druzhnikovskiy chteniya: Tretya volna emigratsyi” in Kraków. The journals *Slavia Orientalis*, *Pamiętnik Słowiański* (Slavic Chronicle), and *Rocznik Slawistyczny – Reveue Slavistique* (Slavic Yearbook – Reveue Slavistique) were published.

The Committee on Sociology organized three sessions devoted to the following topics: “Political Elite and Democratization in Poland” presented by J. Wasilewski, “Poverty Enclaves – Mechanisms of Poverty Inheritance and Social Exclusion” by W. Warzywody-Kruszyńska, A. Golczyńska-Grondas, and P. Bunio-Mroczek, “Discourses on Poverty and Social Exclusion” by E. Tarkowska, and “The New Meaning of Social Order in Poland” by A. Rychard. The journals *Kultura i Społeczeństwo* (Culture and Society) and *Studia Socjologiczne* (Sociological Studies) were published.

The Committee on Statistics and Econometrics held one plenary session and one Presidium meeting. During the plenary session members of the Committee listened to J. Łyko’s paper entitled “Rules of Majority and Proportion in the Issue of Collective Choice.” The Committee co-organized and provided patronage for the following conferences: the Aleksander Zeliaś 4th National Scientific Conference on “Modeling and Forecasting Socioeconomic Phenomena” in Zakopane, the “37th Macromodels International Conference” in Pułtusk, “Data Analysis and Classification – Theory and Practice,” and “MSA 2010 – Multidimensional Statistical Analysis.” The journal *Przegląd Statystyczny* (Statistical Overview) was published.

Teatr rosyjski XX wieku wobec tradycji. Kontynuacje, zerwania, transformacje

[20th-Century Russian Theater in the Context of Tradition: Continuations, Breaks, Transformations]

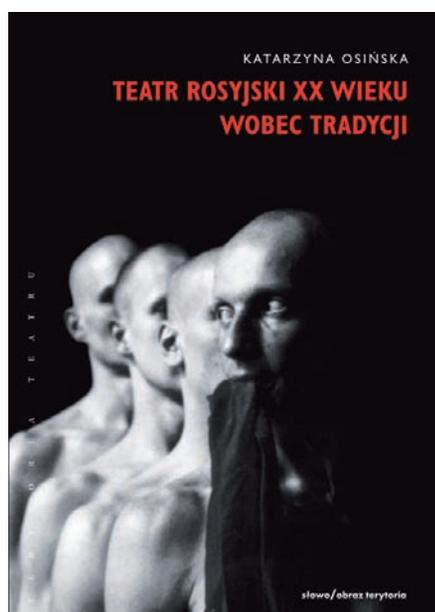
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The book represents Polish literature's first proposal of a comprehensive conceptualization of 20th-century Russian theater, whose achievements, in particular those of such creators as Konstantin Stanislavsky, Vsevolod Meyerhold, Evgeny Vakhtangov, and Alexander Tairov, became a part of world theater culture. The innovative aspect of this study (against the background of reference books available in other languages, including those in Russian) consists in identifying the theatrical concepts of key importance to Russian theater that emerged in the early 20th century and tracking their evolution, taking into account a wide cultural context. These concepts are depicted through theater and laboratory studies; the relations between the theater and art (in particular, relating to the avant-garde art of the early 20th century) and the issue of self-reference of theater architectural designs; the practice of non-psychological acting based on the body expression; the staging of Anton Chekhov's dramas in Konstantin Stanislavsky's and the Moscow Art Theater traditions. These issues are covered by the first four

chapters of the book, which are of a synthetic nature. The subsequent chapters constitute an analytical conceptualization of two examples of the different approach to the traditions by modern authors: Lev Dodin and Anatoli Vassiliev.

For the Russian theater of the latter 20th century, which functioned mainly in isolation from Western theater, the national tradition dating back to the early 20th century served as the point of reference. This confrontation with the national heritage determined the chronological and problem-related timeframe for their work. In the book, the tradition is not viewed as a rigid and stuffy set of standards, but as a dynamic process that developed via different routes and at different levels of specific works of art and art events. The tradition is viewed from three standpoints: 1) a "reference" approach, studying the content of absorbed heritage: theatrical concepts, concrete techniques and methods, including also the ethics and atmosphere accompanying the experiments of the pioneers of 20th-century theater, in particular, in its studio trend; 2) an "acting" approach, concerning how the tradition was transferred: directly from masters, via reading, or at second-hand; 3) a "subjective" approach, incorporating the attitude of post-war generations to the past.

This last approach made it possible to attempt to answer whether the artists who worked in the Soviet Union in the second half of the 20th century took an affirmative attitude toward their predecessors or challenged them. Moreover, it became possible to identify examples of continuations of and breaks with tradition, as well as cases of the most fruitful strategy in the artistic world: that of transforming inherited ideas and concepts. That is, the book presents both the vitality and inspiring force of the tradition, as well as the burden it posed, blocking innovations. The heritage of the Moscow Art Theater became a cultural burden for the Russian people. The chapter dealing with Anton



Chekhov shows the struggle of Russian artists, who wished to defend themselves (often unsuccessfully) against the stereotyped staging of Anton Chekhov's dramas.

This methodological work straddles an array of disciplines: the history and the theory of theater, the history of ideas, sociology (here it owes mostly to classic research in the tradition of Edward Shils and Jerzy Szacki as well as to the most modern studies of the problem made in Russia, such as by Boris Dubin), anthropology (in particular, in the part relating to the actor's creativity), and the history of art. The source database of the book incorporates primarily publications in the Russian language: monographs, volumes documenting the creativity of concrete artists (recordings of rehearsals, interviews), books written by producers, actors, stage designers and art directors, reviews and other press publications, and so on. Part of this base is material collected by the author during research trips to Russia: the author's personal interviews with Russian artists (a total of 21 interviews), notes and publications, and reviews of plays, rehearsals, festivals and exhibitions published by the author in Poland.

The material collected in the book is novel for Polish theater researchers. In Russia it is predominantly known from diverse specialist publications, but its means of presentation here differs distinctly from the existing approaches in both Russian and Western specialist literature. This applies in particular to the chapters which depict the evolution of the concepts that emerged on the basis of the correspondence between theater and the early 20th-century Soviet art vanguard, as well as the concepts and acting techniques of non-psychological acting. In the author's opinion, the evolution of concepts that emerged at the crossroads of avant-garde art and theater developed as follows: from the experiments by Meyerhold, who was inspired by the discoveries by Kazimir Malevich and Vladimir Tatlin, via the constructivist aesthetics in the works of Alexander Tairov, and further via the adaptation of constructivism by the Soviet theater of the 1930s to the vanguard academic approach in the works of producer Nikolay Okhlopkov. Thereafter, the book depicts the example of the transformation of vanguard concepts in latter 20th-century theater in the work of stage designer David Borovsky – who worked together with Yuri Lyubimov at the Moscow

Taganka Theater. In this case, the mechanism of borrowing from the tradition of masters and teachers was reconstructed. The chapter titled *Eccentricity, biomechanics, pantomime (from the circus to the dance)*, which depicts the spiral-evolution concept of theater that developed from movement, the circus, the pantomime and the dance, incorporates material that is poorly known and not drawn upon by Russian researchers (such as the creative work by actress Yudif Glizer or the meaning of Evgeny Kharitonov's work for the revival of the tradition of pantomime).

Certain interpretative aspects of the book have attracted the attention of the Russian public, as evidenced by the Russian-language publication of the chapter on the reception of Anton Chekhov's dramas in a peer-reviewed scientific journal (Osińska K. (2010). Burden of heritage. *Voprosy teatra / Proseanium*, 3-4, 66-83, publ. by the State Institute of Art Studies, Moscow) and the review by Dr. Natalya Yakubova published in the peer-reviewed journal *Stsena* (2010, No. 6 (68), 14-16). The book was chosen as the theater book of the year 2010 by the Section of Theater Critics of the Polish Center of the International Theater Institute.

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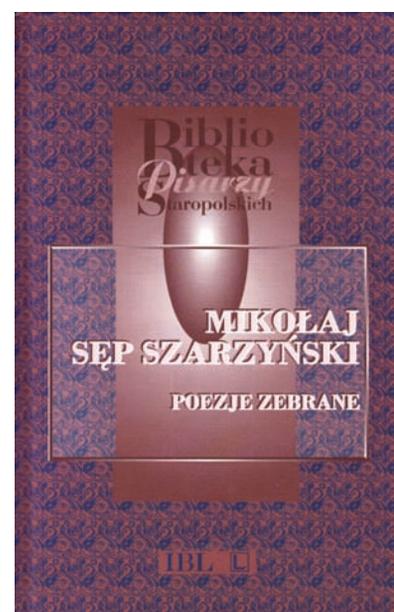
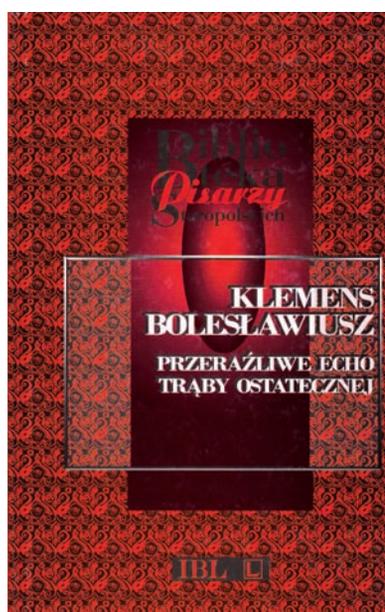
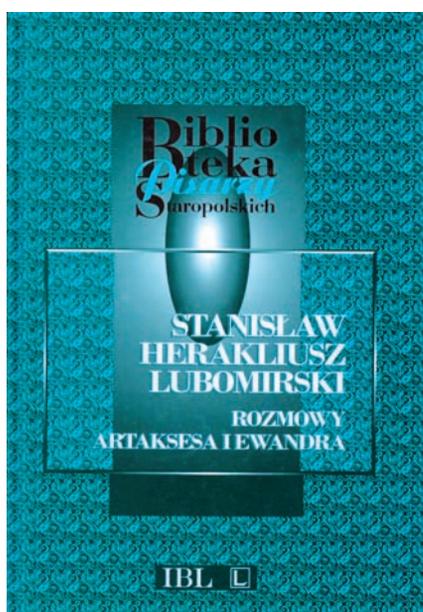
Biblioteka Pisarzy Staropolskich [Library of Old-Polish Authors]

A. Karpiński | Institute of Literary Research | Polish Academy of Sciences

The development and publication of the series *Biblioteka Pisarzy Staropolskich* [Library of Old-Polish Authors] ('BPS') was launched in 1995 at the Institute for Literary Studies, the Polish Academy of Sciences, in cooperation with the 'Pro Cultura Litteraria' Association. Books in the series have been published continually ever since, under the guidance of Prof. Adam Karpiński – with as many as thirty-eight volumes released by 2010. Some of these releases are works that were not published in their time, having instead waited until they could see the light of day in manuscript or old-print form, other texts are known from their non-critical nineteenth-century editions, not easily accessible to today's literary students and historians, whereas others are certain pieces of special importance to the history of Old-Polish literature, not yet published in editions on a satisfactory scholarly level. The agenda of the BPS series aims to fill various gaps and oversights in the Old-Polish field, by presenting works that are known mainly from literary and historical studies yet remain inaccessible in scholarly editions, as well as completely unknown or forgotten pieces. Once rendered available, these works may have a remarkable impact on our overall picture of the Poland of yore.

Ever since its first editions, BPS has presented literary works in the form of critical editions. The founding idea of the authors and editors of the series was that the critical-edition model, elaborated on philological grounds, proves to be the best form in which literature of old periods can be presented. Hence, each volume provides complete information on the preserved sources of the text, presents research on the tradition behind the text, and documents all the efforts made by the editor to conclusively determine such source(s) and/or tradition(s). The adoption of this well-respected critical-edition model is also decisive for how the authors and editors of the series approach various scholarship-related issues. All the volumes are furnished with exhaustive editorial commentary and critical instrumentarium.

The literary works or pieces published as part of BSP series are commented on in the extensive explanatory notes provided (objective, linguistic, and intertextual), which contain the necessary information making the text comprehensible and recognizing its entanglements in the literary tradition and specific language of the period. Moreover, each series volume is complemented with a glossary of archaic



words, the indispensable indexes, and an introduction added as preliminary reading to render the piece more familiar to the reader, identify its position in the history of culture and in the context of early Polish writings. While satisfying the requirements for scholarly editions, the series' volumes are also targeted at non-specialist readers, college/university students, as well as lovers of old-Polish literature.

Over the fifteen years since the series' inception, an active community of students of Polish, including philologists, representing a majority of Poland's research hubs, has emerged around the series. Another remarkable factor is the outstanding contribution of young scholars who have gained valuable experience and first bits of professional expertise in the art of producing scholarly editions of old-Polish works.

The BPS series publishes quite diverse works – including early-Renaissance pieces (*Kupiec* by Mikołaj Rej) through to eighteenth-century works dating to the Saxon-rule era (*Refleksyjje duchowne* by Karol Mikołaj Juniewicz); lyrical verse (*Roxolanki* by Szymon Zimorowic) appear along with epic works (Samuel Twardowski's *Przeważna legacyja*) and plays (Corneille's *Le Cid* in Jan Andrzej Morsztyn's translation – as *Cyd*) as well as extensive prose works (*Rozmowy Artaksesa i Ewandra* by Stanisław Herakliusz Lubomirski). The series publishes illus-

trious works of fame and renown (e.g. the first-ever critical edition of *Poezje zebrane* – The Collected Works of Mikołaj Sęp Szarzyński), alongside completely forgotten ones (*Pamiętka krwawej ofiary Pana Zbawiciela Naszego Jezusa Chrystusa*, a mesiad by Abraham Roźniatowski) or those belonging to popular literary genres (*Przerazliwe echo trąby ostatecznej*, a work by Klemens Bolesławiusz). The series has also contributed to the increasing number of published volumes of Old-Polish Latin-language literature (the prose works by Andrzej Maksymilian Fredro and Szymon Starowolski, epigrams by Maciej Kazimierz Sarbiewski), where the original Latin text is always accompanied with its Polish parallel translation.

These are but exemplary highlights of the myriad works and pieces that have already been carried in the BPS series. The diversity and richness of Old-Polish literature becomes further revealed year by year as the series list expands. 2011 is due to see another four works published and more than twenty new volumes are presently under preparation.

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Unique Temple of Thutmose I

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In the autumn of 2009, after being closed for many years, the so-called Metropolitan House Store-room located inside an undecorated tomb in the necropolis on the West Bank of Thebes in Egypt was made accessible to the present author. The main aim was to find traces of Queen Hatshepsut's building activity. The first look inside the tomb gave the impression of a large amount of rubbish accumulated on both sides of a long corridor, all covered with a thick layer of dust (Fig. 1). This rubbish-like material soon turned out to be a pile of decorated block fragments mixed together with pottery, fragments of statues and hard stone splitters which were probably elements of architecture and statuary. Preliminary examination indicated that the material is

homogeneous and very likely comes from one temple. The idea was to check the possibility of identifying and, perhaps, reconstructing the building in question. After four days of hard work, the first selection was made and the most diagnostic fragments were collected to be drawn and photographed. A great adventure of fitting the pieces of the puzzle together began.

Almost immediately it became clear that these fragments belonged to the temple discovered by Abu el-Ayun Barakat in 1971, described by him as the *Kha-akhet* temple (He-Who-Appears-on-the-Horizon): a fragment of a statue base reported by Barakat in an article concerning this discovery was found standing at the door of the storeroom (Fig. 2). The



Fig. 1. Inside the Metropolitan House Storeroom after opening

temple has so far been attested only in five texts from the times of Hatshepsut (1479-1458 BC). It functioned only during the reign of the queen and her stepson Thutmose III. During inspection of the stone material, three fragments bearing the name of the temple were found (Fig. 3). Astonishingly, the name carved on them was different from the one that Barakat believed to have identified. It appeared to be the name of the temple of Thutmose I called *Khenemet-ankh* (United-with-Life), which has been sought by scholars since the 19th century. The temple of Thutmose I was well known from texts of the epoch, information about its priests and cult, as well as the temple itself being attested in many sources. Still, its location remained unknown.

Barakat's very brief report concerning the temple contains a plan of the excavations, where an almost square courtyard with a single row of columns on at least two sides is visible. Literally nothing remained on the excavation site. However, the fragments of columns and architraves left by the excavator in the storeroom enabled them to be identified as coming from this part of the building. It seems very likely that there were some doors



Fig. 2. Fragment of the statue base



Fig. 3. Fragment of the architrave with the name of the temple

leading from the courtyard into the inner parts of the temple, considering that many fragments of different door jambs and lintels were among the blocks.

The temple whose fragments are deposited in the Metropolitan House Storeroom was built of two types of stone. Sandstone was used to construct the most important architectural elements, mainly those that supported the building, namely the columns, pillars with their bases, door lintels, architraves or flat ceilings. Other parts of the temple, mainly walls and vaulted ceilings, were made of limestone.

The main distinctive architectural feature of the temple of Thutmose I was the presence of niches of different sizes and decoration. Many fragments of blocks with small scale decoration were found in the storeroom.

Some of the blocks stored in the tomb are essential for the temple's reconstruction, displaying traces of later architectural changes such as re-building of some rooms or adding of a wall.

Given the fact that ancient sculptors alternately used sunken and raised relief styles, it is possible to determine that there was a decoration inside and outside the building. During the Tuthmoside period the use of sunken relief painted yellow was restricted to the outer walls, where the sun operated, and the raised sculptured polychrome reliefs were found inside the dark chambers.



Fig. 4. Fragment of the false door with a representation of Thutmose I

Analysis of the decoration proves the existence of at least two different types of chambers. There are many scenes characteristic primarily of hypostyle halls. The battle and festival scenes, as well as scenes representing the king in front of the gods, belong to this group. The second type of scenes indicates that there was an offering chapel connected to the royal cult. There are many fragments of an atypical false door (Fig. 4) that normally constitutes the main part of the western wall of the offering chapel in every royal temple from the Old Kingdom (2649-2150 BC) onward. There are also many fragments of an offering list, representations of offerings and offering-bearers that most probably belong to this room.

The temple of Thutmose I was unique in many ways. The decoration style is one of them. So far there are only four false doors belonging to royal temples of 18th dynasty (1539-1292 BC) known to be preserved, all made of granite. This feature is of particular importance because the false door of Thutmose I was made of limestone instead of granite, which is without precedent. The battle scenes that were represented on the walls of this temple are

very rare for the period. There is also the first representation in the New Kingdom (1539-1075 BC) of a festival calendar depicted on an external wall of a building. The almost black colour of the wall decoration's background is also unparalleled, and cannot be explained by the state of preservation or storing conditions because it covers the surfaces of almost all the preserved fragments of blocks. Contrary to prevailing standards, a unique type of architrave decoration was used: the sunken relief was painted with different colours instead of being left yellow, which is hard to explain. An intriguing feature was also observed: as the temple was constructed and used before the Amarna times, one should expect the representations of gods to have been hammered by King Ekhнатon's iconoclasts and restored by the artists of subsequent kings. However, some gods in the temple of Thutmose I remained intact. This implies that this particular part of the building was no longer in use during the Amarna period or that some rooms were closed off and therefore out of use at that time. All these questions remain unanswered, but the coming seasons may bring further data and solutions.

It seems very likely that the temple was not commissioned by the king himself but rather by his royal daughter, Hatshepsut. There are many indications which suggest that even if she was not the only builder, the decoration of the walls was finished during her reign. The cult of Thutmose I was practiced in the temple until Ramesses IX or perhaps even later. The temple was mentioned for the last time in the list of temples preserved in the tomb of Imiseba, the head of the temple-scribes of the estate of Amun during the reign of Ramesses IX. After this reign, the temple met its sad fate and was totally destroyed and cut into pieces to obtain material for stone vessels that were produced on site. The only remains of this procedure found to date are the fragments of blocks stored in the so-called Metropolitan House Storeroom.

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Kraj bez wyjścia? Migracje z Polski 1949-1989

[A Country With No Exit? International Migrations From Poland, 1949-1989]

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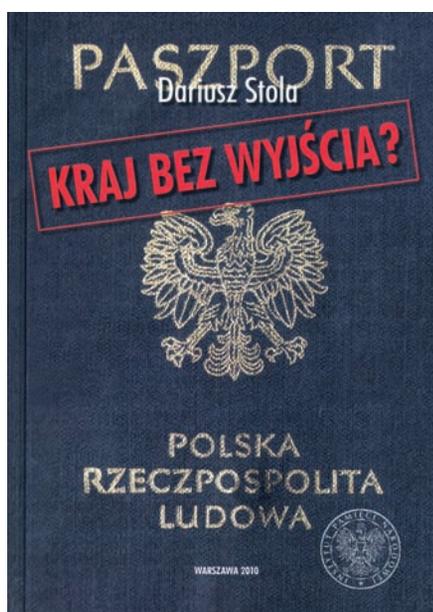
The Sovietization of Poland, which accelerated in the late 1940s, coincided with the end of the great postwar population transfers. By 1952 Polish Communists imposed policies of isolation, creating institutions that gave the state unprecedented control over external mobility. Travel abroad, especially outside the Soviet Bloc, became a rare exception to the non-exit rule. In 1951, the total number of trips to all Western countries (almost exclusively business trips by state and party officials) stood at less than two thousand. In 1954 only 52 individuals gained passports for private trips to the West and less than 50 individual emigration permits were issued. Most cross-border mobility consisted of transports of Soviet military person-

nel, moving to or from their bases in the GDR and Poland.

Two distinct pillars supported this non-exit regime: the Passport Bureau and the border control system. The long and exceedingly cumbersome application process was centralized, required an in-depth screening of the applicant and at least one personal visit to the Bureau's office in Warsaw. As the Passport Bureau was a part of the frightening Ministry of Public Security few people dared to apply. The second pillar of this isolationist regime was the border control system, with 1100 kilometers of barbed wire fence and 1314 watch towers; more than 32,000 border guards and thousands of secret agents and informers operated along the border.

The government made two exceptions to the non-exit rule: for the Germans and the Jews. Communist Poland was to be a homogenous nation-state of ethnic Poles. The governments of the newly established German Democratic Republic and Israel insisted that emigration of Germans and Jews, respectively, be allowed, especially for members of families divided by war. Warsaw eventually agreed to these requests, especially as it desired to rid the country of "unproductive" Germans in the Western Territories, and the Israelis were ready to pay for every Jewish emigrant.

During the process of destalinization Moscow actively encouraged the revision of policies relating to international mobility. This coincided with an improvement in East-West relations. As economic crises, intra-party strife, and decentralization tendencies destabilized the Polish regime in 1956 and 1957, the selection criteria for those applying for



emigration on the grounds of familial reunification widened. Up until early 1959, some 275,000 people left for the two German states, more than 50,000 for Israel, and some 28,000 emigrants left for other countries, mainly to concentrations of Polish diaspora overseas.

An overall relaxing of emigration constraints was a necessary but not sufficient condition for this emigration explosion. Particularly in the ethnically mixed and polyvalent communities of the Western Territories, powerful inner dynamics of the migration process drew thousands of Silesians, Masurs and Pomeranians out of their home towns. This process impacted more than 1.2 million people who relocated from Poland to the FRG between 1956 and 1989.

The re-stabilization of the passport regime after 1956 was not a simple return to the status quo ante. It was a significant reform of relevant rules and institutions. Out of the initial confusion there gradually emerged a new, complex set of guidelines that replaced the crude non-exit policy of the past. In the Passport Bureau, the reform altered the balance between the office's regular administrative tasks and the tasks it carried out as a part of the Security apparatus. To process higher numbers of applications the Bureau opened branches within provincial police headquarters. In the 1960s, in response to growing international mobility and the increased demand for travel documents, the passport service opened several hundred sections in medium-sized towns and gradually decentralized decision-making to the provincial departments.

New types of passports for travel within the Bloc were issued under simplified procedures and at low cost. Travel outside the Bloc remained difficult, as the application process was longer and cumbersome. Most difficult was long-term emigration to the West, normally restricted to narrowly defined family unification. Special restrictions applied to the young, educated or skilled. In addition to unwelcome destinations and categories of migrants, the Security Service denied passports to thousands of individuals it classified as suspect or prone to leave indefinitely, as well as to families of defectors.

The two decades 1960 to 1980 were the most stable period of the PRL and its passport policy. Legal emigration remained limited, usually ranging from 10,000 to 25,000 émigrés each year, largely to the West. When the numbers of applications grew in the mid-1960s, the Passport Bureau tightened its

grip further and the refusal rate grew to upwards of 90%. Meanwhile, travel within the Bloc expanded and in the 1970s became massive. Beginning in 1972, Poles and East Germans could cross the border between their countries visa-free, with a regular identity document stamped by a local passport office. This year the number of Poles' visits abroad increased tenfold, to ten million. Five years later a set of agreements similarly facilitated travel to other countries of Eastern Europe. After the Helsinki conference of 1975, travel to the West became easier as well and grew quickly, reaching 695,000 by 1980.

In the years between 1960 and 1980 about half a million people left Poland for good. The outflow was highly concentrated to a few countries. Germany (mainly West Germany) attracted two thirds of the émigrés; the United States became a destination for about 15%. The popularity of Israel as an emigration goal declined, with the exception of the years 1968-1969 when the "anti-Zionist campaign" pushed out more than 13,000 people. From the late 1960s onward, the flows towards Canada and Australia declined. Great Britain and France attracted about 1% of emigrants each. Most of the émigrés came from a handful of regions throughout Poland. Three voivodships in the Western Territories with large native communities contributed jointly more than half of all exiters. Emigration was exceptionally high in 1972 and between 1976 and 1979, due to the new "family unification" drive following the PRL-FRG agreement regarding normalization of bilateral relations and a major credit agreement in 1975.

Four groups of migrants held legal work abroad: pendular cross-border workers, predominantly female; a few thousand Polish seasonal workers under agreements for "youth summer camps," internships and student placements, employed under bilateral agreements in Czechoslovakia and the GDR; predominantly male migrants, employed by Polish firms and contracted to carry out construction abroad, mainly in Czechoslovakia, the GDR, the USSR and several developing countries; and lastly, individual migrants employed by foreign companies via Polservice.

Illegal labor migrations are by nature more difficult to track. Many migrations belonged to a gray zone of informal activities that were neither clearly legal nor illegal according to the laws of the PRL. Almost all temporary migrants were "false tourists." Some Poles took unregistered jobs in

other communist countries, mostly the GDR. The primary destination of illegal labor flows, however, was the West. International petty trade became popular among visitors to both capitalist and socialist countries.

The economic and political crisis of 1980-1982, the emergence of the Solidarity movement and the declaration of Martial Law in December 1981 coalesced to represent the second major turning point in the migration history of the PRL. Initially restrictions on travel abroad declined, but Martial Law effectively sealed the borders and made most passports invalid. At the same time some 150,000 Poles who were in the West decided not to return. Martial law strengthened the motives for emigration and contributed to its growth in the last years of the PRL. As living conditions remained bad and prospects for economic or political reforms bleak, the desire for exit became stronger and more widespread than ever. While restrictions on emigration remained high, the restraints on short-term mobility lessened. This inconsistency resulted in a massive irregular emigration. Most emigrants who left Poland during the 1980s did so with a regular tourist passport and formally remained residents of the country. The census of 1988 discovered more than 600,000 people who were "temporarily absent."

In late 1980s, the Polish government made passports available to almost everyone who applied. This coincided with the final stage of the PRL's eco-

nomics decline, a broader feeling of helplessness, an unprecedented flow of information from the West that contributed to strenuous relative deprivation, the cumulative dynamics of transnational networks and rumors that the FRG might withdraw from its generous policy towards the Aussiedlers from Poland. Emigration grew from 60,000 in 1985 to 120,000 in 1987 to 260,000 in 1988 and crested at about 400,000 in 1989.

Even greater was the number of temporary migrations. In the late 1980s millions of Poles turned to petty trade or found employment abroad. Migration became a respected strategy by which to cope with the implosion of the PRL's economy. The Polish petty trader became a familiar figure in Central and Eastern Europe. They filled the large Polenmarkt that emerged in a square of West Berlin, traded in the streets of Austria and Sweden, imported tons of goods from Istanbul. More adventurous tourists penetrated the Soviet interior and reached as far as Mongolia, China, Thailand and India. In the 1990s many of these travelers became the pioneers of Poland's new market economy.

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Studies on culture determinants of emotional expression

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Studies of emotional expression are of great importance not only for cross-cultural psychology, but also for analysis of the embodiment of emotion. This phenomenon consists in the fact that various forms of expression lead to emotions (strong version) or modify emotions (weak version). Inspiration for the embodiment theory comes from an experiment by Strack and colleagues (1988). They found that subjects' mood was modified by an activity that as a by-product led to changes in facial muscle tension that were similar to emotional expression (holding a pen in mouth or in teeth). Since that time many studies have shown that mood

changes are manifested the most in cases when the change in muscle pattern takes place in a natural way (cf. Winkielmann, Niedenthal, 2008; Niedenthal et al., 2009). In the Strack et al. study subjects were forced to manifest expression. The present study explored another approach: the expression of the subjects was situationally justified. While posing for photos people try to smile although they are not necessarily happy at that particular moment. A smile on a photo is usually a form of self-presentation. The author analyzed pictures that were presented on the Internet. He assumed that self-presentation motives were almost equal between cultures because

all subjects selected the photos on their own. He included 2000 photos from 10 countries (100 photos of females and 100 photos of males from each country). Significant differences in smile frequency were found between East and West European countries, as well as between men and women. The author also found correlations between frequency of smiling and various indexes of quality of emotional life such as Life Satisfaction Index and Happiness Index. There was also a moderate correlation between frequency of smiling and Gross Domestic Product per Capita and Human Development Index. These studies have important consequences for the embodiment theory because smiling may not just be a manifestation of the emotional state of an individual but may also contribute to the improvement of emotional well-being. Further experimental studies are needed to determine which direction of these relationships is more important.

The research “The Mystery of the European Smile: A Comparison Based on Individual Photographs Provided by Internet Users” was published in *Journal of Nonverbal Behavior*, 2010, 34(4), 249-256.

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In pursuit of a universal perspective on history of technology

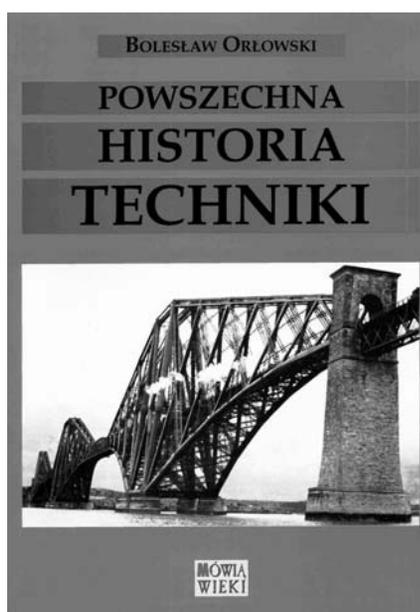
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Writing a universal and objective history of technology is a challenging task, one that few authors have taken on thus far, and even fewer have done so with earnest. Most works of this sort have discussed technological development from a Western perspective. This is not surprising, however, since they were mainly written by scholars from the leading industrialized countries. The popular saying that history is written by the victors also applies to the field of technology and science. Authors from countries involved in the mainstream of technological growth quite often fail to recognize the contribution from the peripheries. Of course, there is no universal Western interpretation of how technological development progressed. Surely the French experience has differed from that of the Germans or Americans, but a common theme running throughout this egocentric attitude is the barely noticeable recognition of the non West European or North American contri-

bution to technology and science. Here the author of the presented book does not actually attempt to fill the gap – such was the purpose of many of his previous books (dealing with the Polish contribution) – but rather emphasizes the necessity of taking a more holistic approach.

The book has a distinctive structure. Unlike most works having the word “history” in the title, it is laid out not in a typical chronological order, but in a topical one. The author begins his contemplations emphasizing the importance of practicing and promoting the history of technology, since this is the way to understand mankind’s historical development.

In the second chapter, he analyzes the origins and the role of innovation in the development of culture. He argues that technological breakthroughs played a key role in speeding up the process of human evolution. He also discusses the soundness of the



history of technology as an academic discipline, and refers to the theories and concepts shaping the current research in that field.

A bit further on, he challenges the platitudes and truisms that abound in the popular version of the history of technology. Such a discussion is not an easy task. The myths and misstatements repeated through generations have already rooted their way not only into the colloquial language (“necessity is the mother of invention”), but also into works of recognized authors.

In subsequent chapters, the author discusses the conditions that paved the way for technological change, this time in chronological order. However, his narrative does not resemble the ticking-off of milestone achievements, but takes the shape of an in-depth analysis of the history of civilization, telling the story of technological progress against the background of political, economic, and social events. The author analyzes, among other issues, the question of the technological advantage that enabled the political, military, economic, and cultural expansion of Europe in the fifteenth century.

In the next chapter the author discusses the question of “Harnessing the environment” (sources of energy from water wheel to cold fusion), “Improving nature” (material engineering, construction and water engineering, lighting), “Conquering time” (recording words, images and sound, measuring time), and “Conquering distance and space” (observation, communications, military technology,

transportation). Within each subdivision he pursues a fast-paced narrative by citing dozens of examples, indicates the reasons and driving factors that made them happen, and explains the implications they had upon the social, economic, and political life of humankind. This entire section is crowned by a debate on “future prospects,” in which the author skips the typical optimistic vision of civilization prevailing over the laws of gravity. On the contrary, he foresees that more attention will be (should be?) given to such banal yet important issues like improving safety on the roads or restoring the disturbed ecological balance.

The book comes with a timeline of events and an index, which makes it much easier to navigate and transforms this piece into an excellent textbook, helping prospective teachers to systematize their lectures. The author invariably tries to draw others in and infect them with his enthusiasm for the history of technology. Both average readers and experienced scholars will benefit from this special work. It would be highly advisable for *Powszechna historia techniki*, an objective and unbiased perspective on the history of technology, to be made available to readers outside Poland. Some of Orłowski’s previous books have been translated into languages including Swedish, Hungarian, Croatian, and Georgian.

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Mały słownik gwar polskich [The Little Dictionary of Polish Dialects]

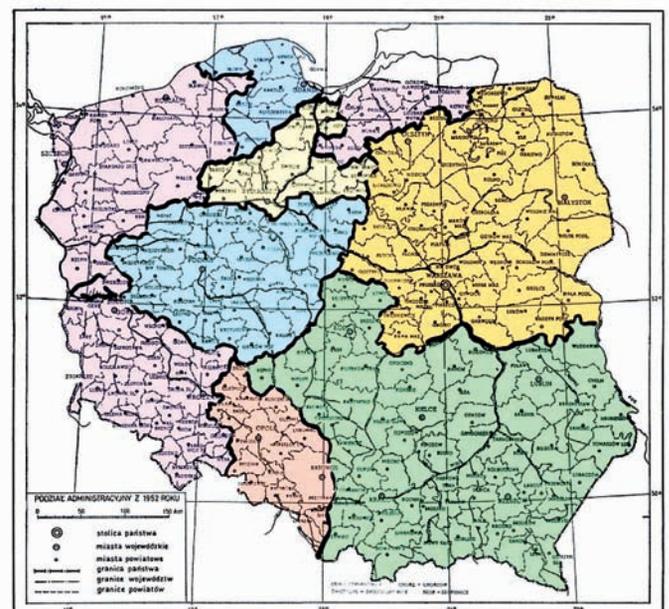
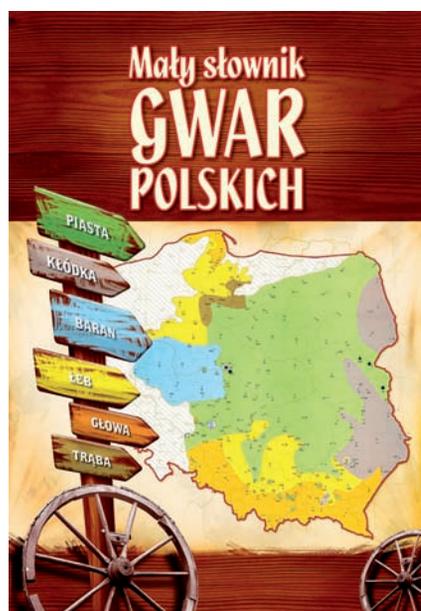
J. Wronicz | Institute of the Polish Language | Polish Academy of Sciences

The Little Dictionary of Polish Dialects is the first complete work on dialect lexis since the appearance of *The Dictionary of Polish Dialects* by Jan Karłowicz (1900-1911). It enables readers to gain an overall grasp of dialect vocabulary and to find out which words are specific to just one dialect, which have a wider scope, and which cover all or almost all Polish dialects. It was created based on a card index of Polish dialect words consisting of about 2.4 million cards, which is also the basis for a “large” multi-volume dialect dictionary that is currently being published by the Institute of the Polish Language at the Polish Academy of Sciences.

The dictionary covers more than ten thousand entries, describing words that differ in form and/or meaning from words in standard Polish and that are representative of dialect lexis. The dictionary includes material never before published, recorded by dialectologists talking to people speaking a given dialect. Entries are designed to be accessible to people without language-science backgrounds. The phonetic notation has been transcribed into standard Polish orthography, preserving all morphological and syntactic characteristics of the original dialect

text. Phonetic characteristics were preserved to the extent allowed by the standard Polish orthography. Each entry provides information on the geographical scope of a given word. The division of Poland into dialect regions follows the concept presented by Kazimierz Nitsch, the founder of Polish dialectology.

This publication will serve as an aid not only for dialectologists and teachers but also for writers, journalists, cultural-center staff, and all those interested in Polish regional culture. It will also be useful to anyone fascinated by the diversity of “local homelands,” helping them to become more familiar with the uniqueness of their own regional vocabulary and



Śląsk	Pomorze południowe
Małopolska	Kaszuby
Mazowsze	Nowe dialekty mieszane
Wielkopolska	

Fig. 1. The main Polish dialects areas: Masovia (orange), Lesser Poland (green), Greater Poland (light blue), Southern Pomerania (yellow), Kashubia (dark blue), Silesia (pink), and new mixed dialects (violet). The boundaries are based on Kazimierz Nitsch's division (save that the yellow territory was in Nitsch's division a part of the Greater Poland dialect)

its connections to other regions nearer and farther afield, and to Poland as a whole. *The Little Dictionary of Polish Dialects* illustrates the geographical differentiation of Polish dialect lexis and also richly documents the material and spiritual culture of dialect-speaking communities from the beginning of the 19th century until present times.

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Biological Sciences

Division II – Biological Sciences now embraces 17 research institutions (including two international units) employing altogether over 600 scientists. It covers scientific activities in virtually all fields of biological research, including anthropology, biochemistry, biophysics, botany, cellular and molecular biology, ecology, evolutionary biology, microbiology, nature conservation, neurobiology, palaeobiology, parasitology, virology, and zoology. Eleven scientific committees are affiliated with the Division covering a similarly wide spectrum of life science disciplines. In 2010, the Division had 35 national members prior to the May 2010 elections and 40 members (20 full and 20 corresponding) afterwards, along with 26 foreign members. The elections of national members taking place in 2010 brought in Prof. Czesław Cierniewski, Prof. Z. Maciej Gliwicz and Prof. January Weiner as full members of the PAS. The newly-elected corresponding members, in turn, are Prof. Grzegorz Bartosz, Prof. Barbara Bilińska, Prof. Marek Konarzewski, Prof. Kazimierz Strzałka, and Prof. Grzegorz Węgrzyn.

The Division held three plenary sessions in 2010: one devoted to elections on 7 April, a session on 23 June at the Marcei Nencki Institute of Experi-

mental Biology PAS, and an autumn session convened on 25 November at Warsaw's Palace of Culture & Science.

The 7 April election session was devoted to the presentation of candidates for national members, who were then subject to review and consideration. The 23 June session included a lecture on "The Neanderthal heritage of modern humankind" given by Dr. Katarzyna Kaszycka of the Institute of Anthropology of the Adam Mickiewicz University in Poznań. That session also brought the adoption of two resolutions by the Division, the first of these concerning the transformation of the Mammal Research Institute PAS, previously having the status of a department, into an independent research institute. The second resolution was, in turn, devoted to the election of members to a panel tasked with recommending candidates for the position of directors four Division II institutes: the Institute of Biochemistry and Biophysics PAS, the Institute of Botany PAS, the Institute of Parasitology PAS and the Institute of Ichthyobiology and Aquaculture PAS.



The Division's plenary session on 23 June at the Marcei Nencki Institute of Experimental Biology PAS, from the left: Prof. Wiesław Bogdanowicz, deputy chairman of the Division, Prof. Andrzej B. Legocki, chairman of the Division, and Prof. Adam Szewczyk, deputy chairman of the Division (J. Gaczyńska)



On 22 June 2010, Division II received guests from Amity University in India: Prof. P. Pushpangadan, director of Amity University for Herbal and Biotech Products Development (AIHBPD) and Dr. V. George, director of Amity Institute of Phytochemistry and Phytomedicine (AIPP) accompanied by his wife. The visit was a result of cooperation between Prof. Tadeusz Chojnacki from the Institute of Biochemistry and Biophysics PAS and researchers from India (A. Jaskot)

The autumn plenary session featured a lecture on “Genetic mistakes, or the scientific errors holding back or stimulating the development of research” given by Prof. Grzegorz Węgrzyn, corresponding member of the PAS, from the Department of Molecular Biology of Gdańsk University. This session mainly discussed organizational matters of the Division and Academy.

By virtue of a resolution passed at the autumn session, the Division II awards and distinctions for 2010 were conferred. The award for outstanding scientific achievements was won by a team from the Nencki Institute of Experimental Biology PAS comprising Prof. Andrzej Kasprzak, Dr. Łukasz Hajdo, Elżbieta Kocik, and Dr. Krzysztof Skowronek for their studies and series of papers on “the molecular mechanism generating movement by way of Ncd mitotic kinesin.” Distinctions were received by Dr. Zdzisława Stebnicka of the Institute of Systematics and Evolution of Animals PAS for her monographic publication on the beetle sub-family *Aphodiinae*, as well as Prof. Magdalena Borsuk-Białynicka of the Roman Kozłowski Institute of Palaeobiology PAS for the monograph entitled “An Early Triassic vertebrate assemblage from karst deposits at Czatkowice, Poland.”

A process of restructuring the Department of Antarctic Biology PAS began in June 2010. By virtue of a decision of the PAS President, a panel was set up to oversee and guide this restructuring process and the Department’s eventual inclusion within the Institute of Biochemistry and Biophysics PAS.

In March 2010, the Division was joined by the Academy’s Division V – Agricultural, Forestry, and Veterinary Sciences in drawing up certification as regards to genetically modified organisms (GMOs).

2010 also saw the Division’s committees pursue further their statutory activity through the organization of plenary meetings, as well as meetings of their presidia, commissions, and sections. The committees were involved in drawing up expert opinions and recommendations on key contemporary issues. The primary tasks also included maintaining intensive contacts with international organizations, assisting with the Science Festival, and providing opinions on recommendations for Division-level awards and awards on the level of the Prime Minister. The committees were actively involved in organizing and co-organizing a number of scientific meetings, workshops, and research seminars. A few illustrative examples can be listed here: “Contemporary methods of studying people’s activeness, fitness and physical capabilities” (by the Committee on Anthropology), “Nucleic acid technologies in biology and medicine” (Committee on Biochemistry and Biophysics), “Taxonomy as Queen of the Sciences – Algae throughout the karst” (Committee on Botany), “From the plasma membrane to the cell nucleus – Signaling pathways essential to life” (Committee on Cell Biology), “Molecular biology in diagnosing infectious diseases and in biotechnology” (Committee on Microbiology), “Molecular basis of pathology and therapy in neurological disorders” (Committee on Neurobiology), and “Infection complications following cellular, tissue or organ transplants, and other aspects of medical mycology and parasitology” (Committee on Parasitology).

In 2010 the Division published three issues of its electronically distributed bulletin *Biuletyn Wydziału II Nauk Biologicznych PAN*. In the same year, the Museum and Institute of Zoology PAS celebrated its 190th anniversary.

Social inequalities in suicide mortality during Poland’s socio-economic transition

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There are a number of reasons to be interested in the social determinants of suicide mortality. First, suicide is a major public health issue in many countries. Second, in addition to its heavy economic costs, suicide has a massive negative impact on the individual’s family. Third, suicide rates can be

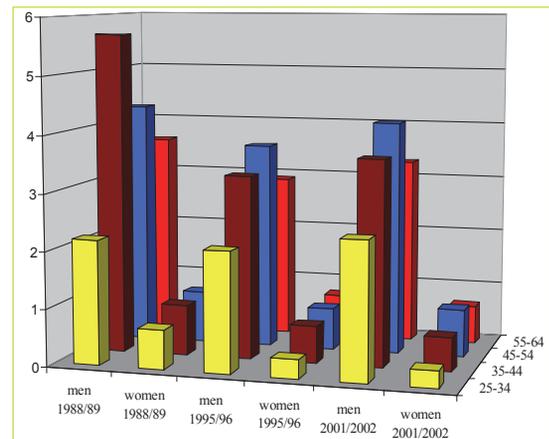
considered more objective and reliable indicators of well-being or quality of life than self-reported health measures. It has been shown that there is strong correlation between suicide and subjective well-being at the individual as well as the aggregate level. A number of studies have shown that

socio-economic factors play a substantial role in explaining suicide mortality. The modern sociological theory of suicide is based on the work of Durkheim, considering suicide a phenomenon with meaningful social components. Durkheim concluded from evidence from several European countries that the suicide rate was higher among the upper social classes, whom he regarded as suffering from a lack of social regulation, or anomie. However, data for England and Wales for the first half of the 20th century showed that the relationship of suicide to social class was U-shaped. American data indicated that the highest suicide rates occurred in the lowest social class. The comparability of these studies is limited for many methodological reasons and further research is needed.

According to Durkheim's theory, suicide rates are expected to increase during periods of rapid economic change and to decrease during the periods of economic stabilization. In Poland, enormous socio-economic changes occurred in the 1990s and at the beginning of the 21st century. A socialist, nationalized economy was transformed into free market economy while a totalitarian one-party system was transformed into a multi-party parliamentary system. All these changes had numerous political, economic, and social consequences. For example, Poland came to face an entirely new phenomenon that had not existed before: unemployment. It is presumed that the recent socio-economic transformation in Poland, accompanied by several changes in certain lifestyle elements, may have affected the biological status of Polish society, and these effects may have been distinct across the social strata. Therefore, a study was performed in order to describe a pattern of changes in suicide mortality in Poland during 1988-2002, when the major socio-economic transformation occurred, examining changes in education-specific and marital status-specific rates of suicide mortality among adults in Poland.

The study explores three surveys of suicide mortality among adults carried out in Poland in 1988/89, 1995/96, and 2001/02. The measure of suicide mortality used in this analysis was the sex-, age-, education-, and marital-specific rate of mortality – defined as a ratio $R_s = m/N \cdot 1000$, where the numerator m was the number of all persons belonging to the category defined by the specific combination of these variables (sex, age, education, and marital status) who committed suicide during

a given period, while the denominator, N , was the total number of all analogously characterized persons alive in that population at the mid-point of the applied period. Individual death data for men and women aged 25-64 were obtained from the national mortality database of Poland's Central Statistical Office. All records of suicide that occurred in Poland during the 2-year periods between 1 January 1988 and 31 December 1989, 1 January 1995 and 31 December 1996, and 1 January 2001 and 31 December 2002 were utilized. These periods were chosen for analyses because data for the denominator were available only from the National Population Census, which was carried out in Poland in 1988, 1995 (Population and Housing Micro-Census) and 2002.



Mortality rates for different age groups in Poland in 1988/89, 1995/96, and 2001/02 among men and women

Several tendencies were apparent in these data. Changes in suicide mortality rates decreased between 1988/89 and 1995/96 but slightly increased during the next period for both sexes. Suicide mortality rates showed a regular social gradient: they were lowest among high educated subjects, intermediate among those with medium level of education, and highest among those with low education. Such a gradient was present in each of the three successive surveys, across all age groups and in both sexes. Among both men and women, being unmarried, widowed or divorced/separated was associated with a higher suicide rate but among men this effect was stronger than among women. A recent European comparative study showed that the suicide risk among unmarried people was two- or threefold higher than for married people in many European countries, even after controlling for socio-economic factors. During the study period, the impact of

each of the two examined social factors (level of education and marital status) on suicide mortality was significant. However, the effect of education has increased substantially while that of marital status diminished between 1988/89 and 2001/02.

The results of this study also showed that men, especially unmarried and with lower education, suffered much more from the consequences of the economic transformation than women. One possible explanation of the difference between women and men could lie in the fact that women are more socially integrated with relatives and friends, as well as with members of the community, as compared with men. This may guarantee more social support in difficult times and a lesser risk of isolation and ostracism.

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The potato genome: another eukaryotic genome fully sequenced with the cooperation of Polish laboratories

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In mid-July *Nature* published the paper "Genome sequence and analysis of the tuber crop potato" by the Potato Genome Sequencing Consortium – PGSC. This international consortium consisted of 32 teams from 14 countries that are significant potato producers with active potato breeding programs (the number of participating organizations are given in parentheses): Argentina (1), Chile (1), China (6), Denmark (1), India (1), Ireland (1), the Netherlands (4), New Zealand (1), Peru (3), Russia (1), USA (4), Great Britain (3), Italy (2), and Poland (1).

The Polish team, representing the PAS Institute of Biochemistry and Biophysics (IBB), co-authored the paper, which was signed by 94 consortium members from 25 leading institutions. Additional assistance was provided by 37 researchers, including those from seven institutions not belonging to the consortium. The assisting groups include the technical team from the IBB's DNA Sequencing and Oligonucleotide Synthesis Laboratory: Beata

Babińska, Małgorzata Filipiak, Ewa Kalińska, and Helena Kossowska.

The work, begun in 2007, was funded by the participating countries' governments. This is the third large genome sequencing in which IBB teams have participated.

The first was the yeast genome sequencing performed as an EU project. It represented a response to the challenge posed by the American HUGO Program, and expressed the specific character of European scientific thought, which places fundamental research ahead of purely applied knowledge. The program laid the basis for eukaryotic gene analysis. The research, documented in several IBB publications, led to a paper published in *Nature* (A. Goffeau, *et al.*, Suppl., 29 May 1997, Volume 387) co-authored by Dr. M. Zagulski – the head of our DNA sequencing lab at the time.

The second genomic program involved the sequencing of the Paramecium genome, initiated by CGM CNRS and IBB PAS, which led first to the

publication of the sequence of Chromosome 1 of *Paramecium tetraurelia* co-authored by the team from IBB PAS (M. Zagulski, J.K. Nowak, M. Nowacki, A. Migdalski, R. Gromadka – *Curr. Biol.* 2004, 14), followed by the announcement of the complete genome (720 million base pairs, 39 642 genes – *Nature* 2006; 444(7116); co-authors from IBB – M. Zagulski, J.K. Nowak).

The next genome program completed with IBB PAS participation is the sequencing of the potato DNA. The potato (*Solanum tuberosum*) is a member of the family *Solanaceae*, which includes other plants of economic importance such as the tomato, bell-pepper, eggplant, petunia, and tobacco. The tetraploidy and high heterozygosity of the potato poses a problem in potato genetics, and hence also in the project. There exist only a limited number of double monoloids, which include the *S. tuberosum* strain from the Phureja group, DM1-3 516 R44, initially submitted for sequencing, further referred to as DM.

The DM strain was sequenced by the consortium using the “Shotgun method” on genome sequencing platforms, one of which was created in Warsaw (Roche GS 454 sequencer). The second strain sequenced was a laboratory *S. tuberosum* heterodiploid RH 89-039-16, further referred to as RH, which resembles industrial varieties more than DM does.

The program actually began with work on sequencing the RH strain, but the heterozygosity and uneven distribution of markers on the genetic map slowed down the work. It was decided to radically change the strategy, selecting the DM strain and the Shotgun approach, using it to identify the structure of short fragments by next generation sequencing technologies (NGS).

The DM strain sequence was inferred from crude shotgun fragments with a total length of 96.6 Gb (96.6 billion base pairs). The sequences were used to infer (using the SOAPdenovo program) a linear sequence representing 86% of the 344 megabase genome. The coverage of the ordered sequence with partial sequences was thus at least 100-fold with certain insignificant variations depending on the region of the full genome. Genetic and physical maps allowed for the genetic localization of 86% of the ordered linear sequences and construction pseudomolecules representing DNA complements for each of the 12 chromosomes.

Ab initio predictions of genes and their functions were verified by RNA transcriptome analysis done for various tissues, development stages and under stress. This allowed for the identification of 39,031 gene-coding proteins. 25.3% of these genes produce RNA that undergoes splicing, coding for an average of 2-3 different proteins. It therefore seems that the potato genome codes for approximately 100,000 different proteins.

Evolutionary analysis indicated that 24,051 potato genes have homologues in the genomes of other, taxonomically distant plants. 3372 are unique to the potato, these of course include genes which are probably responsible for traits specific to the potato, such as the formation of tubers. Comparisons of paralogous fragments indicate that over the course of evolution, the original potato genome underwent two whole genome duplications (WGD).

Comparisons of the DM and RH sequences show that the potato exhibits high heterozygosity. Single-nucleotide polymorphisms (SNP) are encountered on average every 40 nucleotides, while insertions or deletions (or “indels”) of an average length of 12.8 nucleotides are encountered on average every 394 base pairs. This data clearly shows that gene damage in the potato genome is a frequent occurrence, which accounts for the easy degeneration of industrial strains.

It is worth stating that today, the intellectual effort of genome-sequencing teams is fundamental to the advancement of modern biology. This is due to the fact that genomic data represent “hard science,” appropriate for expression as mathematical relationships, making genomics into a science that combines biology and physics with mathematics, chemistry, and computer science. The efforts of the Polish Academy of Sciences teams contribute to the world-wide efforts in this area.

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Myrmica ants (Hymenoptera, Formicidae) of the Old World

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G.W. Elmes | Centre of Ecology and Hydrology | Wallingford

The Holarctic ant genus *Myrmica* contains nearly 150 species, some of which such as *Myrmica rubra* sting very freely. These are the European “Picnic ants” that can be such a nuisance when one is sitting beside a river or lake. *M. rubra* was accidentally introduced to some seaboard States of North America where it can form supercolonies (systems of numerous, genetically related nests), and be a real economic pest – the so called “European Fire ant.” Apart from being a nuisance, *Myrmica* has become increasingly important in nature conservation programs aimed at preserving rare and endangered insects, most notably Large Blue butterflies of the genus *Maculinea*. The final instar of *Maculinea* caterpillars live inside *Myrmica* ant nests where they either prey upon the ant brood or in some cases are fed directly by the ants like cuckoos. However, many other species of invertebrate, some with equally high conservation value, also live in *Myrmica* nests and have relationships with their hosts that range from commensalism to extreme social parasitism. It is not known for sure why *Myrmica* ants are such good hosts but it is suspected that it is related to the ants’

proclivity to have more than one functional reproductive queen per colony.

It is increasingly important for practical entomologists to identify *Myrmica* species correctly but the problem was that many confusing infra-specific forms from Europe and North America had been described while the fauna of the rest of the world was very poorly known. Neal Weber attempted a revision of *Myrmica* in 1947, calling it his *crux myrmecologorum* because of the plethora of very variable species, restricting himself to the North American forms with a synopsis of the Palaearctic species. Towards the end of the Soviet era Alexander Radchenko revised the *Myrmica* species of the former Soviet Union, many of which were hardly known to western specialists, and related them to the European species. On the other hand, for more than 40 years Graham Elmes (UK) has studied the ecology, behavior and populations of *Myrmica* and their parasites, amassing a large collection in the process.

Radchenko and Elmes met at the end of the Soviet era and eagerly discussed the origins and relationships between the species. They agreed that the infra-specific forms described from northern Europe were probably a result of recent glaciations and ongoing speciation, and that most of the common Western European and North American species might be more recently derived from an “older” fauna, examples of which persisted in the Himalaya and South-East Asia. The problem was that the *Myrmica* ants of these regions were poorly known and often badly described, so they decided to rectify this first. Right from the start they envisaged a fully illustrated book with keys that could be used by non-specialists; one that also contained as much biological information as possible and outlined their ideas on the evolution and radiation of the genus. They restricted it to the Old World because a preliminary investigation of North American material showed many species needing to be described but virtually no overlap with the Old World fauna.

“*Myrmica* ants of the Old World” is a 787 page hardback. The work was published as vol. 3 of *Fauna Mundi* – a monograph series of the *Natura optima dux* Foundation. The book opens with a brief



Alexander G. Radchenko

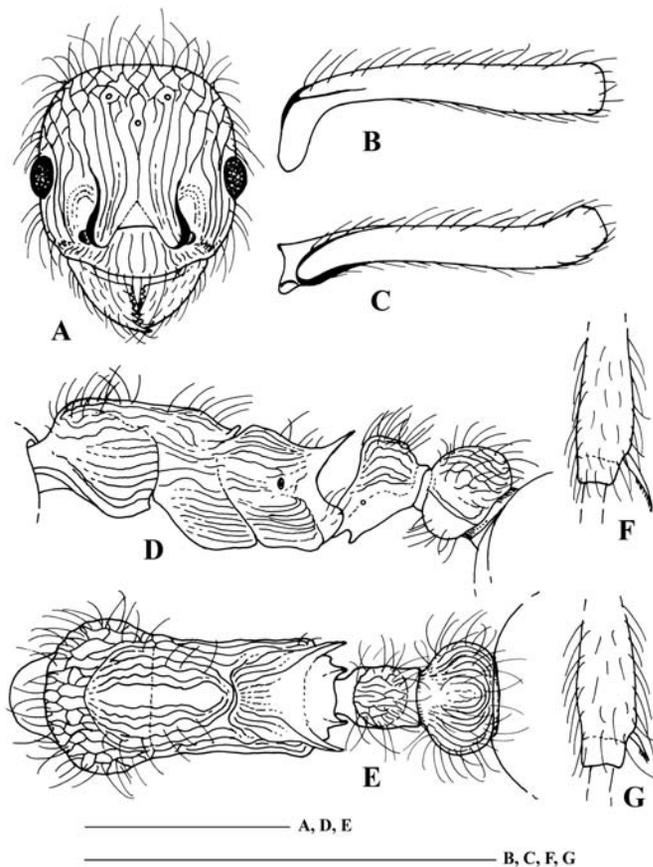


Fig. 1. Details of the species morphology, example of *M. hirsuta* worker: A – head, B and C – scape of antenna (lateral and dorsal view respectively), D and E – alitrunk and petiole (lateral and dorsal view respectively), F and G – distal part of tibia (hind and middle tibia respectively)

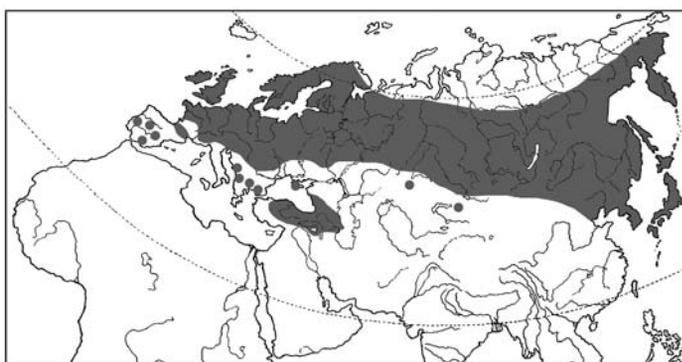


Fig. 2. Species range, example of *M. ruginodis* – one of the commonest and most widely distributed members of the genus *Myrmica* in the Palearctic

Preface section that describes the authors' 15-year collaboration and their respective roles as biogeographer and ant taxonomist (Radchenko), and population ecologist, social insect biologist and conservation ecologist (Elmes). This is followed by five major Chapters which need not be read sequen-

tially. There is a full index of species names. Chapter 1 starts by explaining the scope and layout of the book; the main section is a well-referenced biological review of *Myrmica* sufficient to start a detailed literature search and concludes with photographs and short biographies of the main authors of good *Myrmica* species.

“Review of Species” (Chapter 3) is the core of the book, listing and discussing the 425 names ascribed to *Myrmica* and highlighting the 147 good Old World species in alphabetical order. These are fully reviewed taxonomically, for each caste of each species a set of accurate line drawings are provided (using the type specimens where possible; Fig. 1); for each species its distribution in the Old World is illustrated with a map (Fig. 2). The keys to worker castes are provided in Chapter 5. Apart from the fossil species, separate keys are made for seven distinct geographical regions, which should make them less cumbersome for non-specialist users.

The remaining two chapters are more specialized and outline the authors' latest views on the origins, evolution, spread and current distribution of the genus. Chapter 2 starts by examining the taxonomic position and diagnosis of the genus *Myrmica* and the authors describe their concept of 17 species-groups within the genus. Recent molecular-genetic studies suggest that most of these groups have some phylogenetic value. Chapter 4 addresses zoogeography and evolution; nine major zoogeographic areas are proposed and it is shown that the faunas of the two areas within the Oriental region are quite distinct from those of the Palearctic region. The paucity of fossil *Myrmica* ants makes discussion of the timing of the evolution and spread of genus *Myrmica* very subjective. However, the authors give reasons for supposing that the genus evolved in ancient Eurasia more than 45 Ma and had spread throughout Eurasia by the start of the Miocene Epoch, probably invading North America (and possibly back) via the Beringian land bridge several times in subsequent ages.

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Surface water cooling and salinity decrease during the Middle Miocene Climate Transition at Southern Ocean ODP Site 747

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The study integrates micropaleontological investigations on the evolution of planktonic foraminifera with multi-taxon stable isotopic analysis, which provides insights into the hydrography of the Indian sector of the Southern Ocean. It focuses on the relatively short interval between 15.0 and 12.2 million years ago (Ma), which was a time of great importance for Cenozoic climate history and biotic evolution. This was also a time of the progressing thermal isolation of Antarctica and the Southern Ocean, which resulted in a major turnover in planktonic organisms and the development of the Neogene high-latitude modern-like assemblages of marine microorganisms. Planktonic foraminifera are among the most studied microfossils as they are commonly used for paleoenvironmental reconstructions and biostratigraphy, therefore it is quite crucial to gain a better understanding of the environmental factors driving their evolution.

The high quality of the foraminiferal record at Ocean Drilling Program (ODP) Site 747 (Fig. 1) makes it possible to study in detail the foraminiferal assemblages across the Middle Miocene Climate Transition (MMCT). This was one of the three major steps in Cenozoic climatic history. The cooling of the MMCT terminated the Mid-Miocene Warmth and reached a threshold at ~14 Ma, which is marked by a world-wide and rapid shift in $\delta^{18}\text{O}$ (MMS). That shift has been interpreted as being related to a rapid, major expansion of the East Antarctic Ice Sheet, which was coupled with increased

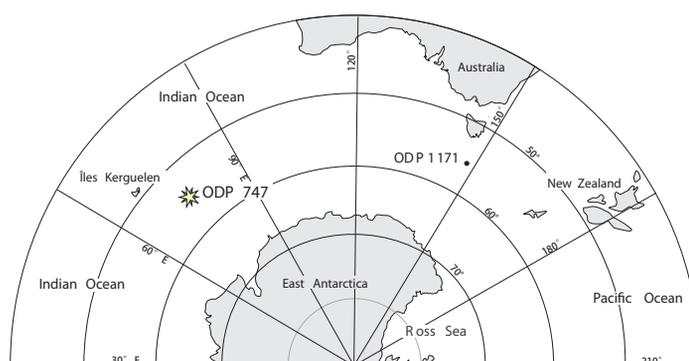


Fig. 1. Location of ODP Sites 747 and 1171 on a paleogeographic reconstruction for 15 million years ago

global cooling. During this time, sea surface temperatures (SSTs) have been interpreted to have decreased by ~6-7°C in the Southern Ocean (see two graphs on the right side of Fig. 2), while deep waters cooled by 1.5 to 3.0°C. Additionally, terrestrial cooling in Antarctica has been interpreted in the McMurdo Dry Valleys, where paleontological and sedimentological evidence has indicated a permanent shift from a wet- to cold-based glacial regime and a shift from tundra to fully polar climates.

Despite that knowledge, very little is known about the changes in nutrient, temperature, and salinity conditions of the Southern Ocean surface waters that occurred in conjunction with MMCT. To fill this gap, paleoceanographic variability has been investigated at ODP Site 747 using oxygen and carbon stable isotope records derived from both

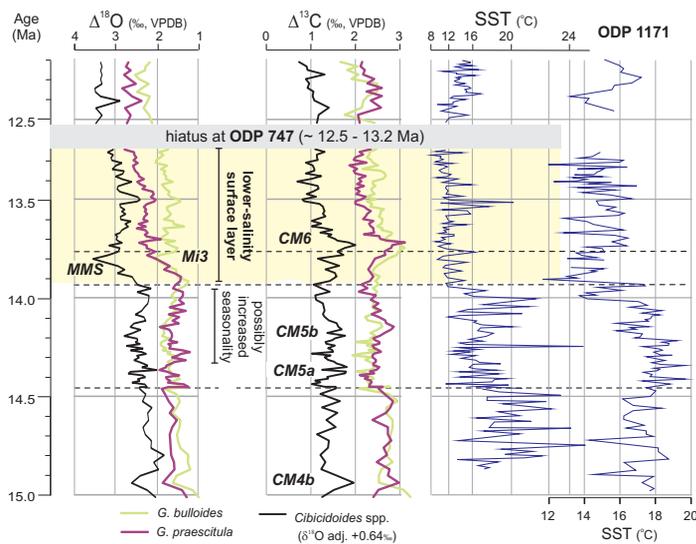


Fig. 2. Comparison between stable isotope results from Site 747 and Mg/Ca paleotemperature records from Site 747 and Site 1171 published by other authors. Major paleoenvironmental events interpreted in this study are indicated in addition to standard oxygen and carbon isotope events (in italics)

benthic and planktonic foraminiferal taxa (Fig. 2). Specifically, possible changes in upper water-column thermal and salinity structure for the interval between 15.0 and 12.2 Ma have been studied. These data and resulting interpretations provide a framework for placing planktonic foraminiferal

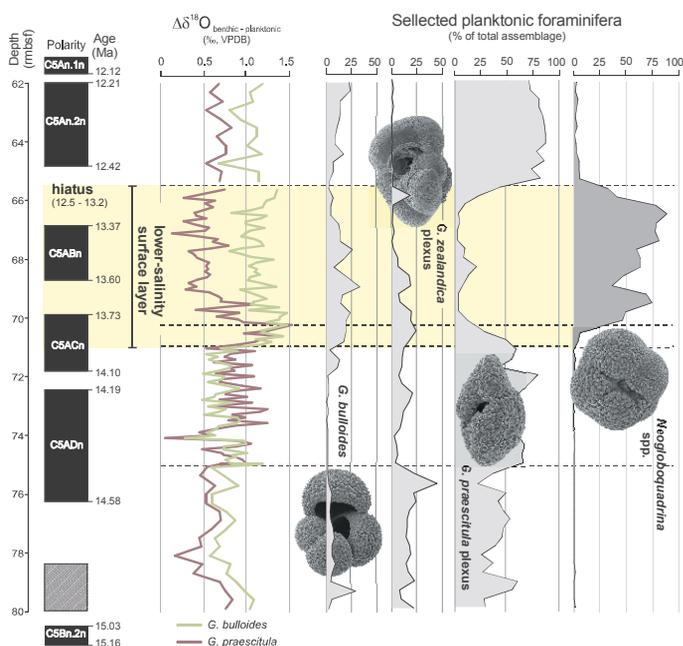


Fig. 3. Stable isotopic differences (gradients) between planktonic and benthic $\delta^{18}\text{O}$ records and abundances of selected planktonic foraminifera. Note vertical scale different than for Fig. 2

assemblage changes during the MMCT into a paleoceanographic perspective.

The stable isotopic records show (Fig. 2) a reversed planktonic $\delta^{18}\text{O}$ hierarchy, between 14.35 and 13.9 Ma, prior to the major cooling, suggesting decreasing strength on thermocline and/or increased seasonality with cooler early-spring and/or late-fall temperatures. During the initiation of the major MMCT cooling at ~ 13.9 Ma, the $\delta^{18}\text{O}$ values measured on two planktonic foraminifera diverge significantly from benthic values and slightly later from each other, suggesting a decrease in surface-water salinity of up to ~ 2 salinity units at ~ 13.9 Ma, persisting until at least ~ 13.2 Ma. The interpreted freshening of the upper water-column at Site 747 occurs in direct association with the Mi3 cooling and glaciation event interpreted from the benthic foraminiferal $\delta^{18}\text{O}$ record, but it appears to lag behind surface cooling interpreted from planktonic foraminiferal Mg/Ca records derived both from Site 747 and Site 1171 in earlier studies (Fig. 2).

Within the later interval, between 13.8 and 13.2 Ma, at Site 747, *Neogloboquadrina* spp. dominate the foraminiferal assemblage (Fig. 3). This increase is the most prominent feature in the foraminiferal record at ODP Site 747 between 15.0 and 12.2 Ma. It has been previously interpreted as a likely response to cooling. In the present record, the rapid increase in *Neogloboquadrina* spp. corresponds to the divergence in the *G. bulloides* $\delta^{18}\text{O}$ record from the *G. praescitula* $\delta^{18}\text{O}$ record. Although the divergence in planktonic foraminiferal $\delta^{18}\text{O}$ could be due to a variety of factors, a decrease in surface-water salinity is a prime candidate. Among recent foraminifera, *G. bulloides* and *N. pachyderma* (the modern descendant of *Neogloboquadrina* spp.) both tolerate a wide range of typical oceanic salinities; however, only *N. pachyderma* (sinistral) shows a preference for low salinities, down to and below 34. Although the increase in neogloboquadrinids cannot be confidently ascribed to a particular environmental factor, this major assemblage change corresponds to the increase in benthic *G. bulloides* $\Delta\delta^{18}\text{O}$ values (Fig. 3) and bolsters the interpretation of a combined surface-water temperature and salinity decrease at Site 747 during the MMCT.

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Liverworts of the Prince Edward Islands at the world's southern extremes

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The Prince Edward Islands (PEI) are a small archipelago consisting of two islands, Marion (46°54'S, 37°45'E) and Prince Edward (46°38'S, 37°57'E), which are small specks of land in the vast Southern Ocean. The remoteness of these islands – which measure 290 and 44 sq. km respectively – is illustrated by the distance to the nearest continent, Africa, which lies 1800 km NNW of them, whereas the distance to the Antarctic continent is 2300 km. The islands are the summits of coalescing shield volcanoes of late Quaternary origin. Their age is estimated at 270,000 years for Marion I. and 215,000 years for Prince Edward I. They lie close to the Antarctic Polar Front (APF), better known as the Antarctic Convergence, an oceanic boundary where cold Antarctic waters from the south meet warmer waters from the north. Close proximity to the APF ensures that the climate of the PEI is cool, wet and windy, with a mean annual temperature variation of about 4°C (including recorded maximum temperatures of above 20°C and minimum temperatures of –6.8°C, with a wind chill factor capable of reducing the experienced effect to –20°C). High humidity (83%), precipitation (2500 mm/year) and wind speeds, as well as cloud cover, are routinely experienced. Phytogeographically the PEI belong within the Subantarctic and politically they are possessed by the Republic of South Africa. Geographical isolation and position relative to the APF are significant determinants of the flora and vegetation of these subantarctic islands. Because of the lack of arborescent vegetation, the PEI ap-

pear bleak and barren, and have a monotonous plant cover.

Bryophytes, a group of cryptogamic plants consisting mosses, liverworts (or hepatics) and hornworts, account for a large part of the plant cover of the PEI. They are found in all habitats on the is-

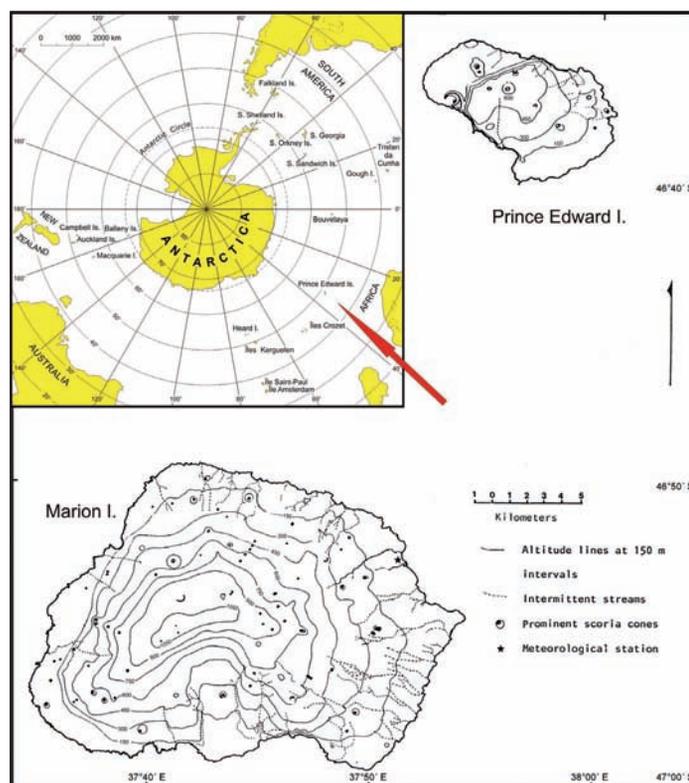


Fig. 1. Marion and Prince Edward Islands and their position in the Southern Ocean (inset)



Fig. 2. Marshy coastal plain and cinder cone of Junior's Kop overlooking Transvaal Cove at NE coast of Marion Island, showing progressing primary vegetation succession of the sparse fellfield with *Azorella selago* in upslope trend (A). Intermittent stream crossing the fellfield with *Azorella selago* and *Agrostis magellanica* at foot of Horingberg, with Boggel, McAll Kop and Platkop in the background on Prince Edward Island (B)



Fig. 3. *Marchantia berteroana*, a thallose liverwort (A), and *Acrobolbus ochrophyllus*, a foliose liverwort (B), two widespread pan-south-temperate species

lands, occurring from sea level to the highest elevations. The wet climate of the PEI is very suitable for bryophytes, especially liverworts, because they mostly grow in damp conditions, forming large mats and carpets in much of the lowland vegetation, whereas in the upland areas they are mostly represented by cushion-forming species. The hepatics are, apart from mosses and lichens, the major components of the terrestrial vegetation. They are usually less prominent than mosses, and are often concealed within moss tufts, cushions and mats, but sometimes they occur copiously, both in terms of frequency and cover, and are the dominant structural elements in some plant communities on the PEI.

The first collection of hepatics, comprising six species, was made on Marion I. by the *Challenger* expedition in 1873. However, subsequent collections of these plants were made only after the annexation of the PEI by the Republic of South

Africa in 1948 and they are generally scattered in the literature.

The challenge of producing a complete Flora of the liverworts of the PEI was taken up by the present authors, and work commenced a decade ago when *A Flora of the Liverworts of the Subantarctic Prince Edward Islands* was conceived. The background field work for this Flora consists of three seasons on the Prince Edward Islands, in 1999, 2001 and 2003, during which the first and the last authors explored major parts of both Marion I. and Prince Edward I. The experience in the field with these plants resulted in the growth of ecological and biological information on particular species and the results of these field investigations have been published in many scattered accounts. In total over 3,500 specimens of hepatics have been collected, this being apparently the largest collection of these plants from a single area in the Subantarctic. No fewer than ten

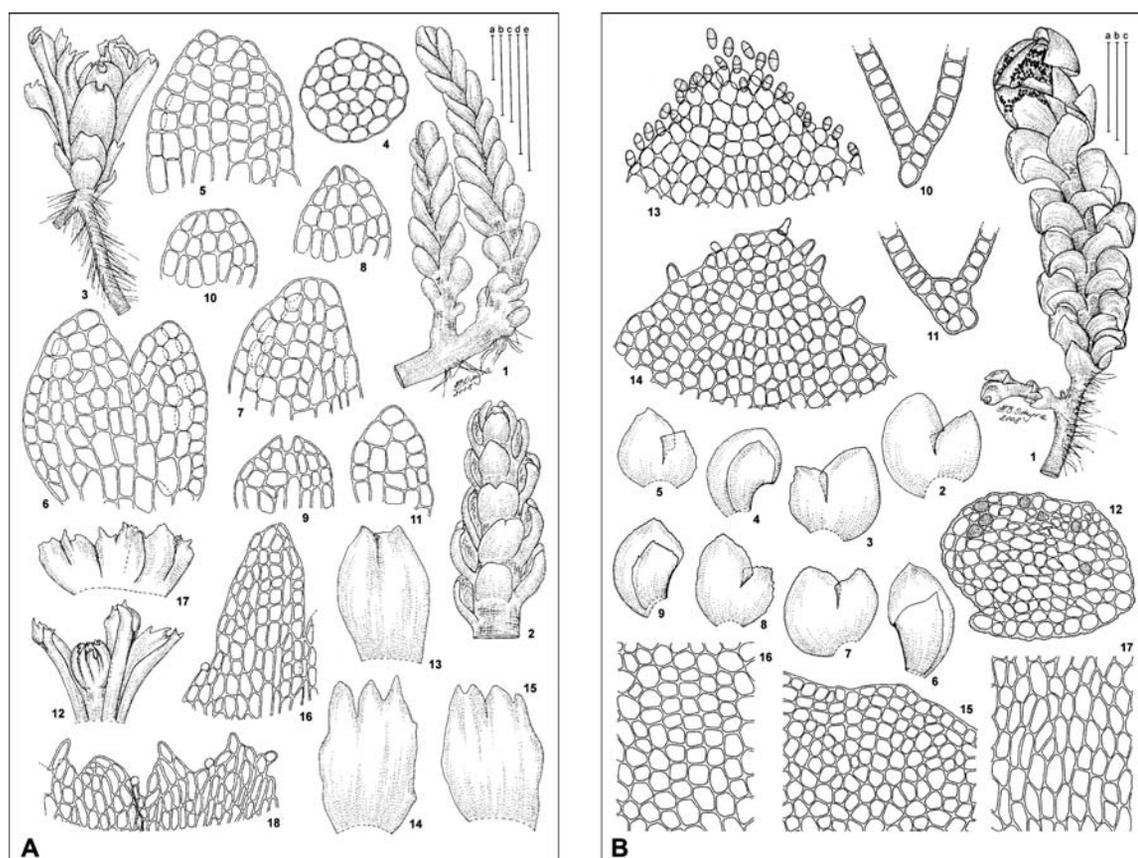


Fig. 4. A plate showing *Paracromastigum ryszardii* (A) and *Scapania valdonii* (B), liverwort species endemic to the subantarctic Prince Edward Islands

species are new additions to the hepatic flora of the archipelago. Moreover, two species, *Scapania valdonii* and *Paracromastigum ryszardii*, were described and one species and genus will be described as new to science from this collection. The Flora is currently under preparation and should be completed and published at the beginning of 2012.

The hepatic flora of the PEI consists of 54 species and this makes it the second richest liverwort flora in the Subantarctic, after South Georgia. All species are classified into 20 families and 37 genera. The objective of this work is to provide a comprehensive account of the liverworts of the PEI based on critical assessment of any available specimens from this area and on ecological data for habitats and communities. Biologists must rely on accurate determinations of the plants being studied, but there has always been much confusion regarding the identity of cryptogams. Consequently, it is often difficult to be certain which species are referred to in published research reports and, more critically, whether data for the same species can, in fact, be validly compared between accounts. Therefore it has long been rec-

ognized that there is a great need for descriptive Floras to provide the basis for making accurate determinations and offer new opportunities in terrestrial plant research in polar regions. Such information is crucial in studies of evolutionary relationships at the molecular level, community dynamics, conservation, and environmental management. It is also necessary in assessing global biogeography and biodiversity relationships with other regions of the globe.

It is worth noting that this is the first descriptive Flora of liverworts in the Subantarctic and in the temperate part of the Southern Hemisphere. It is a continuation of a series of bryophyte Floras published by the authors for the austral polar region, including *The Moss Flora of King George Island, Antarctica* (1998), *The Liverwort Flora of Antarctica* (2000) and *The Illustrated Moss Flora of Antarctica* (2008).

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Mathematical, Physical, and Chemical Sciences

Division III – Mathematical, Physical, and Chemical Sciences covers scientific activity in astronomy, physics, mathematics, and chemistry. The Division consists of 74 members of the Academy (44 full members and 30 corresponding members) plus 47 foreign members.

Division III coordinates the activity of 14 research institutes, with a total of 1034 researchers (compared to 991 in 2009) pursuing fundamental research in domains represented in the Division or working in various applied research fields. In 2010 the institutes carried out 1033 (942 in 2009) research projects, 167 (160) of which involved foreign cooperation. Over the past year, researchers from the Division's institutes published 1917 (1997) papers in refereed journals of international circulation, and the institutes were engaged in editing 12 (14) scientific journals.

Twelve of the institutes affiliated with the Division are authorized to confer doctorate (PhD) degrees, while 11 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 in joint research programs in collaboration with neighboring universities.

Six scientific committees encompassing a total of 280 members are affiliated with the Division. Four of them deal with the branches of knowledge represented within the Division – the Committee on Astronomy, the Committee on Chemistry, the Committee on Mathematics and the Committee on Physics – and function on a standing basis. The other two – the Committee on Analytical Chemistry and the Committee on Crystallography – are appointed for the term of the Academy's Presidium. As bodies representing the entire scientific community, these committees express scientific opinions, discuss research priorities, and are engaged in organizing scientific events and publishing journals. The 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 III 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* –



The ceremony of granting the Division III awards. From left: Prof. Aleksander Jabłoński from the the Insitute of Physical Chemistry, Polish Academy of Sciences, Prof. Janusz Jurczak (chairman of Division III), and Prof. Michał Kleiber (president of the Polish Academy of Sciences)



From left: Dr. Marcin Stępień from the University of Wrocław, Prof. Jerzy Zabczyk (deputy chairman of Division III), and Dr. Krzysztof Oleszkiewicz from the University of Warsaw



Chairman of the Division III granting the Stefan Pieńkowski Award in physics and astronomy to Dr. Piotr Deuar from the Institute of Physics, Polish Academy of Sciences

Mathematics, and *Dissertationes Mathematicae* in the domain of mathematics.

The Division was engaged, directly or via its Committees, in the promotion of gifted high school and university students in 2010. The International PhD Studies established at Division III in 2000 also continued this program. The Division's institutes participate in International EU Programs, and specific attention is paid to activities pursued through Centers of Excellence. The Division continued coordination of the Polish part of the EU – Republic of Korea scientific cooperation Program (KORANET). Close collaboration with other scientific societies, active in the domains represented in the Division, has been continued. The Division coordinated preparations for the International Year of Chemistry 2011 and the celebration of the 100th anniversary of the Nobel Prize in Chemistry for Maria Skłodowska-Curie.

During the present term of office of the Academy authorities, Division III is headed by Prof. Janusz

Jurczak as chairman, and Prof. Jacek Kossut and Prof. Jerzy Zabczyk as deputy chairmen.

Two plenary sessions of Division III were held in 2010. At its spring session the Division elected six candidates to become corresponding members of the Academy: Prof. Józef Barnaś, Prof. Paweł Haensel, Prof. Ryszard Horodecki, Prof. Henryk Kozłowski, Prof. Marek Pfützner, and Prof. Andrzej Skowroński, as well as four candidates to become full members of the Academy: Prof. Tomasz Dietl, Prof. Robert R. Gałązka, Prof. Stanisław Kwapiień, and Prof. Bogdan Marciniak. The fall session was devoted to analyzing the scientific condition of the institutes and centers, and concluded that all the Division's scientific units are in good shape in relation to their funding situation.

As is traditional, the Division granted its annual prizes. In 2010, the prestigious Maria Skłodowska-Curie Award was bestowed upon Prof. Aleksander Jabłoński from the Institute of Physical Chemistry, Polish Academy of Sciences, for his research in quantitative analysis of surfaces using electron spectroscopy. The research awards of Division III, in turn, were given as follows: the Waclaw Sierpiński Award in mathematics went to Dr. Krzysztof Oleszkiewicz from the Faculty of Mathematics, Informatics and Mechanics of the University of Warsaw for his work "Noise stability of functions with low influence: invariance and optimality;" the Stefan Pieńkowski Award in physics and astronomy went to Dr. Piotr Deuar from Institute of Physics, Polish Academy of Sciences, for a set of papers related to ultracold boson gases; and the Kołos Award in chemistry went to Dr. Marcin Stępień from Faculty of Chemistry of the University of Wrocław for a set of papers about functional porphyrinoids.

Advances in polymer modification

A. Gałęski | Center for Molecular and Macromolecular Studies | Polish Academy of Sciences

Investigations of phenomena at the nanometer scale carried out at the Center of Molecular and Macromolecular Studies, Polish Academy of Sciences, in Łódź have concerned the development of new polymeric nanocomposites and also understanding and making use of polymer crystal plasticity. Polymeric

materials are specific nano-materials in which the nanostructure – nano thin lamellar crystals separated by amorphous nano thin layers – forms in a natural way during solidification. Nano-scale phenomena and interactions are decisive for the solidification, morphology, and properties of polymeric nano-materials.

One of the ways of further modification consists in compounding crystalline polymers with nanofillers. Excellent dispersion of nano-fillers and their ordering in matrices of polymeric nano-composites, and also their ordering into nanolayers, leads to new materials with unexpected physical and end-use properties. Some of those materials are characterized by extraordinary high barrier properties against gases and vapors as well as excellent mechanical properties. The two-dimensional crystallization of polymers, confined between layers, represents both a challenge and an opportunity due to the long-chain, covalently bonded nature of the macromolecule. Using an innovative layer-multiplying coextrusion process to obtain assemblies with thousands of polymer nanolayers, we discovered a morphology that emerges as confined polyethylene oxide (PEO) layers are made progressively thinner. When the thickness is confined to 20 nanometers, the PEO crystallizes as single, high-aspect-ratio lamellae that resemble single crystals. Unexpectedly, the crystallization habit imparts a two-orders-of-magnitude reduction in gas permeability. These findings support the concept of a significant increase in a torturous diffusion path in films due to a parallel orientation of crystal or filler platelets to the film surface. For design and packaging strategies, polymer nanolayers or filler nanolayers can be incorporated into conventional polymeric films with the right barrier properties for less cost, which in turn may reduce the environmental and energy impact.

A significant influence on morphology and solidification is also exerted by changes in conformation of macromolecules in amorphous phase. A new means of polymer modification was developed, based on the introduction of poly(tetrafluoroethylene) (PTFE) powder to thermoplastic polymers. During compounding, solid PTFE particles are subjected to shear and deformed into nanofibers. PTFE particles of crystallinity above 50 wt.% and melting temperature of 330°C or higher are deformed into individual nanofibers forming neither bundles nor agglomerates, with transversal sizes ranging from 10 to 100 nm. The advantage of the invention is that nanofibers are formed directly during compounding with a thermoplastic polymer. Other advantages are that such nanocomposites exhibit increased melt strength and elevated temperature of crystallization and they are well suited for production of rigid foams (Fig. 1).

Although polymers are considered to be plastic materials, the phenomena that are responsible for

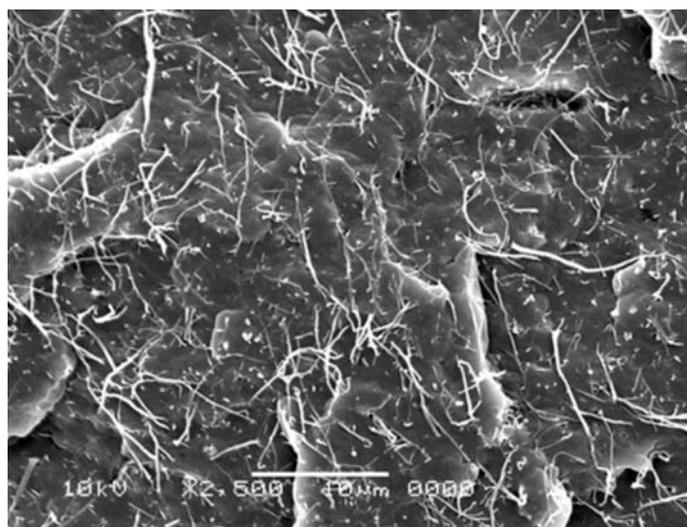


Fig. 1. SEM micrograph of PTFE nanofibers in polypropylene obtained during compounding

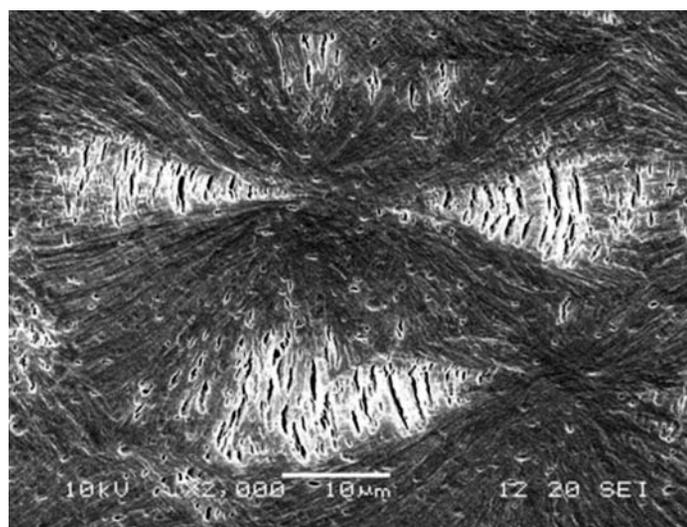


Fig. 2. SEM micrograph of microcracks and cavitation pores in polypropylene subjected to drawing

plasticity are still not fully known and understood. In particular, our understanding of polymer crystal plasticity, the formation of pores (cavitation), during drawing, and the interdependence of these phenomena with dynamic free volume is poor. Cavitation, the phenomenon of pore formation in amorphous phases between lamellar crystals, is observed during plastic deformation in many crystalline polymers. A polymer cavitates if the strength of the amorphous phase is lower than the stress required for plastic deformation of polymer crystals. Cavities have sizes in the micro- and nanoscale (Fig. 2) and they influence the further course of deformation: lowering the yield stress, lowering the plastic flow stress,

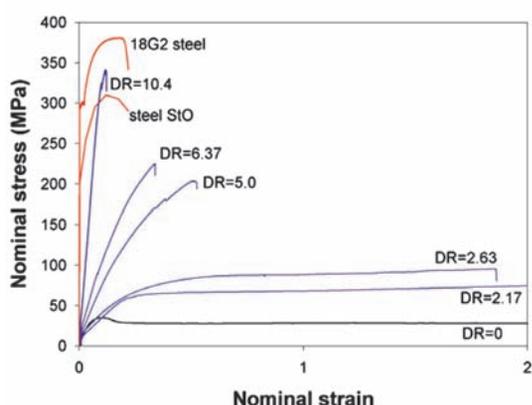


Fig. 3. Comparison of strength of oriented polypropylene rods with the strength of steel

and intensifying the plastic deformation of crystals via their fragmentation.

Positron annihilation spectroscopy has shown that removing low molecular weight fraction and impurities from the amorphous phase of polymers results in increased cavitation intensity due to the emptied dynamic free volume. Low molecular weight penetrants were therefore introduced into the amorphous phase of polypropylene, polyethylene, and polyamide 6, filling their dynamic free volume. Cavitation turned out to be either significantly lowered or even completely eliminated. Suppression of cavitation was caused by the destruction of cavitation nuclei that were the largest dynamic free volume pores.

Cavitation is considered to have a negative impact on the mechanical properties of polymers. Our investigations indicate that materials can be modified so that cavities are not formed during deformation. Understanding cavitation phenomena and developing ways of eliminating them take us towards

developing ultra high strength polymeric materials, with strength comparable to that of steel. (Fig. 3)

Most commodity semicrystalline polymers contain low molecular weight additives and also low molecular weight fractions that are accumulated in their amorphous phase during solidification. The presence of additives and low molecular weight fractions influences the mechanical properties of these industrially important thermoplastics. All formerly well-grounded views on the mechanical properties of commodity polymers thus must be revised, especially their tendency to cavitate.

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High power laser arrays based on GaN

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The Institute of High Pressure Physics, Polish Academy of Sciences (IHPP PAS) in Warsaw is one of the world's pioneers in research on gallium nitride – a key material for 21st-century electronics and optoelectronics. Janusz Karpiński, Sylwester Porowski, and Izabella Grzegory have been working on discovering GaN's thermodynamic properties

since the mid-1980s. Their work has led to the development of monocrystalline GaN growth technology using high pressure techniques. Other groups involved in semiconductor physics have also been interested in this material. Scientists at the Faculty of Physics, Warsaw University, have worked on another high pressure method for the synthesis of

gallium nitride, called ammonothermal technology, which has been further developed by the company Ammono. In 2001, using its own gallium nitride crystals, the IHPP PAS demonstrated one of the world's first laser diodes and set up the company TopGaN together with private capital. This venture focuses on producing and optimizing semiconductor laser diodes emitting violet, blue, and green light. The efforts of these hi-tech companies and cooperating research institutes have allowed a critical mass to be reached, achieving effective technological solutions that are competitive even against large Japanese corporations.

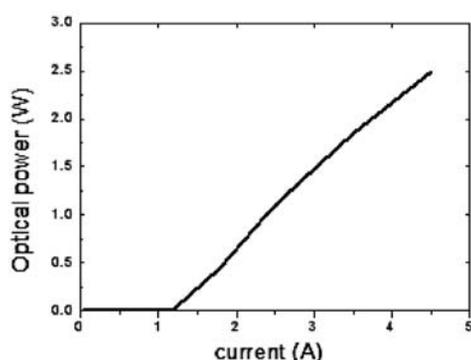


Fig. 1. Optical power as a function of current for the three-emitter mini laser array

Since the very beginning TopGaN was especially interested in producing very high optical power semiconductor lasers that can be used for image generation (laser television), in photolithography, and in the printing business. It was therefore the very first company in the world to launch systematic research on the implementation of laser arrays. Laser arrays are integrated multi-emitter systems that combine the benefits of conventional laser diodes (compact size, reliability) with very high total optical power. Laser array production requires very high quality substrates, a fact that has posed a substantial obstacle to their development worldwide.

Collaboration between the IHPP PAS and the companies TopGaN and Ammono has resulted in the presentation of a mini-laser array of 2.5 W total optical power operating in continuous wave mode at room temperature with 408 nm wavelength. The epitaxial structure was grown using metalorganic chemical vapour deposition (MOCVD) on the ammonothermal substrate. The active layer emitting light in the laser diode was a multi quantum well

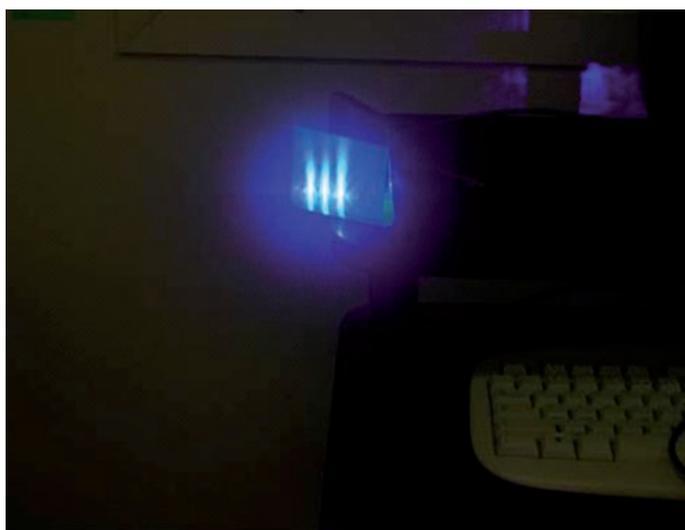


Fig. 2. Light beam image from a three-emitter GaN based laser array

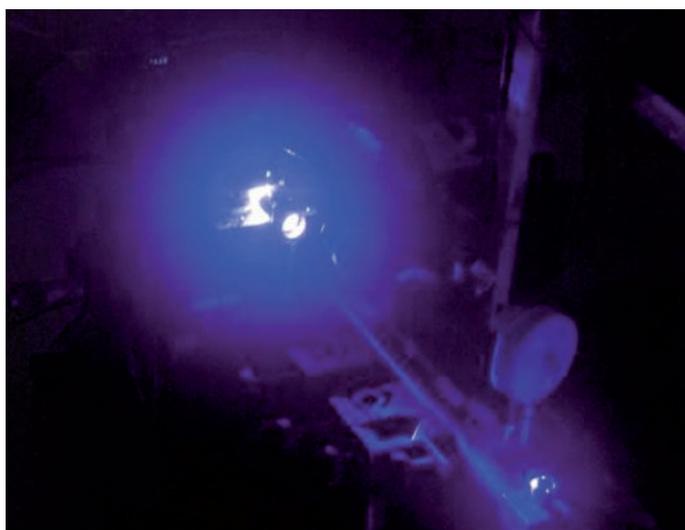


Fig. 3. Working GaN based high power laser array

arrangement made of 3.5 nm thick gallium indium nitride epitaxial layers. Lasers were produced in an oxide isolated ridge waveguide geometry, providing spatial separation of carriers and optical field. Each device consisted of three emitters – 10 μm wide bars separated by 80 μm . The laser array had 1250 mA threshold current and 1.1 W/A efficiency. The chips were mounted p-side down on the diamond submounts. Laser-submount assemblies were placed between two massive copper heat sinks. Device temperature was stabilized by a Peltier cooler. Maximum power was limited by the thermal parameters of the system. Further optimization of thermal resistance may increase the optical power even by as much as several tens of percent. The demonstration of this device opens up the prospect of such high

power laser arrays being brought to market. The presented laser array demonstrates one of the highest optical powers of all monolithic integrated nitride sources worldwide.

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Harmonic analysis of orthogonal expansions

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Classical harmonic analysis – the theory of Fourier series and integrals – saw rapid development in the 19th century, stimulated by physical problems, and was finally established as an independent mathematical discipline. Since then, in the 20th century, it has split into a multitude of significant branches, whose further evolution has resulted in many applications in various fields of mathematics, including functional analysis, complex analysis, probability theory, and differential equations. It is remarkable that applications of harmonic analysis also go far beyond theoretical mathematics, contributing to quantum mechanics, econometrics, electrical engineering, optics and acoustics, to mention a few examples, and even to medicine, providing the foundations for modern methods of medical imaging.

A large part of our research activity concerned a classical thread of the theory known as non-trigonometric Fourier analysis, the more current name being *harmonic analysis of orthogonal expansions*. A prominent role in this area is played by expansions with respect to systems defined by means of various special functions, especially the so-called *classical orthogonal polynomials* named after Hermite, Laguerre and Jacobi. There are deep motivations for the study of analogues of fundamental objects of classical harmonic analysis in the non-trigonometric framework. These objects include heat-diffusion and Poisson

integrals, maximal operators, Riesz transforms, conjugate Poisson integrals and square functions. In recent years we have widely investigated the above operators as well as others in the contexts of Laguerre and Jacobi expansions. Earlier many such operators were defined and well understood for Hermite expansions, whereas the more sophisticated Laguerre and Jacobi cases remained open. Our research has resulted in numerous publications, several of them in reputable journals like *Advances of Mathematics*, *Journal de Mathématiques Pures et Appliquées*, and *Journal of Functional Analysis*. Here we shall briefly present three of the latest papers on the subject.

One of the deepest in this connection is a paper authored jointly with P. Sjögren. We investigate the maximal operator of the heat-diffusion semigroup corresponding to expansions into standard Laguerre functions. Maximal operators play an important role in the theory of semigroups of operators, in particular their mapping properties are directly connected with the boundary behavior of the semigroups. We perform an exhaustive study of the maximal operator associated with a semigroup existing in the literature, but not covered by a general theory due to an anomaly called the *pencil phenomenon*. The description we obtain is sharp, intricate, and unexpected. Certain results depend on the dimension of the underlying space: the situation

changes dramatically when one passes to dimension 4 and higher. An important aspect of our work is the suggestion of methods and tools, as well as an intuition for similar questions in other classic contexts where the general theory does not apply.

A second paper, authored jointly with K. Stempak, deals with fractional integrals for Laguerre expansions. Classical fractional integrals, i.e. negative powers of the Euclidean Laplacian (also referred to as Riesz potentials), have been extensively studied due to their importance in analysis. One of the basic results in the theory of Sobolev spaces going back to the 1930s, used originally by Sobolev to prove his celebrated embedding theorem, is the Hardy-Littlewood-Sobolev fractional integration lemma. We prove generalized analogues of this lemma in Laguerre contexts. This complements and extends several earlier Laguerre fractional integration theorems, providing in addition a more natural and transparent line of reasoning. We believe that our results will come into play in connection with Sobolev spaces in Laguerre settings, an interesting subject that remains to be investigated.

Lastly, we can mention our research related to expansions into Jacobi polynomials. This family covers as special cases several other well-known systems of orthogonal polynomials, such as those of Chebyshev, Legendre, and Gegenbauer (also called ultraspherical). (Fig. 1) Over the last 50 years a lot of effort has been made in studying problems related to Jacobi expansions. However, many basic aspects of the corresponding harmonic analysis have so far not been investigated, because in contrast to the Hermite and Laguerre cases no suitable formula for either the heat or the Jacobi-Poisson kernel was available. In our recent joint work with P. Sjögren we derive a convenient double-integral representation for the Jacobi-Poisson kernel. Then we employ the general theory of vector-valued Calderón-Zygmund operators on spaces of homogeneous type to investigate, in a unified way, a set of fundamental operators expressible via the Jacobi-Poisson kernel. To make this modern and panoramic approach possible, we develop an original technique of kernel estimates, which is of independent interest and as such is one of the main achievements of our work. A natural and desirable continuation of this line of research is to describe the behavior of the Jacobi heat kernel and study associated objects.

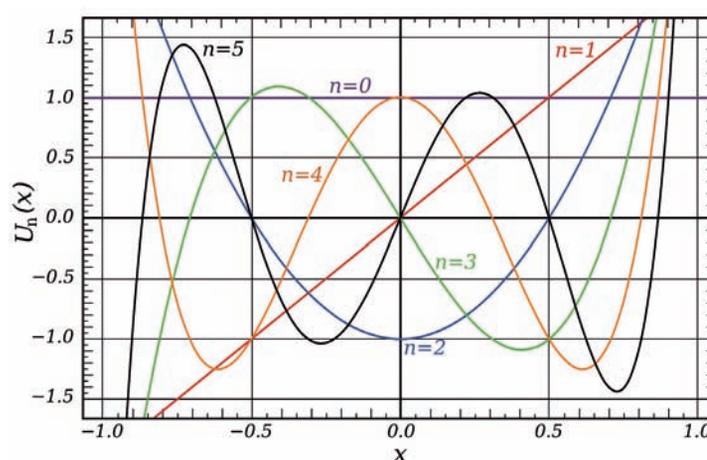


Fig. 1. The first few Chebyshev polynomials of the second kind in the domain $-1 < x < 1$: The flat U_0 and U_1, U_2, U_3, U_4, U_5

Since there is generally no hope for obtaining an exact formula (except for a heavily oscillating series), one could try to find sharp estimates of the kernel. This problem seems challenging and is in fact the subject of our present investigations. Here an additional motivation comes from the fact that the Jacobi heat kernel is also the transition probability density for the Jacobi diffusion process, which has interesting applications in stochastic modeling in physics, economics, and genetics.

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The neighborhood of the Solar System as observed by the IBEX mission

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The Solar System is made up of eight planets, a plethora of their satellites, millions of asteroids, comets and Kuiper belt objects, interplanetary dust ranging from tiny nanometer grains up to meter-large boulders, and also the solar wind, a rarefied plasma (mostly protons, electrons, and alpha particles) that flows out of the solar corona at a supersonic speed of 300-800 km/s and fills in all the space surrounding our star up to a distance of about 150-200 Astronomical Units (1 AU being the distance from the Sun to the Earth). The solar wind (SW) cuts out a cavity in a medium called the Local Interstellar Cloud (LIC), in which it is embedded. The boundary between the SW and LIC is roughly determined by the equilibrium of pressures (a total of kinetic, thermal, and magnetic components) of both media and shows a complicated structure, which nevertheless can be explained in terms of magnetohydrodynamic interactions. The inner shock (at about 100 AU) is the surface where solar wind speed slows down to below sonic value, and the heliopause (at about 150-200 AU) is a physical boundary that separates the already subsonic SW plasma from the ion component of the LIC.

For more than four decades scientists have been trying to determine the properties of the LIC using

mostly optical methods (absorption of light from nearby stars), but also analyzing the neutral LIC component, especially its principal species, hydrogen and helium, which can reach the inner solar system provided it survives ionization losses along the way. In the current picture the LIC is envisaged as a cloud of perhaps a million AU in size, composed mostly of partly ionized hydrogen ($n_{\text{H}} = 0.1/\text{cm}^3$) in thermal equilibrium ($T \sim 6500$ K), which moves with a speed of 26 km/s with respect to the Sun. It is assumed that the LIC also contains heavier elements with abundances roughly similar to average cosmic abundances, although only the helium density ($n_{\text{He}} = 0.015 \text{ cm}^{-3}$) has recently been determined from measurements onboard the Ulysses mission.

X-ray observations suggest that the LIC (with other similar relatively small clouds) is immersed in a vast region, some 20-30 million AU across, of very hot ($T \sim 10^6$ K), tenuous ($n \sim 0.005 \text{ cm}^{-3}$), fully ionized plasma called the Local Bubble (Fig. 1).

The ion and neutral components of both the SW and LIC interact one with another mostly via charge-exchange processes, in which a neutral atom transfers an electron to a colliding ion. As a result the new-born neutral inherits the kinetic properties of the ion from which it has originated. Since the mean free path of neutral atoms in the LIC and SW is on the order of 100 AU, part of this population can easily reach the inner solar system and be observed onboard space missions. Neutral atoms thus provide a diagnostic tool to determine properties of otherwise inaccessible plasma regions located far from the Sun. From the scientific point of view, regions located around the heliopause are especially interesting. The heating and acceleration processes there give rise to a suprathermal plasma component and, after charge-exchange, to Energetic Neutral Atoms (ENAs).

In order to investigate this interesting region in more detail, in 2008 NASA launched the medium-size IBEX mission, with a significant Polish contribution (algorithms of spacecraft attitude determination, data processing and interpretation, modeling of neutral atom fluxes) provided by a team

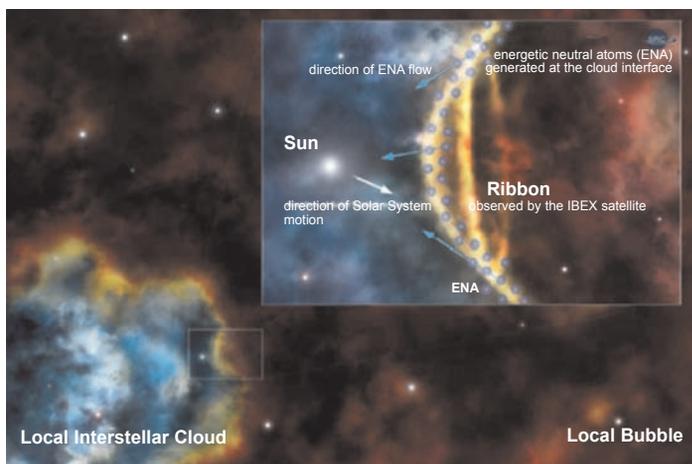


Fig. 1. Cartoon illustration of the idea of the IBEX Ribbon's formation at a nearby boundary between the Local Cloud, in which the Sun is embedded, and a very nearby hot, tenuous, fully ionized Local Bubble

led by Prof. Maciej Bzowski, continuing the tradition of the neutral interstellar medium research school established at the SRC in the late 1970s by Prof. Stanisław Grzędzielski. The spacecraft moves on a very elongated orbit (apogee close to the Moon's orbit) and carries two neutral atom detectors operating in different energy ranges, which in one half-year long cycle can provide an all-sky map of neutral atom fluxes. The surprising result of the first cycle (Fig. 2) was a very pronounced, but unexpected, ribbon-like structure centered at right ascension = 15^h25^m, declination = +22°. The IBEX observations of the ribbon were considered by NASA to be the Discovery of the Year in 2009.

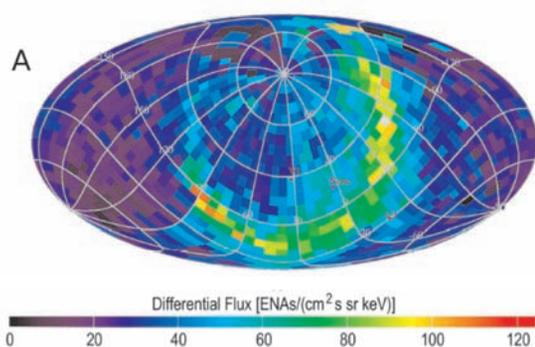


Fig. 2. The sky map of the ribbon of ENA emission for the 1.74 keV channel of IBEX-Hi, centered at galactic/ecliptic coordinates $(l,b)/(l,b) = (33^\circ, 55^\circ)/(221^\circ, 39^\circ)$, with the grid of galactic coordinates superimposed (Source: NASA, IBEX Team)

Several interpretations have been proposed, but only two have been supported with quantitative results. The most consistent is the interpretation proposed by the Polish team, attributing the observed effect to the interaction between the LIC and the Local Bubble. This interpretation is based on the idea of ENAs produced by charge-exchange between the neutral hydrogen atoms at the nearby edge of the LIC and the hot protons of the Local Bubble. These ENAs can reach the Sun's vicinity because of very low column density of the intervening LIC material. It was shown that a plane-parallel or slightly curved interface layer of contact between

the LIC Hydrogen atoms ($n_H = 0.2 \text{ cm}^{-3}$, $T = 6000 - 7000 \text{ K}$) and the LB protons ($n_p = 0.005 \text{ cm}^{-3}$, $T \sim 10^6 \text{ K}$), together with an indirect contribution coming from multiply-scattered ENAs from the LB, may be able to explain both the shape of the ribbon and the observed intensities, provided that the edge is $< (500 - 2000) \text{ AU}$ away, the LIC proton density is (correspondingly) $< (0.04 - 0.01) \text{ cm}^{-3}$, and the LB contains $\sim 1\%$ of non-thermal protons over the IBEX energy range. If this model is correct, then IBEX has provided the first imaging using ENAs of a celestial object from beyond the confines of the heliosphere and can therefore directly diagnose the plasma conditions in the LB.

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cerning the application of FeAs-based superconductors is that of anisotropy. To address this query, small pieces of the Sm111 single crystals have been cut into special form using the Focus Ion Beam (FIB) technique, one example of the prepared sample being shown in Fig. 2. The measuring current flows through the nanobridge oriented along the ab-plane of the crystal and the resulting voltage is measured by two separate leads. Similar samples (not shown in the Figure) with nanobridges oriented along the c-axis have been also prepared.

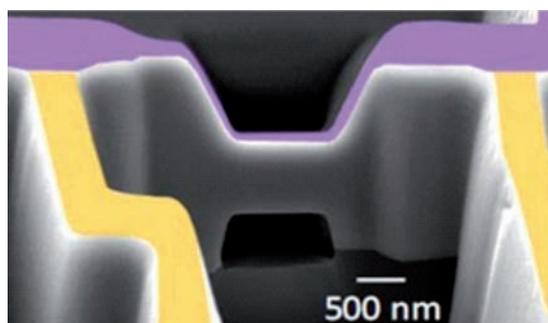


Fig. 2. Fragment of the $\text{SmFeAsO}_{0.7}\text{F}_{0.25}$ single crystal prepared for measurements of the critical current density in the ab-plane. The exposed nanobridge (cross-section $\sim 600 \text{ nm} \times 600 \text{ nm}$, length of narrow part $\approx 1 \mu\text{m}$) was cut from a single crystal lamella. During this cutting, most of the lamella is removed leaving only the small current path (violet) and small voltage leads (yellow). The lamella is rotated in the FIB to carve the free-standing structure out of the crystal bulk

Using such carved pieces of the RE111 single crystals, the critical current density has been measured in the ab-plane and perpendicular to the plane, and the critical current anisotropy has been determined, for the first time for these compounds. For the Sm111 single crystals, the results at 5 K and 10 T are as follows: $j_c^{ab} \approx 1 \cdot 10^6 \text{ A/cm}^2$ and $\gamma_{j_c} = j_c^{ab}/j_c^c \approx 2$. The high and almost isotropic value of j_c is similar to that obtained from magnetization measurements ($j_c^{ab} \approx 2 \cdot 10^6 \text{ A/cm}^2$) and, surprisingly,

it is almost field independent at low temperatures. Thus, we conclude that the superconducting magnetic and transport properties of the RE111 single crystals reveal a promising combination of high and nearly isotropic intragrain critical current densities.

To summarize, the FIB technique has been used to reveal new possibilities and open up a new area for exploration in the anisotropic properties of superconductors with high critical parameters. For the FIB prepared samples, high critical current values and low anisotropy of the REFeAs(O,F) single crystals (RE = Sm, Nd) have been measured in high magnetic fields, for the first time for this type of materials. The results clearly show that the recently discovered iron arsenide compounds have superior intrinsic superconducting properties compared with other high- T_c superconductors, which consequently makes them a promising new candidate for large scale applications.

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Technical Sciences

Division IV – Technical Sciences covers all the disciplines of technical sciences, including architecture, urban planning, automatics, biocybernetics, biomedical engineering, civil engineering, chemical and process engineering, computer science, electric engineering, laser technology, materials science, machine building, robotics, and the mechanics of fluids and solids. At the end of the year 2010 the Division had 64 national members (34 full members, 30 corresponding members) and 32 foreign members. In 2010 three full members, Prof. Wojciech Szczepiński, Prof. Tadeusz Zagajewski, and Prof. Zbigniew Bojarski, and one foreign member, Prof. Qian Wei Chang, passed away.

The Division supervises the work of 9 research institutes. These institutes publish scientific journals, seven of them publishing the following journals in English: *Control and Cybernetics*, *Biocybernetics and Biomedical Engineering*, *Archives of Hydroengineering and Environmental Mechanics*, *Theoretical and Applied Informatics*, *Archives of Thermodynamics*, *Transactions of the Institute of Fluid-flow Machinery*, *Archives of Metallurgy and Materials*, *Machine Graphics and Vision*, *Archives of Acoustics*, *Archives of Civil Engineering*, *Archives of Mechanics*, *Computer Assisted Mechanics and Engineering Sciences*, *Engineering Transactions*, and *Journal of Technical Physics*.

There are 16 scientific committees affiliated with Division IV, composed of a total of 497 elected scientists involved in research in the field of technology. The activity of the committees concentrated on supporting research and the popularization of science by organizing conferences and scientific symposiums (the overall number of such meetings in 2010 was 130), keeping contact with foreign scientific centers, organizations and associations. There is also one task-force committee affiliated with Division IV: the Committee on Production Engineering. The committees continued their publishing activity in 2010, editing 21 titles, including 18 quarterlies, 15 of them financially supported by the Polish Academy Sciences.

The Division continued publishing its own scientific quarterly – *Bulletin of the Polish Academy of Sciences: Technical Sciences*, listed on the Master Journal

List (Thomson Reuters). In 2010 particular issues focused on the following themes: *Robotics, Automatics, Power Electronics, Optoelectronics* (vol. 58, no. 1), *Advanced Materials and Technologies* (vol. 58, no. 2), *Research Cooperation in Computer Science* (vol. 58, no. 3), and *Optoelectronic Devices and Systems – Fractional Calculus and its Applications* (vol. 58, no. 4). In 2010 IF of the quarterly reached 0.945.

Two plenary sessions were held in 2010. The first session held on 31 March in Staszic Palace in Warsaw was devoted to the election of new members of the Polish Academy of Sciences. Three new members were elected: Prof. Bogusław Major, Prof. Janusz Mroczka, and Prof. Henryk Petyk. Four corresponding members were elected to become full members: Prof. Jacek Błażewicz, Prof. Janusz Kacprzyk, Prof. Jerzy Klamka, and Prof. Zbigniew Wesołowski. During the meeting Prof. Adam Janiak delivered a lecture entitled “Useful aspects of computational complexity theory.”

The second plenary session was held on 4 November at the new headquarters of the Institute of Fundamental Technological Research in Warsaw.



Opening of the plenary session of Division IV held at the Institute of Fundamental Technological Research on 4 November 2010. From left: Prof. Andrzej Nowicki (director of the Institute), Prof. Władysław Włosiński (chairman of Division IV), and Prof. Andrzej Styczek (deputy chairman of the Division)



Plenary session

The director of the Institute, Prof. Andrzej Nowicki, gave a short lecture about its research activities, its successful collaboration with other research units, and the research programs coordinated by the Institute. The three new corresponding members, Prof. Bogusław Major, Prof. Janusz Mroczka, and Prof. Henryk Petryk, presented their research achievements and fields of scientific interest.

At the end of this meeting the Division IV annual academic awards were also announced. They were bestowed upon: Dr. Grażyna Mrówka-Nowotnik from the Rzeszów University of Technology in materials science, Dr. Adam Niesłony from the Opole University of Technology in machine building, Dr. Robert Nowicki from the Częstochowa University of Technology in computer science, Dr. Elżbieta Pamuła from the AGH University of Science and Technology in biomedical engineering, Dr. Roman Rutkowski from the Wrocław University of Technology in architecture, Dr. Wojciech Stanek from the Silesian University of Technology in thermodynamics, and Dr. Maciej Zdanowski from the Opole University of Technology in electric engineering.

Furthermore, in 2010 the members of the Division and employees of its institutes were frequently



The ceremony of granting the Division IV scientific awards. From left: Roman Rutkowski, Wojciech Stanek, Grażyna Mrówka-Nowotnik, Władysław Włosiński, Elżbieta Pamuła, Adam Niesłony, Maciej Zdanowski, and Robert Nowicki

commended and honored for outstanding achievements in science. Honorary doctorates were granted to Prof. Marian Kaźmierkowski by the Institute National Polytechnique de Toulouse and to Prof. Michał Kleiber by the Military Technical Academy in Warsaw. Prof. Marian Kaźmierkowski became a foreign member of the Hungarian Academy of Sciences. Prof. Andrzej Rakowski received a prestigious distinction, the gold Medal for Merit to Culture – Gloria Artis, granted by the Ministry of Culture and National Heritage in Poland. Prof. Jacek Marecki became a member of the Academy of Engineering in Poland. Members of Division IV were often recognized and distinguished by international groups of scientists: Prof. Roman Pamuch was again elected editor-in-chief of *Ceramics International*, Prof. Tadeusz Burczyński received the distinction of Fellow in Recognition of Contributions to the Field of Computational Mechanics from the International Association for Computational Mechanics, and Prof. Janusz Kacprzyk was elected to the Administrative Committee of the Institute of Electrical and Electronics Engineers Computational Intelligence Society.

VOCs Abatement: Catalytic combustion on structures

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J. Łojewska | Jagiellonian University

Many gaseous pollutants emitted into the atmosphere are volatile organic compounds (VOCs) – dangerous poisons, carcinogens, or mutagens. Owing to their diverse serious consequences, VOC emissions pose a vital environmental problem. In Poland, yearly VOC emissions exceed 900,000 tons. The problem of VOC abatement has been taken up in recent years by a team at the Institute of Chemical Engineering, Polish Academy of Sciences, and at the Faculty of Chemistry, Jagiellonian University.

Catalytic combustion would appear to offer a satisfactory remedy. The application of catalytic combustion to vehicle emissions has met with success and automotive afterburners based on ceramic monoliths and platinum catalysts have become a worldwide standard. However, typical VOC emission involves problems like the serious dilution of reactants, large end-pipe gas streams, and a high conversion requirement. Usually, the reaction rate

is limited by the mass transfer between catalyst surface and flowing gas.

A classic monolithic reactor displays very good (i.e. low) flow resistance, but mass transfer in the long capillary channels is rather weak. VOC combustion is thus limited by mass transfer, leading to excessive reactor length and large noble metal catalyst consumption. However, it is a well established fact that the local transfer coefficients are high near the channel entrance (the so-called entrance distance), while in the remaining portion of the channel they tend towards a low constant value. To overcome this restriction, a concept was proposed to use several very short monoliths – called short-channel structures – instead of a single long-channel monolith. The length of the short-channel structure has to be close to the entrance distance.

Two ways of implementing this idea were considered: very short (sliced) monoliths and stacked wire gauzes. Preliminary mathematical modeling showed

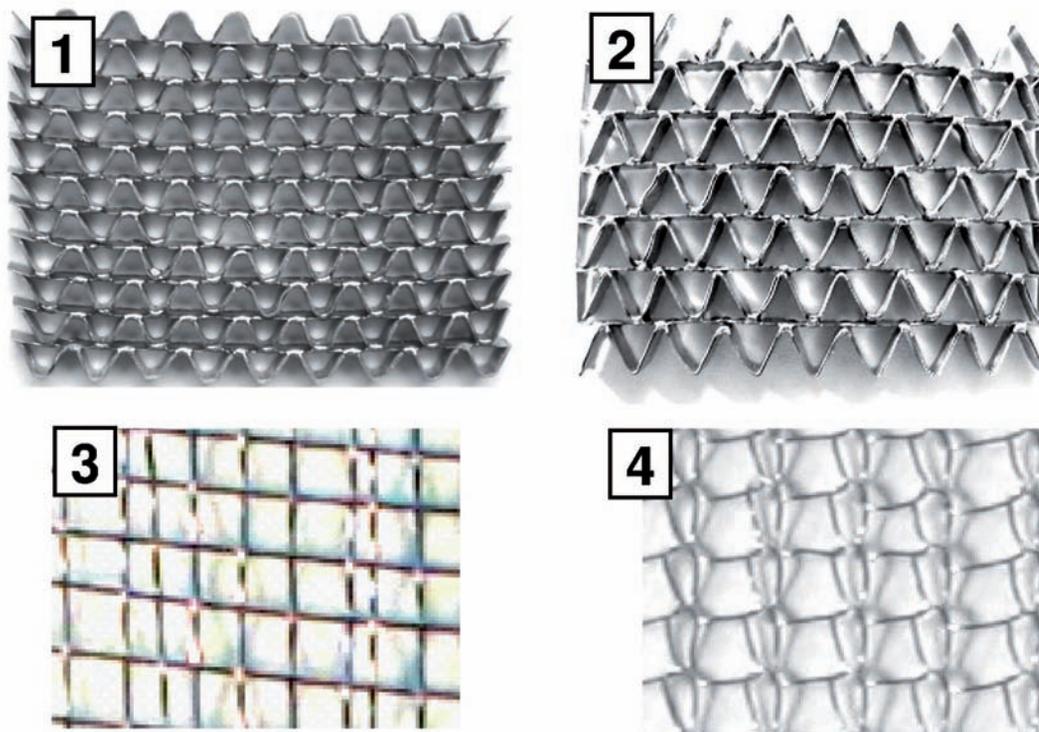


Fig. 1. Short-channel structures studied: 1 – sine structure; 2 – triangular structure; 3 – woven wire gauze; 4 – knitted wire gauze

short-channel structures of sine and triangular cross section to be most promising. Four wire gauzes (woven and knitted) as well as the sine and triangular short-channel structures (Fig. 1) were manufactured from chromium-aluminum steel (Kanthal).

The experimental program studied flow resistance, heat and mass transfer coefficients. The results fully confirmed the previous theoretical predictions. The mass transfer of the wire gauzes and short-channel structures was significantly higher than that of classic monoliths and close to that of fixed-bed reactors (Fig. 2). The flow resistance of the short-channel structures was slightly larger compared to

the monoliths but highly lower than that of fixed beds. The flow resistance of wire gauzes was situated in between that of classic monolith and fixed bed reactors (Fig. 3).

The catalyst layering on the metal structures proceeded in two steps. First, the aluminum-containing steel was calcined in air at 900°C for 24 hours. The aluminum diffused to the metal surface and oxidized there forming a one-micron thick layer of alumina crystallites (Fig. 4). Next, the cobalt oxide catalyst was deposited on this base using a low-temperature plasma technique (plasma-enhanced chemical vapor deposition). The catalyst was rigorously studied

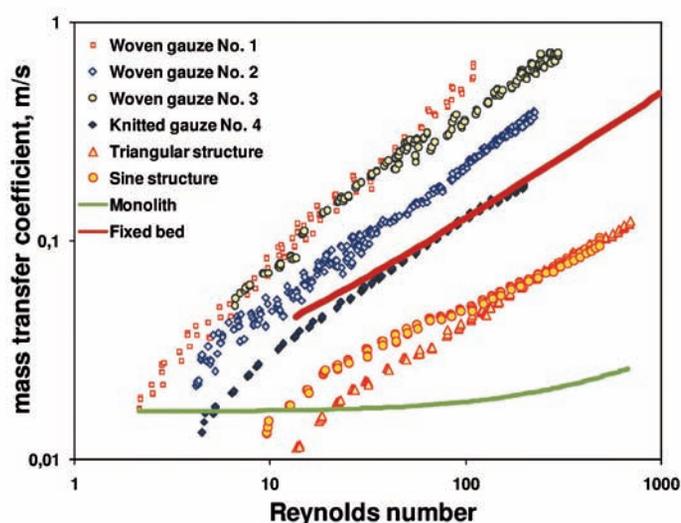


Fig. 2. Mass transfer coefficient vs. Reynolds number for the structures studied. Points represent our own experimental results, lines show correlations from the literature

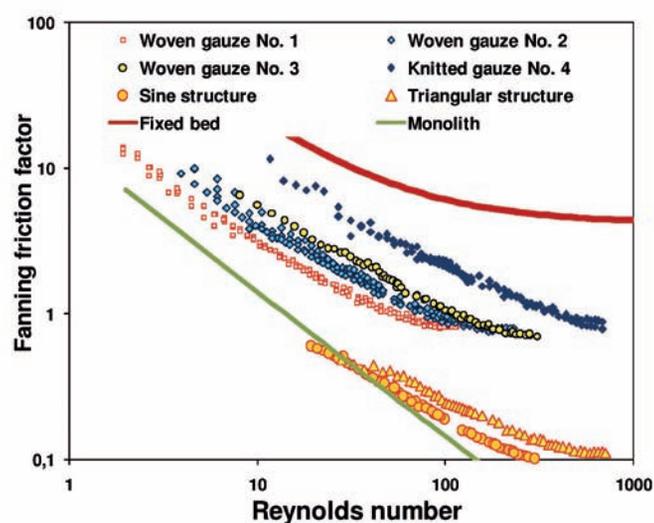


Fig. 3. Fanning friction factor (dimensionless flow resistance) vs. Reynolds number for the structures studied. Points represent our own experimental results, lines show correlations from the literature

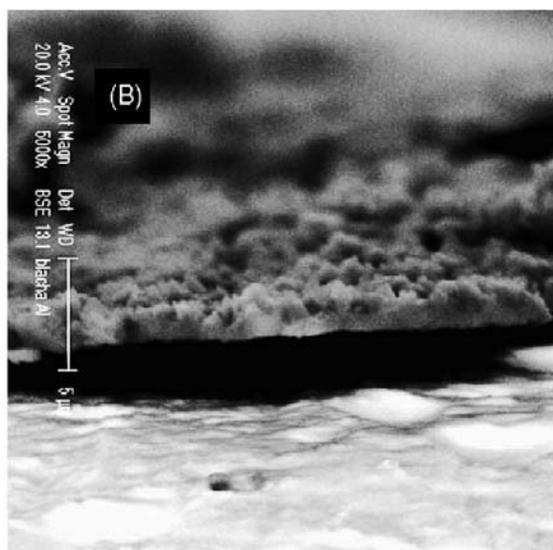
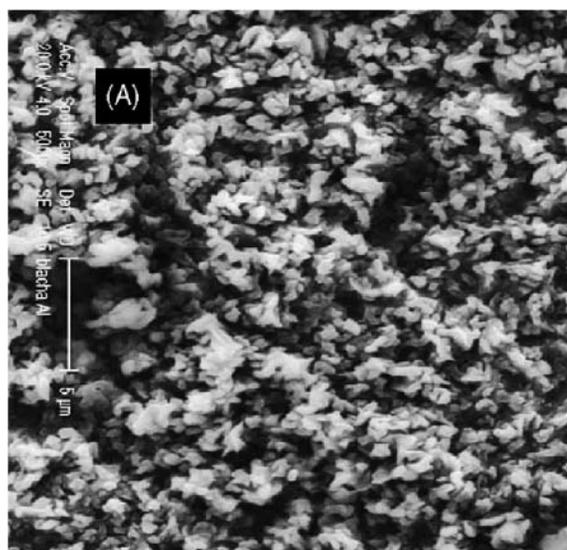


Fig. 4. Scanning Electron Microscopy (SEM) picture of the precalcined Kanthal surface, magnification 5000x: (A) upper view, (B) cross section of the alumina layer

using SEM, AFM, and Raman techniques. The spinel structure of cobalt oxide was proved. The catalyst was tested in the n-hexane oxidation reaction and the kinetic equation was derived. The catalyst activity was, however, slightly too weak at this stage. Subsequently prepared catalysts using thermal spraying showed highly increased reaction kinetics.

A mathematical model was derived for the short-channel reactor. A large laboratory scale reactor was built and filled with knitted wire gauzes with the cobalt oxide catalyst deposited on them. Several reactive experiments of n-hexane combustion were then performed and the results compared with the model predictions. The accuracy of the model was assessed as very good.

Based on the calculations performed, such a structured reactor assembled of stacked short-channel structures (sine or triangular), or stacked wire gauzes, can be a few times shorter than a classic monolith. This leads to significant savings in catalyst and reactor cost. The resulting flow resistance was slightly higher than for a monolith (by 30-40%), although much lower than for a fixed bed reactor. The short-channel or gauze reactor may be carefully adjusted to the process requirements. However, one unavoidable condition for satisfactory reactor design and performance is good kinetics of the chemical reaction considered. In fact, the kinetics offered by the plasma-deposited cobalt oxide

catalyst was unsatisfactory for the short-channel reactor. Subsequent catalysts are hoped to fulfill the requirements.

The developed class of structured chemical reactors seems to offer a promising alternative for chemical processes characterized by fast reaction kinetics, such as catalytic combustion of VOCs.

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Semantic resources for enhancing search engines

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Leading search engines still rely on word matches between query and document, but users would prefer to be returned documents that are topically related to the query. To ensure this, search results should also be sensitive to semantics (domain knowledge). This is why we have developed a novel framework which enables domain knowledge to be exploited in large-scale search tasks, with document collections explicitly assigned (with diversified membership degrees) to various semantic categories.

To support human decision making based on natural language texts, approximations of natural

language semantics are necessary. At present, they are restricted more or less to interrelationships between concepts, expressed typically by **is-part-of** hierarchies. These relationships may be crisp or fuzzy in nature. The incorporation of semantic information into search engine mechanisms is a subject of increased interest among the scientific community. By 2006, for example, the US National Science Foundation had awarded almost 500 grants for research in this field and related ones. Generally, semantic search is understood as the enhancement of traditional document information retrieval with



Fig. 1. Project working meeting. From left: K. Wysocki, M. Damiński, S. Chojnacki, D. Czerski, P. Borkowski, M. Sydow, K. Ciesielski, K. Trojanowski, M. Kłopotek

semantic web technology, exploiting ontology-based metadata. This sub-area of the Semantic Web is the subject of our research.

The semantic information about a document is derived from: (a) the document text itself, (b) the link information, and (c) user-provided semantic tags. In order to make use of this semantic information, we incorporate it into the whole search engine process, starting from document grasping by a spider (crawler) and ending with the query answering module. To obtain manageable results, we have restricted the representation of semantic information to: (1) tags (attributes being simple terms), attached to whole documents (rather than to paragraphs, for instance) either manually or via an extraction process, (2) additionally provided hierarchies of the above terms, and (3) natural language texts possibly attached to terms in those hierarchies (ontologies). We allow for the coexistence of semantically tagged and non-tagged documents, as well as multiple ontologies for representing document contents. Both the contents and the semantic tags may be used for indexing a document collection in terms of a document map.

The traditional approach to matching queries against document contents consists in weighting the importance of a query term based on the frequency statistics of the collection (so-called term-frequency inverse-document-frequency). Our framework is based on the so-called contextual model of document collection: we assume that the documents have been clustered by some mechanism,

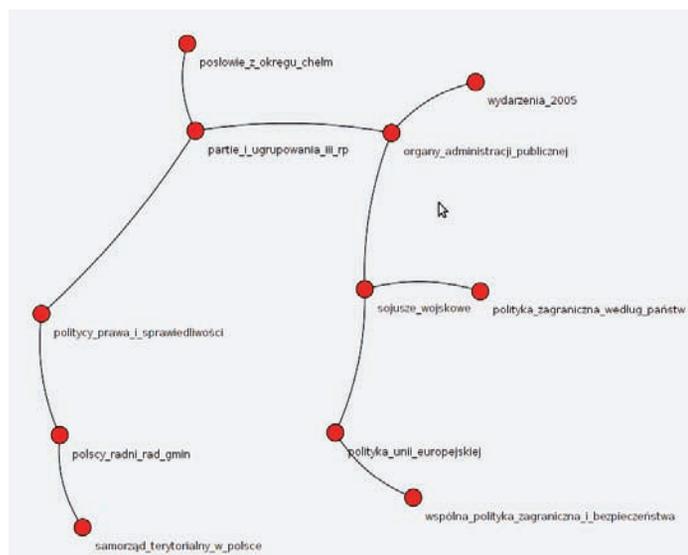


Fig. 2. A path linking the Polish Wikipedia concepts “local government in Poland” and “common foreign and security Policy” as discovered by our system

and the term weights are computed within the cluster, so the actual match of a document to a query depends on the context. In consequence, some terms may prove more important within an identified context than in general, and if the intent of the user is captured better, then the match to the user’s query will be more meaningful.

Clustering is performed using the so-called self-organizing-map approach, or the neural gas approach, where the clusters are not a set of unrelated items but form a network of more or less related topics. The clusters may be identified from pure textual contents of documents. However, if any kind of semantic tags for at least part of documents are available, such semantic tags will be taken into account during cluster formation. Hence by providing semantic information the document provider may convey his/her vision of the clustering. Furthermore, publicly available semantic resources, such as Wikipedia, may also be used as a source of automated categorical tagging, as our research has demonstrated.

Our experiments have shown that inclusion of semantic information even for part of the documents increases the quality of the final grouping of the whole collection, while the time complexity for clustering documents with semantic information remains feasible even for larger collections. Implicit integration of well-defined clustering criteria via exploitation of manually prepared supervised infor-

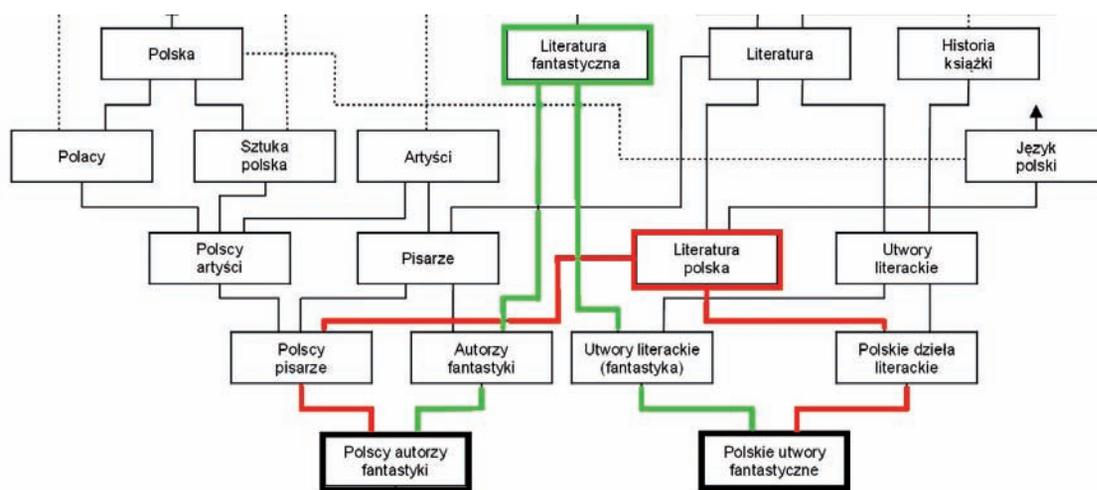


Fig. 3. According to our system, the Polish Wikipedia concepts “Polish fantasy authors” and “Polish fantasy books” share a common most specific supercategory “Polish literature,” which describes them better than e.g. “Fantasy literature”

mation turns out to be particularly useful in cases where the textual-only information is of low quality and/or unavailable (as in case of book descriptions in typical library catalogues).

In our future research, we plan to investigate whether the user profile, describing the user’s information needs, can also be taken into account as an additional dimension(s) in the document space, so that a conceptual framework for personalization of document clustering and document classification can be swiftly obtained.

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Nanofibers for medical applications at Biocentrum Ochota

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M.M. Frontczak-Baniewicz | D.A. Gołąbek-Sulejczak | J. Andrychowski | Mirosław Mossakowski
Medical Research Center | Polish Academy of Sciences

Nanotechnology is the rapid evolving science of manufacturing and utilizing extremely small particles and devices, sometimes as small as single atoms

and molecules. People became interested in the nanoscale because it affects the properties of materials. A very high surface to volume ratio is one of the

most remarkable features of nanomaterials, and is believed to be a key factor in the improvement of their properties. This can make materials more chemically reactive, and affect their strength or electrical properties.

Electrospinning of polymer fibers is one of the simplest and cheapest methods of producing nanomaterials. Electrospinning occurs when a high enough electric field is applied to the liquid jet of a polymer solution. Because of the action of the electrical stresses the jet is stretched by the bending instability and solidifies further on into an ultra thin fiber. Reducing the diameter into the nanometer range through a uniformly applied tensile stress gives rise to a set of favorable properties including a strong decrease in the concentration of structural defects, enhancing the strength of the fiber.

Early interest in nanofibrous nonwovens was driven by prospects for their use in developing new, lighter and stronger materials. The key feature that differentiates classic materials used in construction from nanomaterials is, in general, coarse-grained polycrystalline structure of relatively frequent structural irregularities and dislocations. Other prospective applications of nanofibers include: biological nanofilters, seamless clothing for special applications, and wind-driven aerodynamic profiles of a spider-web structure. The presence of numerous nanopores on the surface of the nanofibers is another key feature, facilitating their use in biomedical applications, such as drug delivery systems, nano-scaffolds for tissue engineering, and absorbable implants of skin or other tissues.

Electrospinning is based on the complex hydrodynamic and electrostatic interactions of charges moving at a rate of several meters per second in an electrostatically driven bending liquid jet of rapidly changing physical properties (elongation, solvent evaporation, crystallization). The nanofiber dynamics research that was first launched at the Institute of Fundamental Technological Research, Polish Academy of Sciences, back in 2003 was initially focused on process control. This led to the development of a computer model enabling selective analysis of the parameters crucial for the stability of the electrospinning process and fiber draw ratio (see Fig. 1). Experimental investigations have confirmed some of the correlations anticipated by the model. The impact of the physical properties of the polymer solution used and the electrical field applied on nanofiber formation was evaluated. However, it

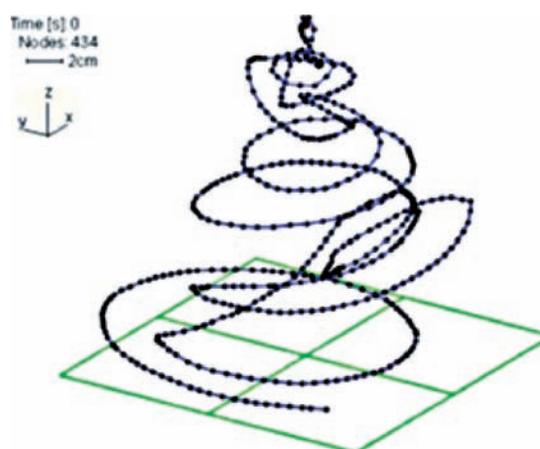


Fig. 1. Computer simulation of the electrospinning process. The fiber, represented as a chain of elementary charges drawn by the electric field towards the collecting electrode, exhibits a looping trajectory with an accelerating amplitude of deviations

seems to be quite a difficult objective to strive to take account of all possible factors contributing to this highly unstable process. In many cases, therefore, selection of the process parameters is based on laborious collection of experimental data.

The favorable mechanical properties expected from nanofibers drove our initial interest in the electrospinning process. However, tests carried out at our institute on individual fibers, fiber bundles, and nanofibrous mats have evidenced no apparent effect of stretching on the fibers' mechanical properties, as suggested by other authors. Young's modulus and the tensile strength measured for the majority of the samples tested were close to the values of standard materials. This effect may be caused by the free fall of not-completely-solidified nanofibers on the collector electrode. Within the initial phase of the electrospinning process the fibers are subjected to stretching, which orders their internal structure. However, during their deposition the nanofibers are likely influenced by a rapid structural relaxation. Analysis of the fibers' crystalline structure performed at our institute using the polarization-interference method has confirmed this hypothesis. Nevertheless, a simple method (patent pending 2010) of producing waterproof and mechanically resistant mats made of polymer nanofibers was developed during this research (comp. Fig. 2). Such nanofibrous mats are well suited for filtration and bio-separation.

Our current interest in polymer nanofibers focuses on biological and medical applications.

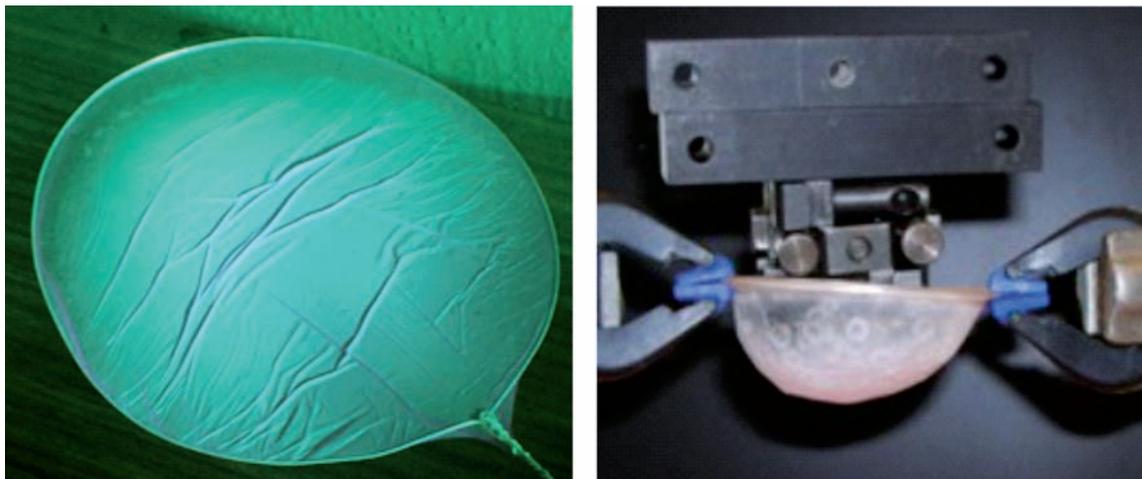


Fig. 2. Nanofibrous membrane of 65 mm diameter and ~ 0.05 mm thickness is formed from bio-compatible polymer (PLLA) using rotating water surface as a collector (patent pending). The structure so obtained exhibits remarkable mechanical strength (over 500g load)

Nanofibers based on blood serum protein (BSA) were applied as a very permissive material for the construction of fluorescent probes for bio-diagnostics. Biocompatible nanofibers were also used to construct post-burn wound protective dressing, successfully tested on mouse skin. Nanofibrous mats have been applied to prevent finger liaisons as well as to facilitate maintenance of skin implants (in collaboration with Prof. B. Noszczyk – CMKP in Warsaw). Another research project deals with the use of electrospun nonwovens as ureter or urinary bladder regenerative implants (in collaboration with the group of Prof. T. Drewna – Collegium Medicum UMK in Bydgoszcz).

Electrospun nonwovens have recently been successfully applied as a dressing material in spinal neurosurgery. Scarring is known to be one of the major post-operative complications for neurosurgery. If it occurs, it may trap a nerve, so that when a patient moves the nerve becomes stretched, causing nerve damage, pain, and internal scarring of the nerve. This causes subsequent complications related to ingrowths of connective tissue onto the spinal canal. The formation of an astroglial scar is another serious postoperative complication of brain neurosurgery. The use of bio-absorbable isolative materials as anti-liaison protection and as possible carriers for neuroprotective drug delivery is expected to help in solving such problems. The nanostructured material acts as an anti-bacterial and anti-liaison barrier while enabling transport of oxygen, nutrients, and metabolites, facilitating the healing process of the surgical wound. The insulating material is

gradually degraded leaving behind lactic acid, which does not adversely affect the surrounding nervous tissue. The neurosurgical application of nanofibrous

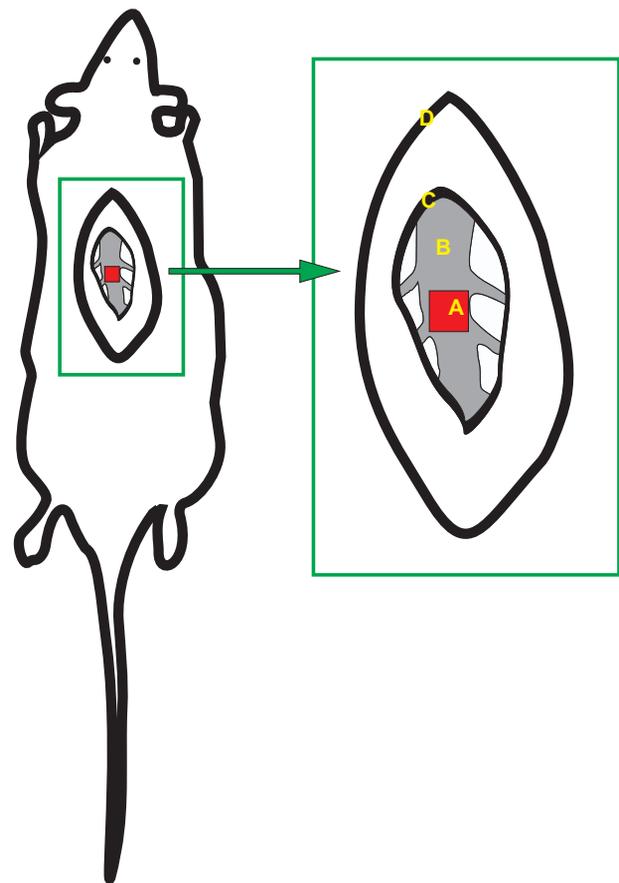


Fig. 3. Schematic illustration of laminectomy surgery, showing the place of application of the electrospun mat. A – nanofibrous mat, B – spinal cord, C – cut of spinal bones, D – cut of skin

mats is a joint project between the Institute of Fundamental Technological Research, Polish Academy of Sciences, and the Mirosław Mossakowski Medical Research Center. The application of poly(lactic acid) copolymers has yielded the first positive results. The mats were applied as a barrier to scar growth, placed into an open spinal canal (patent pending 2011) in the course of spinal laminectomy conducted on a rat model (Fig. 3). The membrane was placed on the surface of the exposed spinal cord and covered with the surrounding dura mater. Ultrastructural and immunohistochemical tests carried out after a certain period of time on dura mater and spinal cord specimens showed a lack of inflammation. Astroglial and connective tissue scars that could be potentially dangerous to regeneration were also shown to be absent. Bone fragments of the spine overgrew normally as part of the healing process. The outcome of this experiment raises expectations for the development of a clinically approved barrier material used to prevent post-operative complications commonly related to the scarring process following spinal surgeries.

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The Synthetic Aperture technique for tissue attenuation imaging

J. Litniewski | Z. Klimonda | A. Nowicki | Institute of Fundamental Technological Research | Polish Academy of Science

Introduction

The attenuating properties of biological tissue are of great importance in ultrasonic medical imaging. It has been emphasized in many publications that ultrasound attenuation is closely related to the type and pathological state of the tissue. Investigations performed *in vitro* and *in vivo* have shown correlations between pathological changes in the tissue and variation of the attenuation coefficient. The liver is the most frequent example. The *in vivo* characterization of this organ is often restricted to its attenuation properties and it has been proved that the ultrasonic attenuation coefficient increases as the amount of pathological fat in the liver increases. Also, the study of excised cancer tissue has revealed differences in acoustic attenuation among cancer types

and degrees of pathology. Saijo et al. (1996) employed a scanning acoustic microscope to measure five types of gastric cancer and reported different attenuation coefficient and sound speed compared to normal tissue. Bigelow et al. (2008) investigated the possibility of predicting premature delivery based on noninvasive ultrasonic attenuation determination in rats and in humans. Worthington and Shear reported that thermal coagulation of porcine kidney changes attenuation and Zderic et al. demonstrated strong attenuation changes in porcine liver related with HIFU treatment.

The long term goal of this study is to develop the attenuation parametric imaging technique and to apply it for *in vivo* characterization of tissue.

Attenuation determination

When a wideband ultrasonic pulse with mean frequency f_0 propagates within the homogenous medium the dispersion of the attenuation coefficient results in the shift of the pulse mean frequency. The new mean frequency f_m can be expressed by:

$$f_m = f_0 - \sigma^2 \alpha_0 x \quad (1)$$

The value σ^2 is the Gaussian variance of the pulse spectrum, x denotes penetrated distance, and α_0 is the attenuation coefficient. Gaussian pulse spectrum preserves its shape during propagation in a linearly attenuating medium, i.e. σ^2 is constant.

The value f_m was estimated using the correlation estimator (IQ algorithm). The estimator is depicted by

$$f_m = \frac{1}{2\pi T_s} a \tan \left(\frac{\sum_{i=1}^N Q(i)I(i+1) - Q(i+1)I(i)}{\sum_{i=1}^N I(i)I(i+1) + Q(i+1)Q(i)} \right) \quad (2)$$

where T_s is the sampling period and N is the estimator window length. Q and I are quadrature and in-phase signal components and are obtained by the quadrature sampling technique. The N parameter is directly related to the axial resolution of the method. The f_m line is created point by point from the raw backscattered RF data.

The f_m lines are characterized by high variance due to the random character of signal backscattered in soft tissue. A reduction in the f_m line random variability was achieved using moving average filtration and the Singular Spectrum Analysis (SSA) technique. The SSA trend extraction algorithm operates along the f_m lines in axial direction. SSA is a relatively new technique of time series analysis. The aim of this technique is to decompose the input data series into a sum of components, which can be interpreted as the trend, oscillatory components, and noise (non-oscillatory components). Major applications of the SSA technique include smoothing the time series, finding the trend, and forecasting and detecting structural changes. The final attenuation estimates were enumerated from the smoothed f_m lines. The use of SSA and the averaging of the scan lines limits the variations of the attenuation estimate but it is still affected by errors.

Synthetic Aperture technique

Synthetic aperture (SA) methods are widely used in radar techniques, although it is also possible for

them to be implemented in medical ultrasound systems with multielement probes. The motivation for using SA techniques in acquiring RF data to be subsequently processed for attenuation determination is twofold. We know that focusing introduces variation in the pulse spectrum, which results in incorrect assessment of attenuation. This effect of focusing must be compensated for. For standard delay and sum (DAS) beamforming, the focusing is performed only in several, fixed distances in the tissue. Thus the influence of focusing varies along the echo line. In the case of the SA technique, the focusing is performed at all points of the imaging tissue and its influence on the mean frequency of the signal is very similar through the whole imaging area. The correction of focusing effects is therefore much easier and more effective for SA imaging. Also, attenuation imaging requires averaging over adjacent echo lines and along a given line, reducing the spatial resolution of attenuation images. In the case of SA the averaging is much more effective because the areas in the vicinity of focus are statistically independent and averaging over just a few of them is required to reduce stochastic factors in the calculated attenuation. Out of focus (the case for most of the imaging area when standard beamforming is used) the areas insonicated by adjacent beams are overlapping and more averaging is required, worsening the resolution of the attenuation map.

Results

The experimental data were recorded using an ultrasonic scanner (UltrasonixSonic TOUCH) equipped with a linear probe (126 elements) operating at 7.0 MHz frequency. The system enables full control of transmission and reception, giving access to every single piezo-element of the multi-element ultrasonic probe. The RF data were collected using the SA scheme, with one element transmitting and all elements receiving. Next the data were processed and an attenuation map was created. The resolution and accuracy of the method was verified using a tissue mimicking phantom (DFS) with uniform echogenicity but varying attenuation coefficient. The phantom consists of two cylinders of 1.5 cm diameter with attenuation coefficient equal to 0.9 and 0.7 dB/(MHz·cm), respectively, embedded in a medium with attenuation of 0.5 dB/(MHz·cm) at a depth of 3 cm.

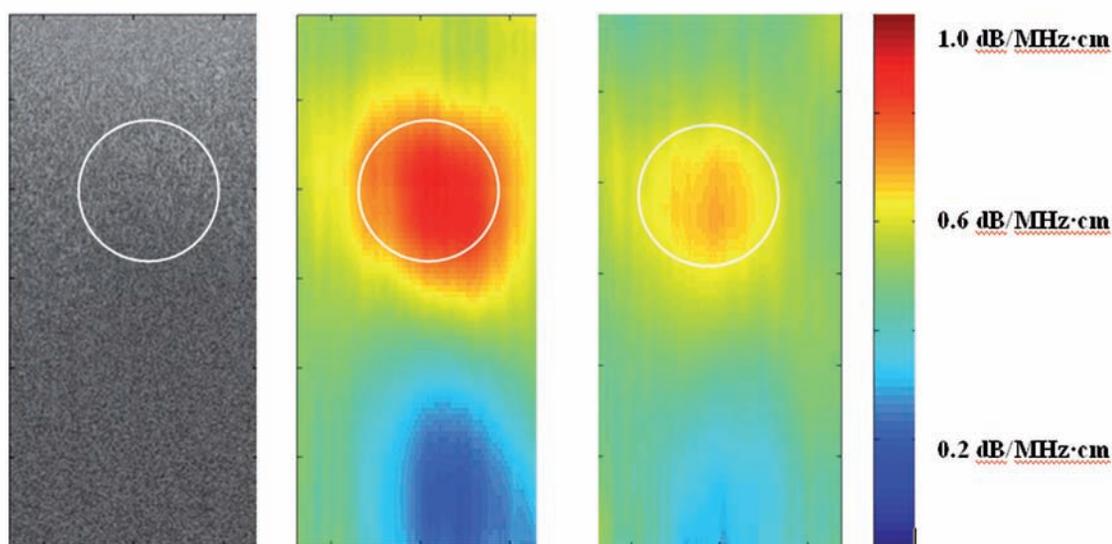


Fig. 1. B-scan image of the cylinder (attenuation 0.9 dB/MHz·cm) (a) its attenuation distribution image (b) and attenuation map of second cylinder (0.7 dB/MHz·cm) (c). Imaging area 60 mm x 30 mm. The white circles mark the real positions of cylinders. The shadows beneath the objects are artifacts and are caused by decreased signal-to-noise ratio (SNR) of echoes, due to increased attenuation

The images obtained using the SA technique and SonicTOUCH system are presented in Fig 1. The objects are invisible in B-mode and clearly visible in the attenuation images.

Conclusions

The mean frequency correlation estimator and SSA technique were implemented for processing of the RF ultrasonic echoes. The estimated attenuation values were equal to 0.7 and 0.9 dB/(MHz·cm) and agreed well with the real values. We have found the RF data obtained using synthetic aperture technique (SA) to be much more reliable in terms of attenuation extraction than echoes recorded using the standard delay and sum (DAS) beamforming. The imaging of attenuation in tissue seems to be a promising technique in medical diagnostics, although the precision of a single scan is often unsatisfactory. The synthetic transmit aperture technique allows similar quality images to be obtained as with the spatial compounding technique, which utilizes a dozen or so images for averaging. The SA technique uses a single scan only, which is more suitable for real time application.

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Agricultural, Forestry, and Veterinary Sciences

For Division V – Agricultural, Forestry, and Veterinary Sciences, the year 2010 was the last in the 2007-2010 term of office of Prof. Andrzej Grzywacz (full member of the Academy) as chairman and Zygmunt Reklewski (full member of the Academy) as deputy chairman. Moreover, in view of the enactment of the new act regulating the Polish Academy of Sciences, Division V will discontinue its activity at the end of this term, 54 years after its creation. Under the new statutes of the Polish Academy of Sciences, it will be merged into Division II – Biological Sciences to create a new Division for Biological and Agricultural Sciences, starting in 2011.

At the end of 2010, the Division included 35 national members (19 full members and 15 corresponding members) plus 24 foreign members. Prof. Jerzy J. Lipa, Prof. Zygmunt Pejsak, and Prof. Marian Saniewski were elected as new full members of the Academy, Prof. Jan Kotwica, Prof. Zbigniew Kundzewicz, Prof. Wiesław Oleszek, and Prof. Erwin Wąsowicz as new corresponding members. It is with deep sorrow that we note that Prof. Ryszard Babicki (full member of the Academy), Prof. Jerzy Ważny (full member of the Academy), and Prof. Dieter Sparr (foreign member of the Academy, Germany) passed away in 2010.

There were 16 committees affiliated with the Division, embracing a total of 459 members: the Committee on Agricultural Economics, the Committee on Agricultural Engineering, the Committee on Agrophysics, the Committee on Animal Sciences, the Committee on the Biology of Animal Reproduction, the Committee on Food Sciences, the Committee on Forestry Sciences, the Committee on Horticultural Sciences, the Committee on Land Reclamation and Agricultural Environment Engineering, the Committee on Management of Mountain Regions, the Committee on Physiology, Genetics and Plant Breeding, the Committee on Plant Cultivation, the Committee on Plant Protection, the Committee on Soil Science and Agricultural Chemistry, the Committee on Veterinary Sciences, and the Committee on Wood Technology.

Two plenary sessions of Division V were held in 2010: on 8 September, putting forward an opinion concerning the new intended structure of the Acad-

emy, and on 24 October, dealing with the Division V research awards.

The spring plenary meeting on 12 May evaluated the PAS Institute of Plant Genetics in Poznań for its activities in 2006-2009, approved a report on the Division's activities in 2009, approved the winners of the M. Oczapowski Medal in 2010, and accepted recommendations for appointing honorary committee members. Concerning the Division V research institutes, a commission was appointed to evaluate the PAS Jan Kielanowski Institute of Animal Physiology and Nutrition in Jabłonna, and commissions were also appointed to organize competitions to fill the post of director at the PAS Animal Genetics and Breeding Institute in Jastrzębiec and the post of director at the PAS Bohdan Dobrzanski Institute of Astrophysics in Lublin. Reports were delivered on the current status of the project to restructure the Ecological Agriculture and Preservation of Native Breeds in Popielno, on the election of new full members and corresponding members of the Academy, and the Division V conference prepared in 2010 by the PAS Committee on Horticultural Sciences.

The autumn plenary meeting on 24-25 October in Jabłonna evaluated the PAS Jan Kielanowski Institute of Animal Physiology and Nutrition for its activities in 2006-2009, passed a resolution concerning the Division V awards in 2010, and discussed the Division's participation in the PAS General Assembly meeting, including its research-devoted portion dealing with the contribution of the agricultural sciences to the development of the Polish countryside and agriculture.

The Michał Oczapowski Award was received by Assoc. Prof. Władysław Danielewicz from the Poznań University of Life Sciences, at the recommendation of the PAS Committee on Forestry Sciences, for his book *Ekologiczne uwarunkowania zasięgów drzew i krzewów na aluwialnych obszarach Doliny Odry* [Ecological Conditions for the Ranges of Trees and Bushes in Alluvial Areas of the Oder Valley].

The Michał Oczapowski Diploma was given (1) to Prof. Teresa Doroszevska, Anna Depta, and Anna Czumacka from the National Research Institute of

Soil Science and Plant Cultivation in Puławy, at the recommendation of the PAS Committee on Plant Cultivation, for their book *Album gatunków z rodzaju Nicotiana; Album of Nicotiana Species*, and (2) to Prof. Jerzy Wiśniewski and Assoc. Prof. Dariusz J. Gwiazdowicz from the Poznań University of Life Sciences, at the recommendation of the PAS Committee on Forestry Sciences, for their book *Ochrona przyrody* [Nature Protection].

The prize and diploma for research work were awarded to the team of Assoc. Prof. Piotr Kachlicki, Dr. Dorota Muth, Prof. Maciej Stobiecki, Assoc. Prof. Paweł Krajewski, Dr. Michał Jasiński, and Dr. Łukasz Marczak, at the recommendation of the PAS Committee on Plant Physiology, Genetics, and Breeding, for their research on identifying flavonoids and their role in plant defense processes (this team included researchers from the PAS Institute of Plant Genetics and the PAS Institute of Bioorganic Chemistry).

The diploma for research work was awarded to: (1) the team of Dr. Marta Libik-Konieczny, Prof. Zbigniew Miszalski, Assoc. Prof. Ewa Niewiadomska, Dr. Ireneusz Ślesak, Prof. Stanisław Karpiński, and Piotr Rozpondek, at the recommendation of the PAS Committee on Plant Physiology, Genetics, and Breeding, for their work on the redox balance regulation in the assimilatory tissue of leaves (this team included researchers from the F. Górski Plant Physiology Institute and the Warsaw University of Life Sciences), (2) the team of Prof. Jan Jankowski, Prof. Zenon Zduńczyk, Assoc. Prof. Jerzy Juśkiewicz, Agata Lecewicz, Prof. Heinz Jeroch, Dr. Bogdan Słomiński, and Dr. Krzysztof Kozłowski, at the recommendation of the PAS Committee on Animal Sciences, for their research into the impact of dietary components on physiological processes in the dietary tract of poultry (this team included researchers from the University of Warmia and Mazury in Olsztyn, the PAS Institute of Animal Reproduction and Food Research, and a foreign research institution).

The highest awards of Division V – the Michał Oczapowski Medals – were granted: to Prof. Nina Baryłko-Pikielna (the PAS Institute of Animal Reproduction and Food Research in Olsztyn, the Warsaw University of Life Sciences), to Prof. Marian Stanisław Grundboeck (the National Veterinary Institute in Puławy), to Prof. Andrzej Grzywacz (full member of the Academy, chairman of Division V; the Warsaw University of Life Sciences), to Prof.

Rudolf Michałek (full member of the Academy; the Hugon Kołłątaj Agricultural University in Kraków), to Prof. Jerzy Strzeżek (University of Warmia and Mazury in Olsztyn), to Prof. Concepcion Vidal-Valverde (Industrial Fermentation Institute, Spanish National Research Council – CSIC, Madrid, Spain), to Prof. Volodymyr Snitynsky (Lviv State Agrarian University in Dublany, Ukraine), and to *Drewno* [Wood], the periodical of the Wood Technology Institute in Poznań.

The Division V Laurel, an award conferred as a sign of recognition and gratitude for outstanding contributions to the development of agricultural-related sciences, was awarded six times in 2010: in animal production sciences to the National Research Institute of Animal Production in Kraków, in the agricultural sciences to the National Research Insti-



Research seminar on “The Role of Science in the Development of Polish Horticulture,” combined with an exhibition of fruits, vegetables, and flowers, prepared by the Polish Institute of Pomology and Floriculture and the Polish Vegetable Crops Institute, both headquartered in Skierniewice

tute of Plant Protection in Poznań and the National Research Institute of Soil Science and Plant Cultivation in Puławy, in the veterinary sciences to Dr. Tadeusz M. Wijaszka from the National Veterinary Institute in Puławy, in forestry sciences to Prof. Stefan Kowalski from the Agricultural University in Kraków, in agricultural engineering to Prof. Zdzisław Wójcicki from the Institute of Technology and Life Sciences in Falenty (formerly IBMER in Warsaw).

The ceremony to confer the Division V research awards and distinctions was held on 6 December.

On 20 October, a Division V seminar entitled “The Role of Science in the Development of Polish Horticulture” was held, combined with an exhibition of fruits, vegetables, and flowers chiefly organized by the PAS Committee on Horticultural Sciences. The topics of the seminar dealt with: the role of science in the development of Polish fruit farming – history, current status, and prospects for further development (Prof. Kazimierz Tomala, Warsaw University of Life Sciences), the development of vegetable farming and the contribution of science (Prof. Mikołaj Knaflowski – Poznań University of Life Sciences), decorative plants and issues of esthetics and utility (Prof. Joanna Nowak, Polish Institute of Pomology and Floriculture, Skierniewice), beekeeping science in Poland – its role and its need and capacity for further development (Dr. Krystyna

Pohorecka, Polish Institute of Pomology and Floriculture, Skierniewice), and the current status and developmental prospects for mushroom-growing in Poland and in the world (Dr. Krystian Szudyga – Polish Vegetable Crops Institute, Skierniewice).

The “Pro Scientia et Vita” Foundation, established by Division V members, provided financial support to young scientists for the ninth straight year in 2010, with prizes and distinctions awarded to 6 individuals.

The scientific activities of the Division, its research units, and its committees resulted in the publication of 23 scientific journal titles, including: *Acta Agro-physica*, *Acta Physiologiae Plantarum*, *Animal Science Papers and Reports*, *Annual Review of Agricultural Engineering*, *Folia Forestalia Polonica (Series A and B)*, *International Agrophysics*, *Inżynieria Rolnicza* (Agricultural Engineering), *Journal of Animal and Feed Sciences*, *Journal of Applied Genetics*, *Journal of Plant Protection Research*, *Journal of Water and Land Development*, *Polish Journal of Food and Nutrition Sciences*, *Polish Journal of Soil Science*, *Polish Journal of Veterinary Sciences*, *Prace i Materiały Zootechniczne* (Livestock Research Papers and Communications), *Problemy Inżynierii Rolniczej* (Problems of Agricultural Engineering), *Problemy Zagospodarowania Ziemi Górskich* (Problems of Management of Mountain Areas), *Reproductive Biology*, *Roczniki Nauk Rolniczych – Seria G* (Annuals of Agricultural Sciences – Series G), and *Zagadnienia Ekonomiki Rolnej* (Problems of Agricultural Economics).

The Division moreover published 8 titles issued by its committees, as well as *Postępy Nauk Rolniczych* (Advances in Agricultural Sciences), the quarterly publication of Division V itself. Issues 544-557 of the non-periodic series *Zeszyty Problemowe Postępów Nauk Rolniczych* (Advances of Agricultural Sciences – Problem Issues) were published in 2010, financed by different Polish scientific units, as well as issues 18 of the series *Biuletyn Informacyjny Wydziału Nauk Rolniczych, Leśnych i Weterynaryjnych PAN* (Information Bulletin of Division V – Agricultural, Forestry and Veterinary Sciences, Polish Academy of Sciences).

Division V of the Polish Academy of Sciences functioned as part of the Academy’s structure for more than half a century. The change of affiliation, its merger with Division II – Biological Sciences, generates new prospects for the Academy members, institutes, and committees to function and cooperate. However, at the end of this term concern was



Seminar participants (from left): Prof. Zygmunt Reklewski (full member of the Academy, deputy chairman of the Division), Prof. Edward Żurawicz (chairman of the PAS Committee on Horticultural Sciences in the 2008-2011 term), Prof. Franciszek Adamicki (deputy chairman of the PAS Committee on Horticultural Sciences), Prof. Andrzej Grzywacz (full member of the Academy, chairman of Division V), and Prof. Jerzy Hetman (chairman of the Decorative Plants Section of the PAS Committee on Horticultural Sciences)

expressed and there were numerous inquiries about the form of activity under the new structure to

ensure the good of the biological, agricultural, forestry, and veterinary sciences.

The molecular mechanism of chloroorganic xenobiotics' effect on the function of reproductive tract in cows

M.H. Wróbel | J. Młynarczuk | J. Kotwica | Institute of Animal Reproduction and Food Research | Polish Academy of Sciences

Polychlorinated biphenyls (PCBs), which were manufactured for industrial use, and dichlorodiphenyltrichloroethane (DDT), a common insecticide, belong to the group of chloroorganic xenobiotics. These compounds, due to their resistance to degradation and lipophilic nature, have penetrated into the environment and bioaccumulated in animals and human bodies. However, since they were recognized as environmental pollutants and potential factors of health risk, the production and use of PCBs and DDT have been banned in Europe, Japan and the US, while DDT is still being used in Africa and Asia. Based on epidemiological observations, PCBs and DDT can impair the course of gestation and cause miscarriages. Hence, the aim of this study was to investigate the molecular mechanism of chloroorganic xenobiotics' effect on bovine oviductal and myometrial contractions that are crucial for fertilization and maintenance of pregnancy. Moreover, since uterine prostaglandins (PGs) and ovarian oxytocin (OT) are natural factors that regulate the motility of the uterus and oviduct, the synthesis and secretion of these hormones under the influence of xenobiotics was therefore studied.

Reproductive tracts were obtained from cyclic and pregnant cows or heifers. Oviductal and myometrial strips, as well as cells from the endometrium, myometrium, oviductal epithelium, granulosa and corpus luteum were treated (2-72 h) with DDT, its metabolite (dichlorodiphenyldichloroethylene, DDE), or PCBs: technical mixture (Ar1248), individual congeners (PCB 30, PCB 77, PCB 153) or hydroxylated metabolites (PCB 30-OH, PCB 50-OH), each at dose of 0.1-100 ng/ml. Next, cell viability, concentrations of PGFM (13,14,-dihydro-15-keto-PGF 2α , metabolite of PGF 2α), PGE 2 , or OT in the culture medium, and expression of mRNA for genes involved in synthesis of PGs (COX-2, PGFS) or OT (NP-I/OT, PGA) were de-

termined. In addition, the contractions of myometrial and oviductal strips were registered, under the influence of xenobiotics (10 ng/ml) jointly or separately with indomethacin (10^{-4} M, INDO), which blocks synthesis of PGs.

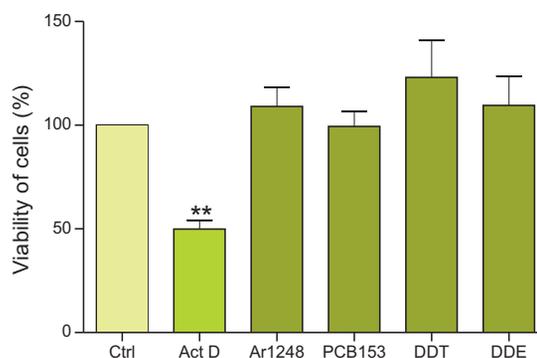


Fig. 1. Mean (\pm SEM; $n = 4$) viability of epithelial oviductal cells after incubation (48 h) with Ar1248, PCB 153, DDT and DDE (10-100 ng/ml). Actinomycin D (Act D; 500 ng/ml) was used as a negative control. Bar with asterisks is different ($P < 0.01$) from the control

The xenobiotics tested did not affect ($P > 0.05$) the viability of the studied cells (Fig. 1). PCB 77 stimulated ($P < 0.05$) the expression of mRNA for COX-2 and PGFS in myometrium and PCBs, DDT, DDE increased ($P < 0.05$) the expression of NP-I/OT and PGA mRNA in ovarian cells. PCBs, DDT and DDE also increased ($P < 0.05$) PGF 2α secretion while DDT and DDE reduced ($P < 0.001$) the same and PCBs did not affect ($P > 0.05$) PGE 2 secretion from endometrial cells after 24 h. Additionally, PCB 77 increased ($P < 0.05$) PGF 2α secretion from myometrial cells after 6 and 48 h, while all the other studied substances stimulated ($P < 0.05$) PGF 2α and PGE 2 secretion after 2 h of oviductal cell culture. A similar effect of xenobiotics (except PCB 30 and DDT) on PGF 2α secretion from oviduct was still observed after 48 h. However,

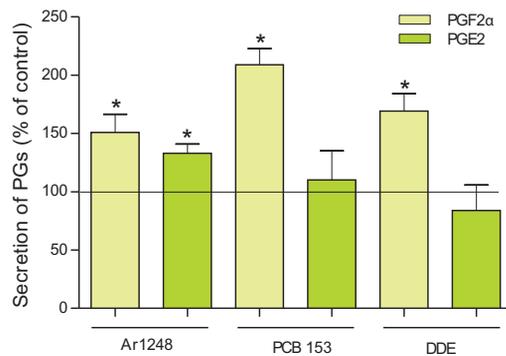


Fig. 2. Mean (\pm SEM; $n = 4$) effect of Ar1248, PCB 153 and DDE on PGF2 α and PGE2 secretion from oviductal epithelial cells, after 48 h of treatment. Bars with asterisks are different ($P < 0.05$) from the control (horizontal line)

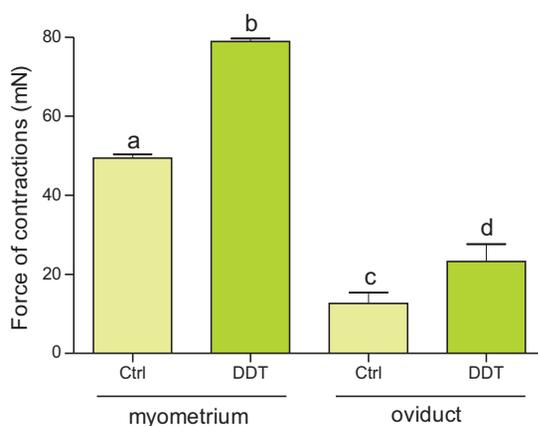


Fig. 3. Mean (\pm SEM; $n = 4$) force of myometrial (3-12 weeks of pregnancy) and oviductal (1-5 days of estrous cycle) strips treated (48 h) with DDT (10 ng/ml). Pregnancy status was supported by progesterone (12 ng/ml) supplementation. Values with different superscripts are significantly different ($P < 0.05$)

their effect on PGE2 was less evident (Ar1248, PCB 50-OH) or there was no effect (PCB 153, PCB 30, PCB 30-OH, DDE), and it was even decreased by DDT ($P < 0.05$) (Fig. 2). The pollutants used also increased ($P < 0.05$) OT secretion from ovarian cells. Therefore, PCBs, DDT, and DDE increased ($P < 0.05$) the basal (Fig. 3) and OT (10^{-7} M)-stimulated contractions of myometrium (48 h). DDT, after 2 h, and DDT and its metabolite, after 48 h, also increased ($P < 0.05$) the force of isthmus contractions (Fig. 3). Moreover, DDE stimulated ($P < 0.05$) the amplitude of isthmus and ampulla contractions, after 2 and 48 h of treatment. Additionally, the effect of PCB 77 on myometrial motility after 48 h, and DDT after 2 h, as well as DDE after 48 h, on oviductal contractions was inhibited by INDO.

The data obtained report on the mechanism of the adverse effect of environmental pollutants on reproductive system function in cows. Since none of xenobiotics affected the viability of the studied cells, the observed changes in uterus, oviduct, and ovary function were not evoked by a cytotoxic effect of the substances used. Xenobiotics impaired the PGF2 α : PGE2 ratio secretion from the uterus and oviduct, and also increased the synthesis and secretion of OT from granulosa and luteal cells.

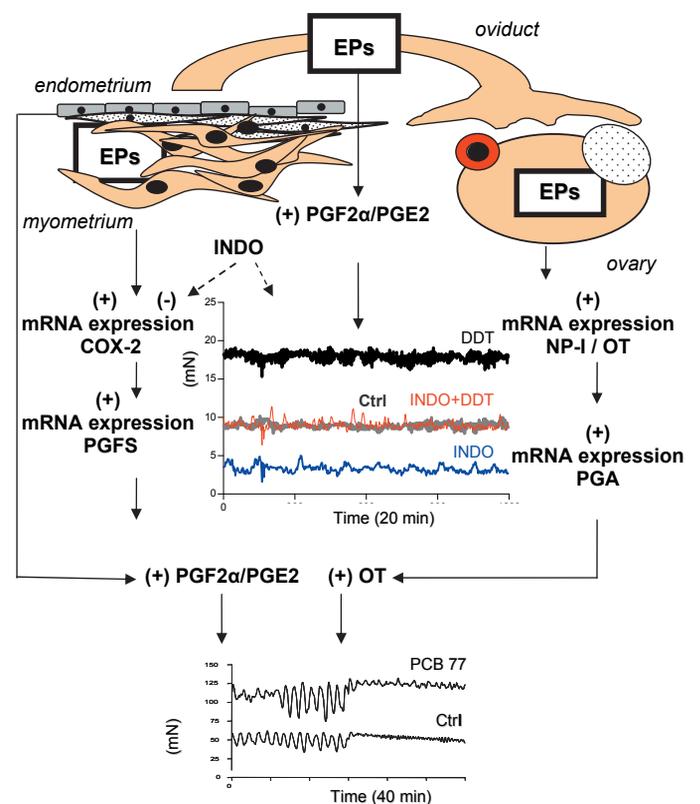


Fig. 4. Mechanism of the adverse effect of chloroorganic environmental pollutants (EPs) on the function of the reproductive system in cows. EPs stimulate mRNA expression of genes involved in PGF2 α and OT synthesis in the myometrium and the ovary, respectively. They also increase the secretion of PGF2 α from the uterus and oviduct as well as OT from the ovary, which is followed by enhanced motility of myometrium and oviduct. INDO, which blocks PGs synthesis, can reduce the effect of EPs on smooth muscle contractions.

Exemplary chart of contractions (above) of four individual oviductal strips from one cow during 1-5 days of estrous cycle. These strips were incubated with DDT for 2 h separately or jointly with INDO (10^{-4} M). Exemplary chart of contractions (below) of two individual myometrial strips from one cow; they were incubated for 48 h and the force of contraction was measured before and after OT challenge

This was followed by an increase in oviduct contractions under the influence of DDT and DDE, similar to the effect of xenobiotics on basal and OT-stimulated motility of the uterus. Since xenobiotics stimulated synthesis of PGF₂ α in myometrium and OT in ovary and this effect was reduced by INDO, it is suggested that PGs and OT are involved in the adverse effect of these xenobiotics on smooth muscle contractions in the bovine reproductive tract.

In conclusion, PCBs, DDT, and DDE can adversely affect the synthesis and secretion of PGs and OT which regulate myometrial and oviductal contractions, and can thereby impair the contractility of these organs. This may be a part of the mechanism by which xenobiotics impair fertilization and reduce reproductive success in cattle.

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Myogenesis in beef and dairy cattle

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In the last century animal breeders have been developing cattle breeds distinctly different in meat and milk production capacity, carcass and meat quality. Nowadays, we have dairy cattle such as Holstein-Friesians, which are selected for the ability to produce large quantities of milk. The carcass quality of HF bulls is relatively poor. In contrast, beef bulls, such as Hereford (HER) or Limousine (LIM), are capable of extended deposition of synthesized substances as meat. Beef breeds are characterized by great carcass weight and a high yield grade.

Cattle breeds selected for milk or meat production offer a suitable model for studying the genetic and physiological basis of variances in muscle tissue development and deposition. The results could be useful in animal breeding and also could help provide a better understanding of muscle physiology in mammals. Cattle are also good model to compare with fetal muscle development in humans, because

of similar pregnancy durations, myogenesis timings, and ways of muscle maturation.

Myogenesis is the process whereby the skeletal muscle is determined and developed into mature muscle fibers. The development of skeletal muscle begins during embryonic life and is completed during postnatal growth when animals reach their adult size (in cattle around 15th month of adult life). Muscle mass is created by the number (determined in prenatal myogenesis) and size of the muscle fibers. The properties of myofibers are acquired in a three-stage process – embryonic, fetal, and postnatal.

The most important aspects regulating myogenesis are a group of muscle-specific transcription factors known as myogenic regulatory factors (Myf5, MyoD, myogenin, and MRF4), which are also considered candidate markers for meat production in farm animals. In addition to MRFs many other factors are involved in muscle growth and

differentiation, including growth factors, hormones, their receptors and binding proteins, many of them involved in the GH-IGF axis. IGFs are potent mitogens for myoblasts and they also stimulate muscle cell differentiation by inducing expression of MRFs.

One of the research projects conducted by the Department of Molecular Biology at the Institute of Genetics and Animal Breeding, Polish Academy of Sciences (IGAB PAS), aims at understanding the regulatory mechanisms of gene expression in high vs. low muscled cattle breeds. The studies are carried out in cooperation with the Department of Physiological Sciences, Faculty of Veterinary Medicine, Warsaw University of Life Sciences (SGGW). We used two main strategies to identify important genes. The first one was focused on the expression of the known “candidate genes” for key physiological pathways related to muscle development in three periods of fetal life and in adult animals. The second strategy based on microarray analysis (enabling measurement of transcript levels of thousands of genes) was to identify genes differentially expressed between skeletal muscle derived from beef and dairy bulls, without any *a priori* knowledge of gene functions.

We observed that some of the genes showed differences in transcript levels characteristic for particular stages in pre- and postnatal muscle development in HF cattle. The results are summarized in Figure 1. For instance, a significant increase in *Igfbp2*, *Igfbp3*, and *Igfbp5* expression was observed in 5-month old fetuses. These genes can po-

tentiate or inhibit IGF1 or IGF2 action by modulation of their bioavailability to receptors.

We compared the gene expression profiles in a skeletal (*longissimus dorsi*) muscle in four breeds of cattle: dairy type – HF and Polish Red (PR), vs. beef type – LIM and HER, at the age of 6, 9, and 12 months. HF and HER bulls showed the most significant differences in gene expression in the studied breeds. The *MyoG* transcript level was extremely low in HF bulls when compared with beef bulls. HER bulls showed high *Igf1* and *Igfbp3* expression. *Igfbp3* expression decreased with age in HF bulls, and in contrast to HER bulls. The inter-breed differences in gene expression levels are schematically summarized in Figure 2.

We also used 18K cDNA microarrays to compare transcriptomes of bovine skeletal (*semitendinosus*) muscle in 12-month-old bulls of beef LIM breed vs. dairy HF breed. Significant differences in expression of 393 genes were shown and the biological functions of 117 differentially expressed genes were classified. Most of them were involved in protein metabolism and modifications, signal transduction, nucleoside, nucleotide and nucleic acid metabolism, cell cycle, cell structure and motility, and developmental processes. The results emphasized the role of growth hormone, IGF1 and calcium-signaling pathways which may indirectly activate myogenic regulatory factors (MRFs) and impair activation of TGF- β 1 and myostatin, and finally to facilitate terminal muscle differentiation.

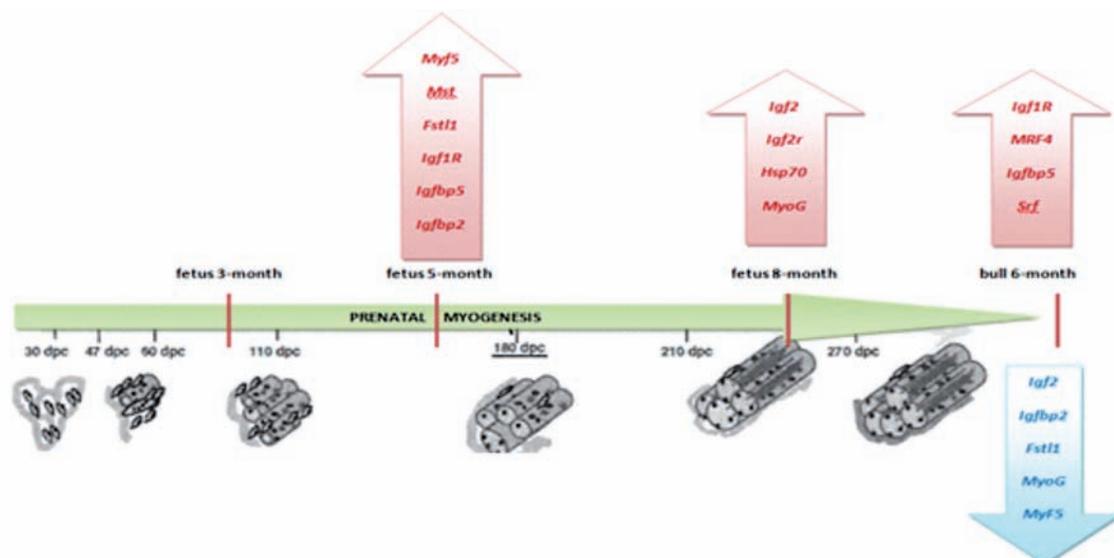


Fig. 1. Schematic representation of the expression profile of MRF and IGF family genes and other genes related to muscle development during pre- and postnatal myogenesis in Holstein-Friesian cattle. Arrows show increased (red) or decreased (blue) expression in three stages of fetal life and in adult, 6-months old bulls

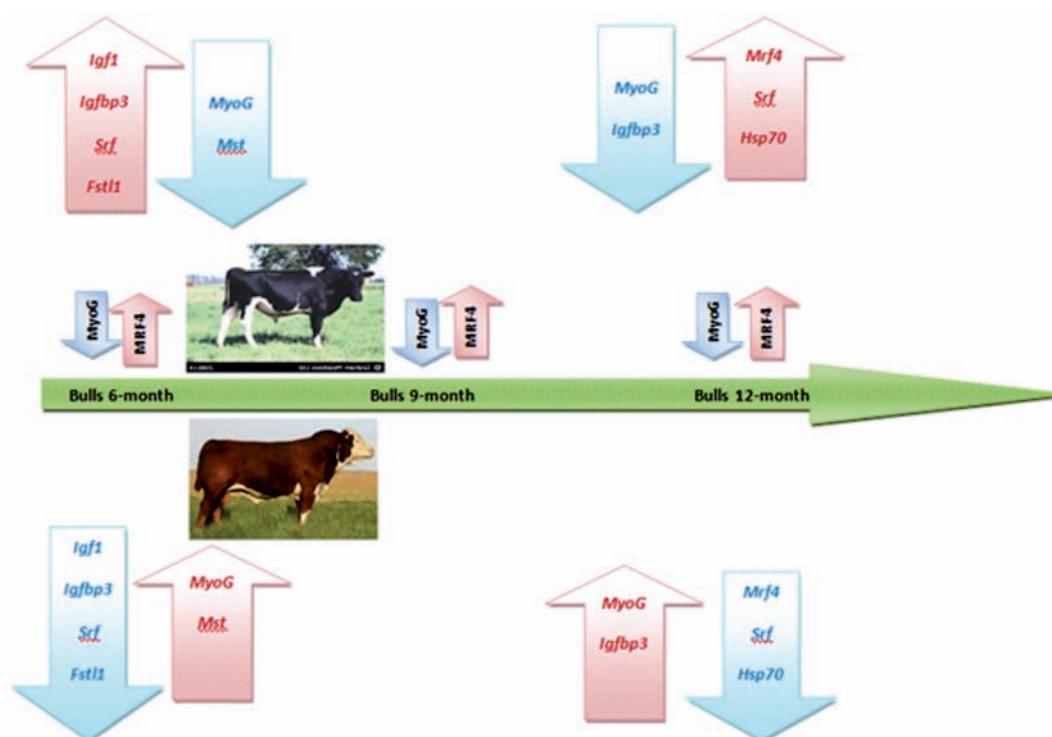


Fig. 2. Expression profile of MRF and IGF family genes and other genes related to muscle development during postnatal myogenesis in Holstein-Friesian and Hereford cattle. Arrows show increased (red) or decreased (blue) expression in three stages of postnatal growth, at 6th, 9th, and 12th month of life

Muscle mass depends on the number and size of muscle fibers, which are primarily fixed in fetal life. Therefore, using BLO expression microarrays, we compared the *longissimus dorsi* muscle transcriptomic profiles of 5-month old male fetuses of beef (HER+LIM) vs. dairy (HF+PR) cattle. As a result, 332 genes were found differentially expressed. Bioinformatic analysis indicated that these genes mainly take part in: tissue and organ development, muscle development, transcription regulation, cytoskeleton protein binding, glycolysis and gluconeogenesis signaling pathways, adherens junction and tight junction pathways, and cell cycle regulation. Differences in transcript levels of genes coding structural proteins in muscle suggest that muscle fibers are created faster in fetuses of beef breeds than for dairy breeds.

In summary, our results showed significant differences in expression profiles of tissue specific genes which were confirmed both by microarray and Real-Time PCR analysis. Furthermore, this study showed interracial characteristic differences in gene expression in skeletal muscles, both in fetal life and after birth. We believe that these results will help in establishing novel molecular markers useful in the breeding of highly productive beef cattle.

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Chitin, a potential source of energy for rumen ciliates and their host

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Chitin is the natural polysaccharide synthesized by numerous organisms. It plays the role of an external skeleton in arthropods, for example in krill and crabs, and is the major carbohydrate of the cell wall in fungi. Global production of chitin reaches 10^{10} - 10^{11} tons per year, making potentially a very important source of energy for heterotrophic organisms.

One unique reservoir of chitin is the rumen – the largest chamber of the complex stomach of ruminant animals. To utilize this polysaccharide, it needs to be degraded to simple sugars. Such a process is of enzymatic character and the relevant enzymes are commonly called “chitinases” or “chitinolytic enzymes.” Unfortunately, ruminants do not synthesize chitinases, making them unable to digest this carbohydrate by themselves. Fortunately, ruminants live in close symbiosis with microorganisms that inhabit the rumen and are helpful to them in the utilization of the indigestible carbohydrates. It is well documented that rumen represents the largest portion of the overall ruminant digestive tract.

The weight of rumen content can reach 10-15 kg in sheep and even more than 100 kg in cattle. This digesta is very densely colonized by anaerobic bacteria (10^9 - 10^{11} cells/g), protozoa – mainly ciliates (10^6 individuals/g), and fungi. No digestive glands are present in the rumen mucosa. Thus the ruminal microbiota become the first digesters of the feed ingested by the host. They use the resulting nutrients to synthesize their own cellular matter. Because all metabolic processes in the rumen proceed under anaerobic conditions, the end products of the carbohydrate metabolism released from the cells of microorganisms are volatile fatty acids (VFAs). It is well documented that they are absorbed from the rumen fluid and utilized by the host as the main source of energy.

The chitin present in the rumen is synthesized by the ruminal fungi, being a constant component of their cell wall. These fungi are of the class *Chytridiomycetes*. Their life cycle consists of stages. The vegetative stage (thallus) develops inside of the

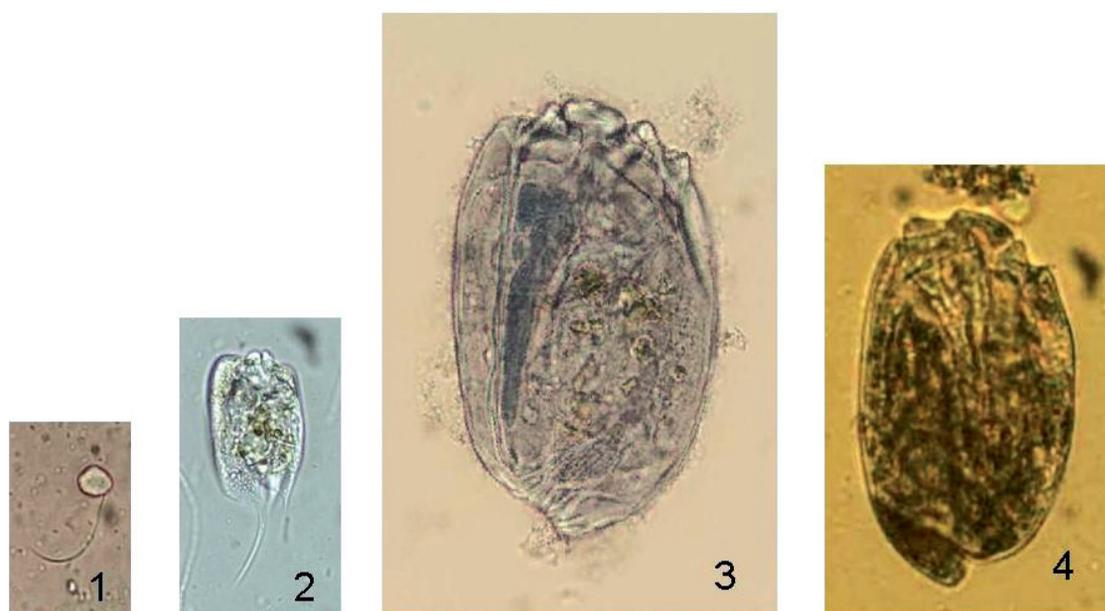


Fig. 1. Fungal zoospore (1) accompanied by the species of rumen ciliates used to perform the studies described here. The figure characterizes the differences between the cell dimensions of particular microorganisms

fibrous feed particles, making it hard for predators to access. The zoospores, on the other hand, represent the freely swimming stage (Fig. 1). Their concentration is similar to that of ciliates inhabiting the same compartment in the rumen (see above), to which they become easy prey.

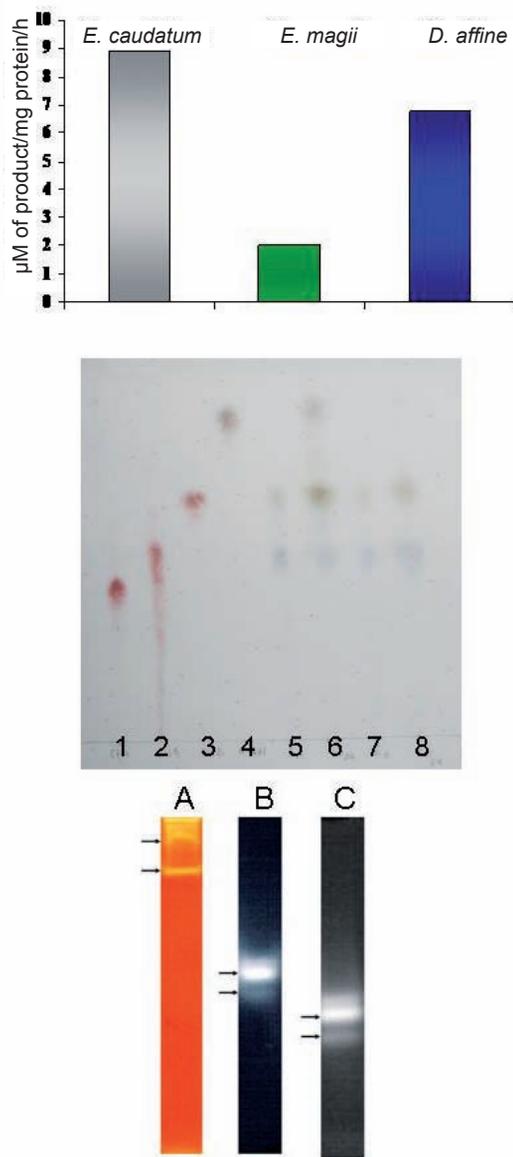


Fig. 2. The chitinolytic activity of the cell extract of *Entodinium caudatum*, *Eudiplodinium maggii*, and *Diploplastron affine* (I); End product of the chitin degradation by cell extract of ciliates (II) and the chitinolytic enzymes identified by zymogram technique following the electrophoretical separation of protozoal protein on polyacrylamide gel (III). 1-4 – tetra-, three-, di- and monosaccharide standards, respectively. 5, 7, 8 – controls, 6 – end product of chitin degradation. A, B, and C – endochitinase, exochitinase and chitobiase, respectively

Several years ago we began to investigate the digestion and utilization of chitin by rumen ciliates. The motivation came from the observations that that these protozoa readily engulf fungal zoospores and that ciliate cell extract exhibits chitino-lytic activity. This enabled us to formulate the hypothesis that ciliates participate in the digestion and utilization of chitin in the rumen. We used common species of protozoa – *Entodinium caudatum*, *Eudiplodinium* and *Diploplastron affine* – to confirm this hypothesis. The first prefers starch while the last two are fibrolytic. We isolated all three species of ciliates from the rumen of sheep. The protozoa were cultured *in vitro* in single species populations and were then inoculated into sheep free of rumen fauna. After the development of populations of ciliates, they were isolated from the rumen fluid, then purified and used to perform enzymatic and fermentation experiments. In order to eliminate the intracellular bacteria or at least reduce their number, the ciliates were incubated overnight with antibiotics before they were used to prepare the cell extract or to perform the fermentation experiments.

The enzymatic studies showed that the cell extract prepared from the examined species of ciliates di-

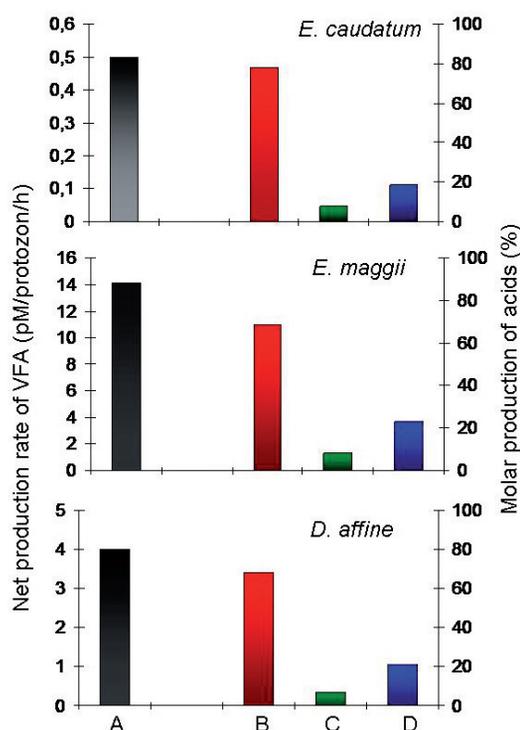


Fig. 3. The production rate of volatile fatty acids (A) and molar proportion of acetic (B), propionic (C), and butyric acid (D) in the total VFAs

gested the colloidal chitin which was prepared from the commercial product. However, the degradation rate of substrate depended on the ciliate species (Fig. 2). Further experiments revealed that the examined species of protozoa possessed three different types of enzymes which enabled them to degrade chitin to simple sugars. We found that the optimal condition for the activity of the identified enzymes also depended on the ciliate species. The molecular mass of enzymes varied between 35 and 80 kDa.

The incubation of protozoa with commercial chitin was accompanied by an increase in the concentration of volatile fatty acids in the culture medium. The net production rate of VFAs – predominantly acetic acid, followed by butyric and propionic acids – varied between 0.5 and 14 pM/protozoon/h (Fig. 3).

The results of the studies enabled us to conclude that all three species of rumen ciliates are able to use chitin to cover their requirement for energy. The main end products of chitin metabolism in the ciliate cells are acetic, butyric, and propionic acid. All three acids are known to be absorbed from the rumen fluid to the blood. They are transported to the cells of the host and utilized there in energy yielding processes.

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Medical Sciences

Division VI – Medical Sciences represents the medical scientific and academic community in Poland (including universities, institutes and respective academic schools), promotes research in medicine, pharmacy, physical training and health education, and also supervises research activity at the Academy institutes affiliated with the Division. Prof. Wojciech Kostowski (corresponding member of the Academy), a psycho- and neuropharmacologist, is the chairman of the Division, with Prof. Sławomir Majewski (corresponding member of the Academy), a dermatologist and immunologist, and Prof. Jacek Zaremba (corresponding member of the Academy), a specialist in clinical genetics and neurology, as deputy chairmen of the Division.

At the end of 2010 the Division had 37 national members (19 full members and 18 corresponding members) as well as 22 foreign members. In 2010 three members of the Division passed away: Prof. Kazimierz Ostrowski, Prof. Zbigniew Herman, and Prof. Olgierd Narkiewicz.

Division VI members actively participated in preparing opinions and expert studies on various regulations, laws, and acts for the Polish Government and Ministry of Health. For example on 6 October the Division published an opinion regarding the overconsumption of psychoactive substances (so called “smart drugs”) and actively participated in the mass-media discussions of this problem in the public spotlight. The Division’s members also participated in the 14th Festival of Science in Jabłonna.

Two plenary sessions of the Division took place in 2010. At the first session on 15 April, the Division elected three new full members of the Academy (Prof. Bohdan Lewartowski, Prof. Andrzej Szczeklik, and Prof. Marek Zembala) and five new corresponding members of the Academy (Prof. Anna Członkowska, Prof. Andrzej Januszewicz, Prof. Paweł Kisielow, Prof. Krzysztof Narkiewicz, and Prof. Ewa Szczepańska-Sadowska).

At the second session on 18 November the Division gave awards to the following scientists: the Jędrzej Śniadecki Medal went to Prof. Jolanta Gutkowska from the Medical Faculty of the University of Montreal for her achievements in the field of clinical endocrinology, especially studying the mech-

anism of action of angiotensin and natriuretic peptide, whereas the Division’s Jędrzej Śniadecki Scientific Prize went to a research team from the M. Mossakowski Medical Research Center in Warsaw (Prof. Krystyna Domańska-Janik, Prof. Barbara Łukomska, Assoc. Prof. Leonora Bużańska and Dr. Mirosław Janowski) for a series of publications (impact factor = 30.8) on the isolation of umbilical blood stem cells and their use in the treatment of experimental neurodegenerative disorders.

The Division VI Individual Scientific Prize went to Assoc. Prof. Krystyna Chrzanowska from the Children’s Memorial Health Institute in Warsaw for a series of publications on genetic predisposition to malignant diseases in children. The Division VI Collective Scientific Awards went to: 1) the team of Assoc. Prof. Małgorzata Filip, Dr. Magdalena Zaniewska, and Dr. Małgorzata Frankowska from the Institute of Pharmacology in Kraków for a series of publications on the mechanisms of cocaine and nicotine addiction; 2) to the team of Dr. Marta Kuczeriszka, Dr. Agnieszka Walkowska, Prof. Janusz Sadowski, and Assoc. Prof. Elżbieta Kompanowska-Jezińska from the M. Mossakowski Medical Research Center in Warsaw for a series of publications on nitric oxide and cytochrome P-450 in the control of renal haemodynamics and tubular transport: the role in the body sodium balance and long term regulation of arterial pressure.



Laureates of the Jędrzej Śniadecki Scientific Prize. From left: Prof. Krystyna Domańska-Janik, Assoc. Prof. Leonora Bużańska, and Dr. Mirosław Janowski from the Mirosław Mossakowski Medical Research Center in Warsaw



Prof. Janusz Komender and a group of students awarded the Doctor Waclaw Mayzel Medical Laurel: Sylwia Szymańska, Katarzyna Chmielowska, Magdalena Świątek, Edyta Szymańska

Five special honorary prizes for medical students – the Doctor Waclaw Mayzel Medical Laurel – were awarded to the following persons: 1) Magdalena Świątek (Technical University of Wrocław); 2) Wojciech Błogowski (Pomeranian Medical University in Szczecin); 3) Marcin Hellmann (Medical University of Gdańsk); 4) Paweł Matusik, Krzysztof Tomaszewski, Katarzyna Chmielowska and Jan Nowak (Jagiellonian University Medical College in Kraków); 5) Edyta Szymańska and Sylwia Szymańska (the Medical University of Warsaw and the Children's Memorial Health Institute in Warsaw).

There are five research institutes affiliated with Division VI: the M. Mossakowski Medical Research Center in Warsaw, the L. Hirsfeld 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. Importantly, all five research institutes were classified by the recent ranking of the Ministry of Science and Higher Education into the highest category A of biomedical research institutions in Poland.

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 Scientific Committee on Human Nutrition affiliated with the Division.

Division VI supervises the activity of 11 scientific committees (over 300 members in all) and 77 commissions (over 1100 members) which represent the medical sciences in Poland. The chairpersons of the committees, mostly non-members of the Academy, participate in the plenary sessions of the Division and enjoy equal rights with the Academy's members except with regards to electing candidates to become new Academy members. Each committee establishes special commissions related to various fields of medical research. Commission members are drawn in a large part from outside the committee body.

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, who chairs Division VI, 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 to 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 PUG-WASH 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), 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 represents Polish scientists at the International Federation of Societies of Electron Microscopy (IFSEM).

Members of the Division published a total of 170 papers in 2010, primarily in international scien-

tific journals, and they organized and actively participated in many meetings and conferences. For example, Prof. Andrzej Górski was nominated as chairperson of a plenary session at the conference “Trends in Science and Technology Relevant to the Biological and Toxin Weapon Convention” (co-organized by the US National Academy of Sciences, the International Union of Microbiological Societies, the Chinese Academy of Sciences and the Institut Pasteur). He also chaired the Scientific Committee of the conference “Current Challenges

in Medical Communication: Diagnosing and Curbing Unethical Practices.” Prof. Ryszard Gryglewski was elected to chair the “John Robert Vane Memorial Conference.” Prof. Stanisław Konturek organized an International Symposium on the “Brain-Viscera Axis” in Kraków. Prof. Tadeusz Popiela, as the President of the International Gastric Cancer Association, was a co-organizer of the “9th International Gastric Cancer Congress” in Seoul (South Korea).

Transcriptomics data in deciphering the genetic basis of primary ciliary dyskinesia

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Introduction

Cilia are evolutionarily conserved hair-like organelles present on the surface of nearly all cells of the human body. Motile cilia are essential for mucociliary clearance, establishing left-right body symmetry, and reproduction; sensory cilia are important for processes of vision, smell, and hearing, as well as organ homeostasis (Satir & Christensen 2008). Congenital dysfunctions of ciliary proteins cause disorders, collectively referred to as ciliopathies, which display complex symptoms involving different body organs (Marshall 2008). Although the basics of cilia biogenesis and functions are known, the knowledge of molecular mechanisms underlying ciliopathies remains far from complete.

Primary ciliary dyskinesia (PCD) is one of the ciliopathies, with symptoms caused by the kinetic dysfunction of motile cilia in the respiratory epithelium, of flagella in spermatozooids, and of primary cilia in the embryonic node (Noone et al. 2004; Barbato et al. 2009). In our recent whole-genome expression study on bronchial biopsies from several PCD patients and unaffected controls (Geremek et al. 2010), by using a Quality Threshold clustering algorithm, we have found evidence of a differential, correlated expression of a number of genes in patients as compared to controls. The largest cluster of significantly down-regulated genes was

significantly enriched for genes related to cilia. These data suggested that cilia-related genes may be under the common control of as-yet unknown regulatory system(s).

Materials & Methods

The study group consisted of 6 PCD patients and 9 controls. In order to identify common regulatory features of cilia-related genes, the set of differentially expressed genes from the whole-genome expression study using Illumina HumanRef-12 Whole Genome BeadChips (Geremek et al. 2010) was used. Conserved regulatory elements in the 5'-region (5' UTR and 500 nt upstream) of the PCD-specific gene set were identified using TRANSFAC and Match tools with minimum false positives matrices. R software and the Bioconductor package were used in clustering analysis.

Results

Clustering of the probe sets

Hierarchical clustering was used in order to check profiles for patients and controls. Individuals with non-consistent expression patterns (1 patient and 2 controls) were excluded from further analysis (Fig. 1).

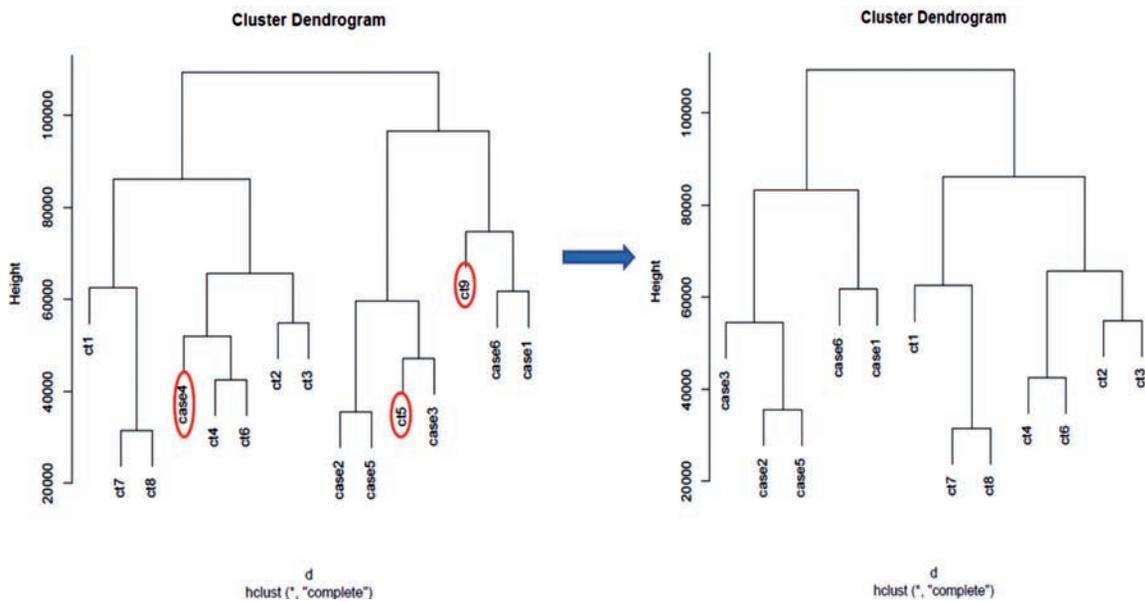


Fig. 1. Hierarchical clustering showed samples with non-concordant expression patterns; these samples were excluded from further analysis

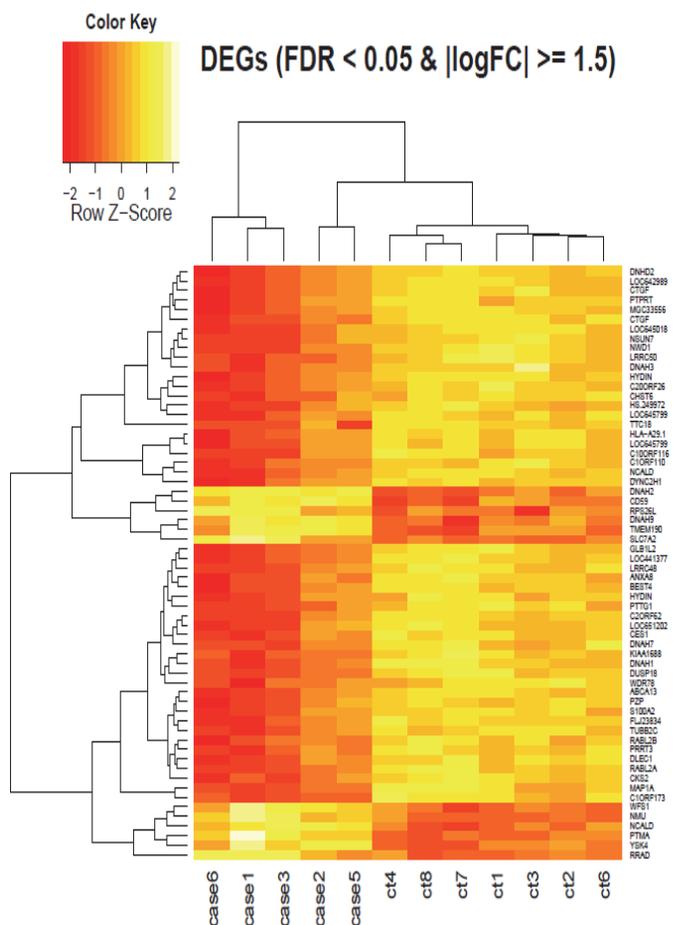


Fig. 2. Heat map indicating differentially expressed genes in PCD individuals (case1-6) and healthy controls (ct1-8). Red and yellow colors indicate up- and down-regulated genes, respectively

Clustering of the differentially expressed genes

A value of 50 was added to all the actual expression scores, to avoid missing differences between weakly expressed genes. The adjusted expression values were logarithmized. Heat maps of the differentially expressed genes, with the log ratio > 1.5 ($|\log_{2}FC| \geq 1.5$) and adjusted $p < 0.05$, were created for the PCD patients and controls (Fig.2.).

Clustering of the differentially expressed genes, performed using the above criteria, revealed 50 downregulated and 13 upregulated genes.

Search for shared regulatory elements

Analysis of the 5'-region in these genes showed the presence of many conserved transcription factor binding sites. The set of genes down-regulated in PCD were grouped by the shared transcription factor binding sites in their 5'UTR+500nt upstream sequences. Clustering revealed two groups of PCD down-regulated genes, apparently regulated by similar sets of regulatory factors (Fig. 3). Functional analysis of the down-regulated genes will have to be performed to elucidate whether these shared regulatory elements are involved in similar cellular and/or ciliary processes in PCD patients.

Conclusions

Hierarchical clustering revealed sets of genes with expression pattern differentiating PDC patients from healthy controls.

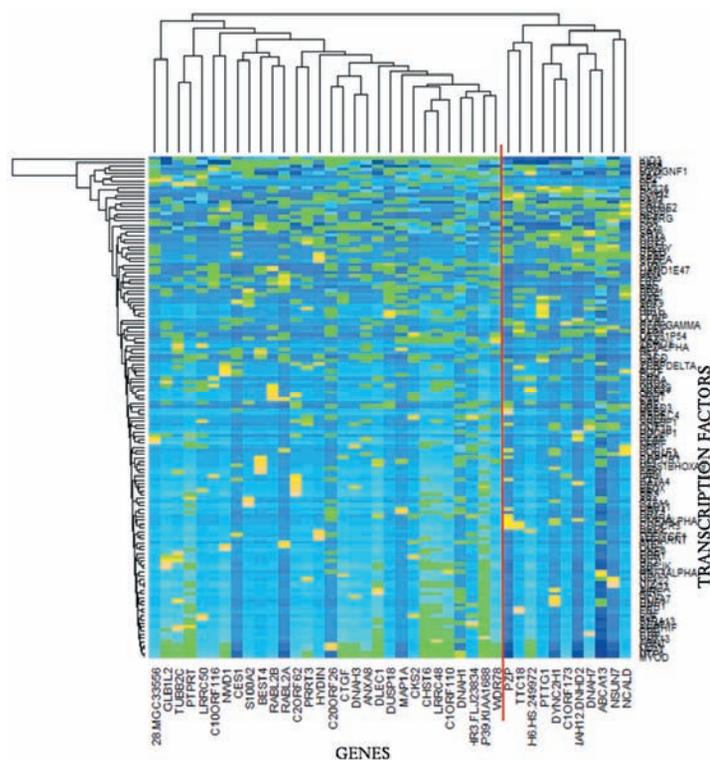


Fig. 3. Clustering of the down-regulated genes by their shared transcription factor binding sites

Analysis of the 5'-region in the down-regulated genes showed the presence of many conserved transcription factor binding sites.

Clustering separated these genes into two groups, apparently regulated by similar sets of regulatory factors, which may be involved in similar processes.

Uncovering patterns of ciliary gene expression offers a promising direction of research, aiming to explain the molecular pathogenesis of ciliopathies.

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We thank Maciej Geremek for providing the normalization data from the whole-genome expres-

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Alterations in the renal medulla: A key to understanding salt-dependent hypertension?

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Hypertension commonly brings forward many cardiovascular complications with potentially high mortality, such as stroke or myocardial infarction. An WHO report shows that, worldwide, hypertension is the cause of 62% of stroke cases and 49% of coronary heart disease cases. Costs of the treatment of hypertension related “end-stage” organ damage are growing exponentially. Most often hypertension is a primary idiopathic disease, although in many cases it is induced by environmental factors and/or organ dysfunction (secondary hypertension). One of the well known risk factors for hypertension is high salt intake: an imbalance of salt intake and renal excretion leads to sodium and water retention and often to so-called salt-sensitive hypertension.

The kidneys control the blood pressure by regulating the volume and composition of body fluids and by synthesizing many humoral active agents, such as angiotensin II (AngII), eicosanoids, nitric oxide, etc. The functional equilibrium of these agents is critical for optimal blood supply to the kidney (renal perfusion) and is important for blood pressure regulation. In particular, perfusion of the renal medulla is a factor participating in long term control of arterial blood pressure. High sodium intake increases the reabsorptive work and oxygen consumption of the renal tubules and may lead to tissue hypoxia, increased generation of reactive oxygen species (ROS), and reduced bioavailability of vasodilator nitric oxide (NO). High concentration of NaCl in the different fluid compartments may also induce local inflammation and cause remodeling of heart muscle and blood vessels; their responses to vasoconstrictor substances like Ang II or norepinephrine may be enhanced. All this prompted us to explore the role of high dietary salt intake in the development of hypertension in normal (Wistar) rats and in spontaneously hypertensive rats (SHR). Moreover, we explored the role of selected molecules from the extracellular matrix as potential mediators in this process.

We exposed the rats to high sodium diet (HS, 4% Na⁺) for 10, 21 or 28 days and non-invasively measured systolic blood pressure (SBP) and obtained blood samples on selected days. At the end of these observations the rats were anesthetized and surgically prepared for measurement of aortic blood pressure and renal perfusion, total (RBF), of the renal cortex (CBF) and of the outer and inner medulla (OMBF, IMBF). RBF was measured using an ultrasonic renal artery probe and flowmeter, and regional perfusion parameters by laser-Doppler flowmetry. The renal water and sodium excretion were also determined. After the experiments the kidneys were harvested for morphometric and immunohistochemical analysis, to evaluate the damage to renal tissue structures.

After 21 days of high salt intake SBP was significantly elevated in both strains of rats, but significantly more so in SHR. RBF and CBF were significantly higher, perfusion of the inner medulla was not increased, whereas perfusion of the outer medulla was significantly lower than the level normally observed in rats on standard diet. In Wistar rats the OMBF/IMBF ratio progressively decreased with increasing length of the exposure to HS diet. The first symptoms of injury in the medulla – hyperemia, atrophy of epithelial cells in the thick limb of Henle’s loop, and patches of necrosis in the interstitium – were seen after 10 days of exposure, while blood pressure increase was significant but minor. Prolongation of high sodium intake to three and four weeks enhanced the changes (Fig. 1), induced fibrosis, and aggravated glomerular injury. In all renal zones anti-PCNA (proliferating cell nuclear antigen) immunostaining was seen (Fig. 1), an indication of degenerative processes. In SHR three weeks of high salt intake augmented the glomerular injury usually observed on standard diet and induced morphological alterations in the medulla. In the SHR strain HS diet significantly increased the glomerular injury index, which correlated with urinary excretion of the vascular endothelial growth

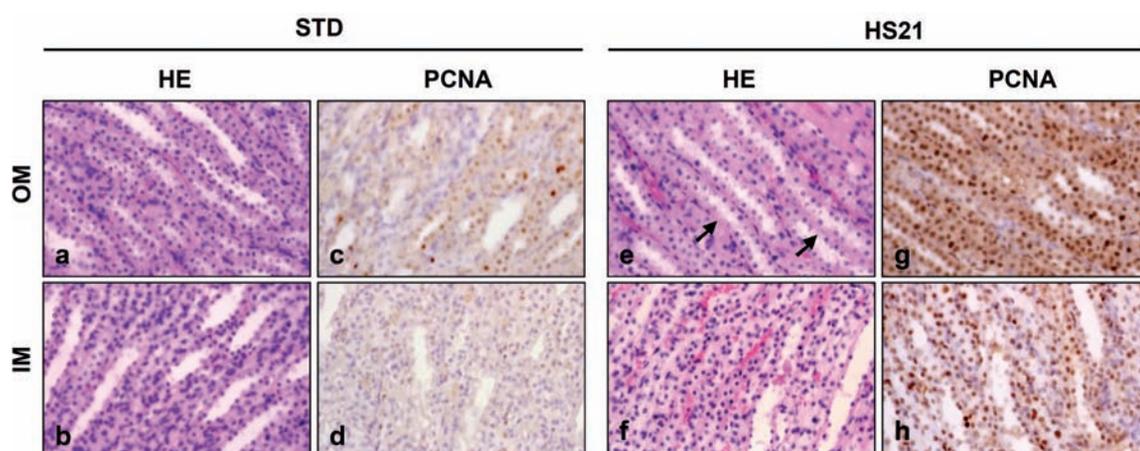


Fig. 1. Deleterious effects of high salt intake on morphologic features of the renal medulla in Wistar rats (x 20; hematoxylin-eosin (HE) and anti-PCNA immunostaining). a, b – normal morphology of outer and inner medulla (OM, IM); c, d – only few PCNA-positive nuclei in the OM; e, f – distinct signs of medullary hyperemia, deletion of some tubular cells (arrows); g, h – PCNA staining of the nuclei within both medullary layers, less pronounced in IM; STD, HS21 – standard or high sodium diet during 21 days

factor A (VEGF-A) (Fig. 2). Since VEGF-A is one determinant of blood vessel permeability and the formation of renal tubules, these findings support

the idea that its excretion may be an early index of glomerular nephropathy.

Thus, our studies strongly suggest a direct effect of high sodium intake on kidney structure and a role played by these structural and functional organ alterations in the development of hypertension. The renal medulla may be the first target of the high sodium-related destruction process. Probably, these changes alter kidney function and elevate blood pressure, which in turn augments kidney injury (a vicious cycle). When hypertension is already present, as a primary or secondary disease, high salt intake would augment organ damage. Limiting salt intake could help reduce local tissue injury and prevent the structural remodeling of cardiovascular and renal tissues, and thereby have a key role in the prevention or alleviation of hypertension.

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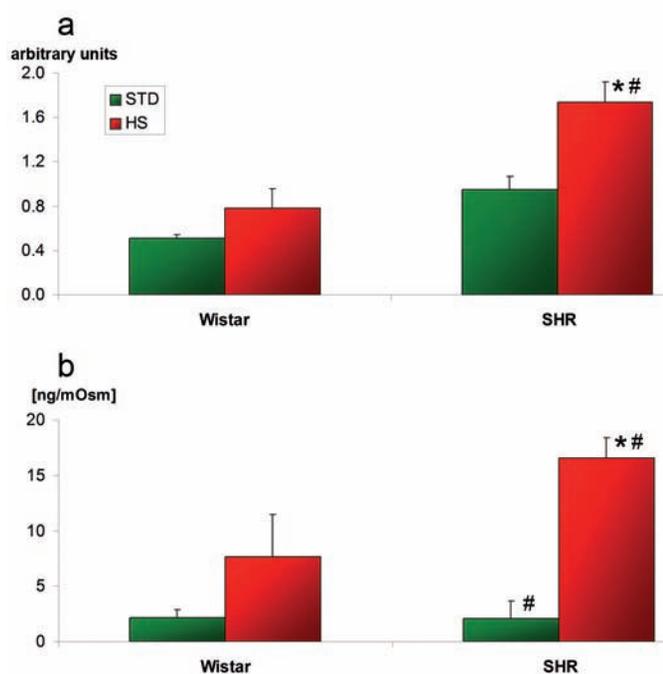


Fig. 2. Glomerular injury correlates with urinary VEGF-A excretion. a) Glomerular injury index (0 – no damage, 4 – 100% damage) on standard (STD) or high-sodium (HS) diet. * – STD vs. HS, # – Wistar vs. SHR ($p < 0.01$); b) Urinary VEGF-A as related to dietary sodium intake; * – STD vs. HS, # – Wistar vs. SHR ($p < 0.05$). NB. The parameters shown in the upper and lower panels are highly correlated ($r = 0.67$, $p < 0.02$)

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Earth and Mining Sciences

Division VII – Earth and Mining Sciences covers the following fields: geology, geophysics, oceanography, geodesy, geography, environmental engineering, and mining sciences. At the end of 2010 the Division consisted of 33 members of the Academy (21 full members and 12 corresponding members) plus 19 foreign members. Two members – Prof. Ryszard Marcinowski (corresponding member of the Academy) and Prof. James Clement J. Dooge (foreign member of the Academy) – passed away in 2010.

The Division is headed by Prof. Bogdan Ney (full member of the Academy) as its chairman, with Prof. Andrzej Ciołkosz (corresponding member of the Academy) and Assoc. Prof. [Krzysztof Jakubowski](#) as its deputy chairmen.

Division VII coordinated the activities of 7 research institutes plus the PAS Museum of the Earth. Eleven scientific committees (with 39 sections/commissions) are associated with the Division, with an overall total of 366 members, including 46 members of the Academy. In 2010 the committees belonging to Division VII continued to publish a number of scientific journals and other periodicals, including: *Acta Geologica Polonica*, *Acta Geophysica Polonica*, *Archives of Mining Sciences*, *Mineralogical Archives*, *Management of Mineral Resources*, *Geodesy and Cartography*, *Studies of the Committee on Water Management*, *Studia Quaternaria*, and *Oceanology*. The journals *Acta Geophysica Polonica*, *Oceanology*, and *Archives of Mining Sciences* are indexed by the Institute for Scientific Information (Thompson Reuters) in Philadelphia. In addition, each of the institutes publishes their own journals and periodicals, often of international scope.

Two plenary sessions of the Division were held in 2010, each of which featured discussion of current issues in research policy and of research events in Poland and in the world. The chairman of Division VII also provided information about important work being done by the Presidium of the Academy.

At the session held on 19 April, the individuals present familiarized themselves with the results presented by teams that had been tasked with evaluating two PAS institutes – the Stanisław Leszczycki Institute of Geography and Spatial Organization

and the Institute of Geological Sciences – and approved their evaluation reports. A commission was elected to select a new director for the PAS Strata Mechanics Research Institute in Kraków. Prof. Andrzej Żelaźniewicz (corresponding member of the Academy) presented a synthetic report on the activity of the Planet Earth Committee, which had completed its activity at the end of 2009.

Also discussed were the directions of change within the system of science in Poland given the enactment of five new laws reforming that system, including a new act regulating the Polish Academy of Sciences. Part of the session was devoted to electing candidates to become members of the Academy. There were three vacancies for full members and three for corresponding members. In a secret ballot, the following candidates were elected: Piotr Korcelli (geography), Jan Kutek (geology) and Stanisław Massel (oceanology) as full members of the Academy, and Lucjan Pawłowski (environmental engineering), Paweł Rowiński (geophysics), and Andrzej Witkowski (oceanology) as corresponding members of the Academy.

The second plenary session was held on 22 November. The members of the Division decided how to grant its 4 research awards in 2010. The remainder of the session was devoted to a presentation of the results of a team tasked with evaluating the PAS Institute of Geophysics and approving its evaluation report. The coming into force of the new act regulating the Polish Academy of Sciences on 30 April 2010 necessitated certain changes in the structure of the Academy, including the liquidation of Division VII in its existing form. Prof. Bogdan Ney, the chairman of Division VII, and Prof. Jan Andrzej Ciołkosz and Assoc. Prof. [Krzysztof Jakubowski](#), the deputy chairmen, presented a synthesis of the activities and research achievements of the Division of Earth and Mining Sciences from its inception in 1978 to 2010.

The members of Division VII received many commendations and distinctions in 2010 for their research, publication, and teaching activities: for instance, Prof. Józef Dubiński (corresponding member of the Academy) received an honorary doctorate from the National Mining University of Ukraine,

as well as the “Mine Rescue Merit” medal and the «Silver Treasurer» prize awarded by the head of the Polish State Mining Authority for efforts to improve mining safety; Prof. Jakub Siemek (corresponding member of the Academy) received an honorary doctorate from the Silesian University of Technology in Gliwice, the first-class prize of the rector of AGH University of Science and Technology for his publications, and the award of the Polish Minister of Science and Higher Education for his four years of work with the Central Commission for Degrees and Titles.

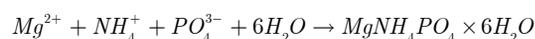
The Stanisław Staszic Award was given to Assoc. Prof. Waldemar Walczowski from the PAS Institute of Oceanology for his monograph *Woda Atlantycka w Morzach Nordyckich – właściwości, zmienność, znaczenie klimatyczne* [Atlantic Water in Nordic Seas – Properties, Variation, Climatic Significance]. The Wawrzyniec Teisseyre Award went to Dr. Anna Pi-

etranik from the Institute of Geological Sciences at Wrocław University for her series of papers on “Magmatism as a Process Controlling the Evolution and Creation of the Continental Crust.” The Ignacy Domeyko Award was granted to Dr. Leszek Marynowski from the Earth Sciences Faculty at the University of Silesia for his series of papers on “The Use of Biomarkers, Biomolecules, and Other Organic Compounds to Reconstruct the Sedimentation Conditions and Genesis of Organic Material.” Assoc. Prof. Stanisław Prusek from the National Mining Institute, in turn, was honored with the Witold Budryka Award for his publication *Metody prognozowania deformacji chodników przyścianowych w strefach wpływu eksploatacji z zawalaniem stropu* [Methods of Predicting Longwall Gallery Deformations in Excavation-Influenced Areas with Collapsed Ceiling].

Recovery of ammonia as struvite and recycling of magnesium and phosphate

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The struvite precipitation reaction can be written as follows (Nelson, et al. 2003):



The fact that the struvite precipitation method is still not widely used for the recovery of ammonium is due to the significant costs of the chemicals involved. One way to reduce the cost of struvite precipitation is by recycling the magnesium and phosphorus used in the process. One of the struvite decomposition methods involving the release of ammonia is heating, or heating in the presence of NaOH (calcination) (Shilong, et al., 2007; Stefanowicz, et al., 1991).

To study the reaction, we performed struvite precipitation in a batch reactor using the effluent from anaerobic digestion. Wastewater used in the experiments was analyzed chemically for the content of magnesium, phosphorus and ammonia nitrogen. Depending on the results of the chemical analysis, phosphoric acid and magnesium chloride were added. Struvite precipitation was carried out at pH values from 8.0 to 9.5, using 10% and 20%

excess of magnesium ions and phosphate in relation to the ammonium ion. The precipitated struvite was subjected to thermal decomposition, at temperatures: 80, 100, 130, 180, and 200°C. The released ammonia was absorbed in a solution of H₂SO₄. The residue after heating was subjected to microscopic observation. Thermal decomposition of struvite was

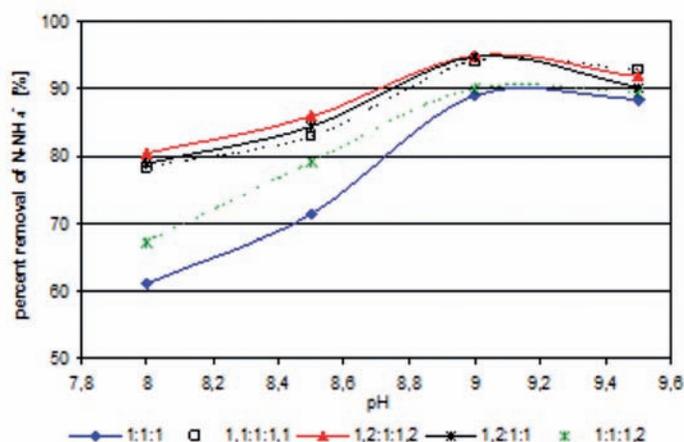


Fig. 1. Dependence of the N-NH₄⁺ removed on pH value and molar ratios Mg: N: P

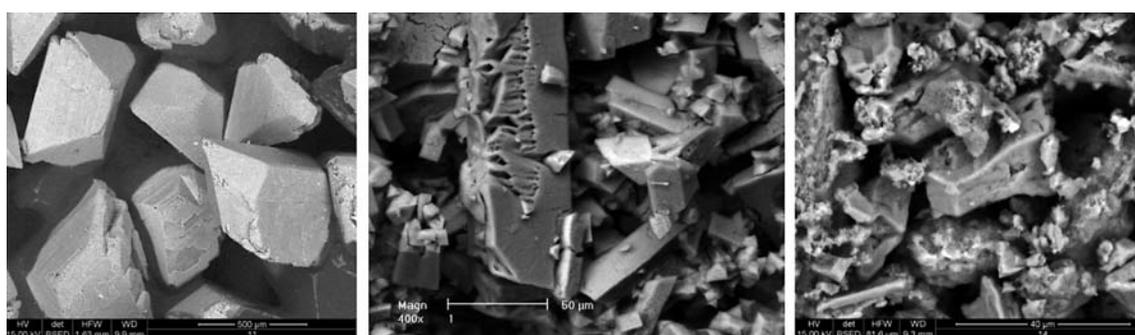


Fig. 2. Thermal decomposition of struvite crystals a) before heating, b) heated to 50°C, c) heated to 200°C

carried out by heating, both in the presence of NaOH ($Mg^{+}/OH^- = 1:1$) and without NaOH. Struvite precipitation using magnesium chloride $MgCl_2 \cdot 6H_2O$ proceeded very quickly and achieved about 95% of the maximum removal of ammonium ion after about 2 minutes.

The effects of reagent excess and pH on the result of ammonia removal from wastewater are presented in Fig. 1. The ammonia removal process was most effective at pH 9.0, irrespective of the excess reactants.

The process of thermal decomposition of struvite involves the loss of volatile components (water, ammonia) and rhomboidal crystals passed in the amorphous precipitate, as is presented in Fig. 2. The composition of the struvite thermal decomposition product (at 200°C) is similar to the theoretical composition of $MgHPO_4$.

The kinetics of the struvite thermal decomposition are presented in Table 1.

temperature °C	constant reaction rate [min^{-1}]	
	pure struvite	with NaOH addition
80	0.003	-
100	0.007	0.012
130	0.018	0.042
160	0.054	0.080
200	0.114	0.205

Table 1. First order constant reaction rate values of isothermal struvite decomposition

On the basis of the experimental data, the Arrhenius equation parameters were calculated and are presented in Table 2.

Parameters	Unit	$MgNH_4PO_4 \cdot 6H_2O$	
		pure	with NaOH addition
E	kJ/mol	42.5	40.2
A	1/min	$2.42 \cdot 10^6$	$2.32 \cdot 10^6$
$-\Delta S$	J/mol K	134.8	135.2

Table 2. Kinetic characteristics of isothermal struvite decomposition

The rate of isothermal struvite decomposition increased with temperature. The presence of NaOH increased the degradation rate twofold (Table. 1).

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Stability relations of REE phosphates and aluminosilicates as a function of pressure, temperature, and fluid composition – An experimental study

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Monazite [(REE,Th,U)PO₄], allanite [(CaREE)(Al₂Fe²⁺)Si₃O₁₂(OH)], and fluorapatite [Ca₅(PO₄)₃F] are relatively common accessory minerals, and three of the main hosts of rare earth elements (REEs) and actinides in the Earth crust. Their stability relations in metamorphic processes are strongly dependent on pressure, temperature, fluid composition as well as the mineral composition of the host rock. Overprinting of numerous processes during one or more tectonic cycles commonly inhibits the reconstruction of mineral-fluid interaction histories and specific fluid-rock reactions. One of way to explore and determine the stability of minerals in the presence of fluids is through experimental petrology. The goal of this study was to experimentally explore and constrain the geochemical relationship between monazite, fluorapatite, and allanite in the presence of aluminosilicate minerals as a function of pressure, temperature, and fluid composition (Budzyń et al. 2011).

The experiments were conducted at the Deutsche GeoForschungsZentrum (Potsdam, Germany) uti-

lizing cold-seal autoclaves on a hydrothermal line. Three sets of experiments were performed at P-T conditions of 450-610 MPa and 450-500°C representing conditions typical of the Earth's middle crust. The first set of experiments utilized 50-100 μm grains of monazite + albite + muscovite + amorphous quartz + CaF₂, while biotite and K-feldspar were added to the assemblage in the second and third set. A variety of fluids included doubly distilled H₂O, (KCl + H₂O), (NaCl + H₂O), (CaCl₂ + H₂O), (Na₂Si₂O₅ + H₂O), 1M HCl, 2M NaOH, 2M KOH, 1M Ca(OH)₂, 2M Ca(OH)₂, (CaCO₃ + H₂O). The mineral mix plus fluid were loaded into 15x3 mm Au capsules (Fig. 1) that were arc-welded shut using an Ar plasma torch while the Au capsule was partially immersed in an ice-water bath. The duration of the experiments was 16 days.

Most of the experiments resulted in monazite alterations. The presence or lack of reaction products shows that the stability relations between monazite, fluorapatite, and allanite/REE-epidote are dependent on the fluid composition and the alumino-



Fig. 1. One of the sealed Au capsules with starting minerals + fluid charge used in the experiments

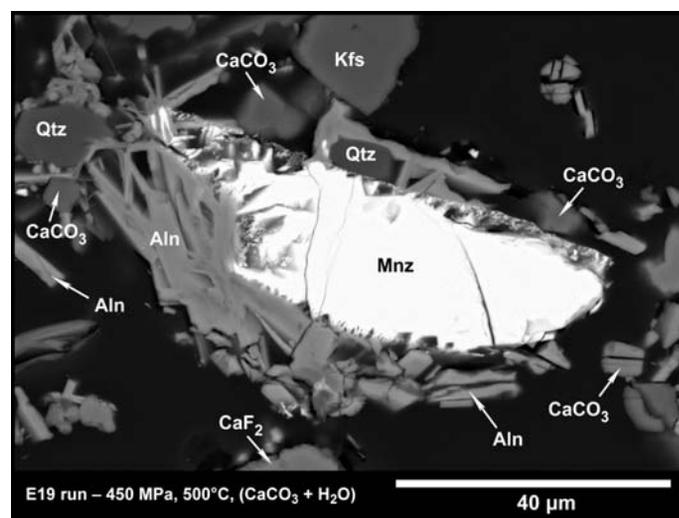


Fig. 2. The allanite (Aln) grains formed on the altered monazite (Mnz) surface (from Budzyń et al. 2011). Kfs – K-feldspar, Qtz – quartz

silicate minerals assemblage rather than the P-T conditions. Monazite dissolution and formation of fluorapatite and allanite/REE-epidote occur in experiments with a high-Ca fluid. The texture presented in Figure 2 replicates very well the textures observed in nature, emphasizing that partial replacement of monazite by allanite is promoted by high Ca activity in metamorphic fluids. However, high Ca + Na fluids promote allanite/REE-epidote formation only with increased pressure conditions. The 2M NaOH fluid is the only one that resulted in dissolution of monazite used in the experiment and formation of fluorapatite and a secondary monazite, which is consistent with recently reported observations in natural rocks (Budzyń et al. 2010).

The strongest alteration of monazite and mobilization of REEs and actinides was observed in the experimental run with $(\text{Na}_2\text{Si}_2\text{O}_5 + \text{H}_2\text{O})$ fluid. The monazite grains show patchy zoning (Fig. 3) related to depletion in Th, U, and Pb in the altered areas (Budzyń et al. 2011, Williams et al. 2011). Such alteration is a result of a fluid-aided coupled dissolution-precipitation process that causes mobilization of selected elements within the mineral structure at sub-micron scale. The implications are significant for monazite Th-U-Pb dating. Assuming that fluid-induced alteration causes the total removal of Pb from monazite, the resetting of the Th-U-Pb clock can provide an age constraint on the alteration process (Williams et al. 2011).

The results of this experimental study confirm natural observations that the replacement of monazite by fluorapatite, REE-epidote, and allanite under middle to high grade metamorphic conditions is driven by fluid-aided reactions involving the Ca component in plagioclase. The fluid composition controls the mechanism of mineral alteration and the timing of reactions. It should be highlighted that the experiment duration of 16 days was enough to replicate processes that in nature take tens or hundreds of thousands years in the geological time scale.

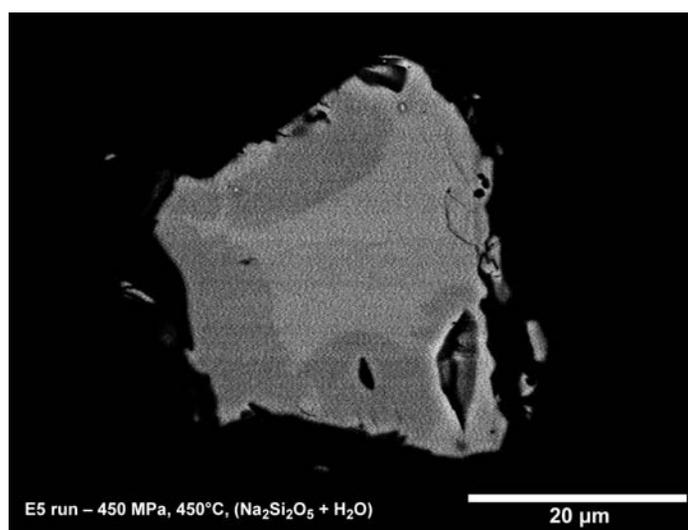


Fig. 3. Monazite showing patchy zoning formed as a result of fluid-aided coupled dissolution-precipitation process (from Williams et al. 2011)

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Latest advances in the similarity theory of the stably-stratified atmospheric boundary layer

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Introduction

Similarity theory is a method used for finding universal relationships between physical variables, often applied in situations when the complexity of physical processes precludes obtaining direct solutions of the governing equations. The theory is based on dimensional analysis, which allows characteristics of a given phenomenon to be expressed in terms of scaling factors (scales). The approach has been proven useful in many disciplines, such as physics, fluid mechanics, and meteorology. Classical milestones include Kolmogorov's "2/3 law" and Obukhov's "-5/3 law" for isotropic turbulence, and the Monin-Obukhov similarity theory of the atmospheric surface layer.

The Monin and Obukhov (1954) similarity theory is based on an assumption that the turbulent regime, in the atmospheric surface layer, is governed by the momentum flux τ_o , the surface temperature flux H_o (both constant in height near the underlying surface), and also by height z and the buoyancy parameter $\beta = g/T_o$, where g is the gravity acceleration and T_o is the reference temperature. From these parameters, the following similarity scales can be obtained: $u_* = \tau_o^{1/2}$, $T_* = -H_o/u_*$, $L_* = -u_*^3/\kappa\beta H_o$, for velocity, temperature, and length. A statistical moment X (e.g., standard deviations of the vertical velocity σ_w , and of temperature, σ_θ), scaled in terms of the similarity scales, is expected to be a universal function of dimensionless height z/L_* :

$$\frac{X}{u_*^a T_*^b L_*^c} = F_X(z/L_*) \quad (1)$$

where the exponents a , b , c are chosen in such a way that the function F_X is dimensionless.

Data accumulated in recent years indicate, however, that the approach has intrinsic limitations in stable (nocturnal) conditions. Specifically, the similarity scales u_* , T_* decrease with thermal stability, while their observational errors increase, causing the values of the stability parameter, $L_* \sim u_*^2/T_*$, to be highly scattered. In addition, the dimensionless similarity functions and their argument z/L_* ,

contain common divisors (i.e., u_* , T_*), a flaw referred to as "self-correlation."

Alternative similarity formulation

The described defects can be remedied by defining similarity scales in terms of gradients of scalars, which are better behaved than fluxes in very stable conditions. An alternative local (i.e., height dependent) scaling can be introduced as follows (Sorbjan, 2010):

$$U_s = l_o N, \quad T_s = l_o \Gamma, \quad L_s = l_o \quad (2)$$

where $N = \sqrt{\beta\Gamma}$ is the Brunt-Väisälä frequency, $\Gamma = d\Theta/dz$ is the vertical gradient of the potential temperature, $\beta = g/T_o$ is the buoyancy parameter, g is the gravity acceleration, T_o is the reference temperature, and l_o is the mixing length in neutral conditions. In the proximity of the underlying surface, the mixing length is a linear function of height, $l_o = \kappa z$, where $\kappa = 0.4$ is the von Karman constant. Farther from the surface, the growth of the mixing length l_o with height is expected to be slower.

As implied by the dimensional analysis, a non-dimensional product of a statistical moment X (such as the fluxes H , τ , and the standard deviations, σ_w and σ_θ), and the flux-based scales (2), are universal functions of the Richardson number Ri :

$$\frac{X}{U_s^a T_s^b L_s^c} = G_X(Ri) \quad (3)$$

where $Ri = N^2/S^2$, $S = \sqrt{(dU/dz)^2 + (dV/dz)^2}$ is the mean wind shear, and U and V are the components of the wind vector.

Assuming in (2) that the dependence of the mixing length on height is linear, $l_o = \kappa z$, and using the SHEBA data (an acronym for the Surface Heat Budget of the Arctic Ocean experiment), Sorbjan (2010) obtained the gradient-based similarity functions for fluxes and standard deviations, valid in the surface layer. For example, for the standard deviations, σ_w and σ_θ , the following functions were found:

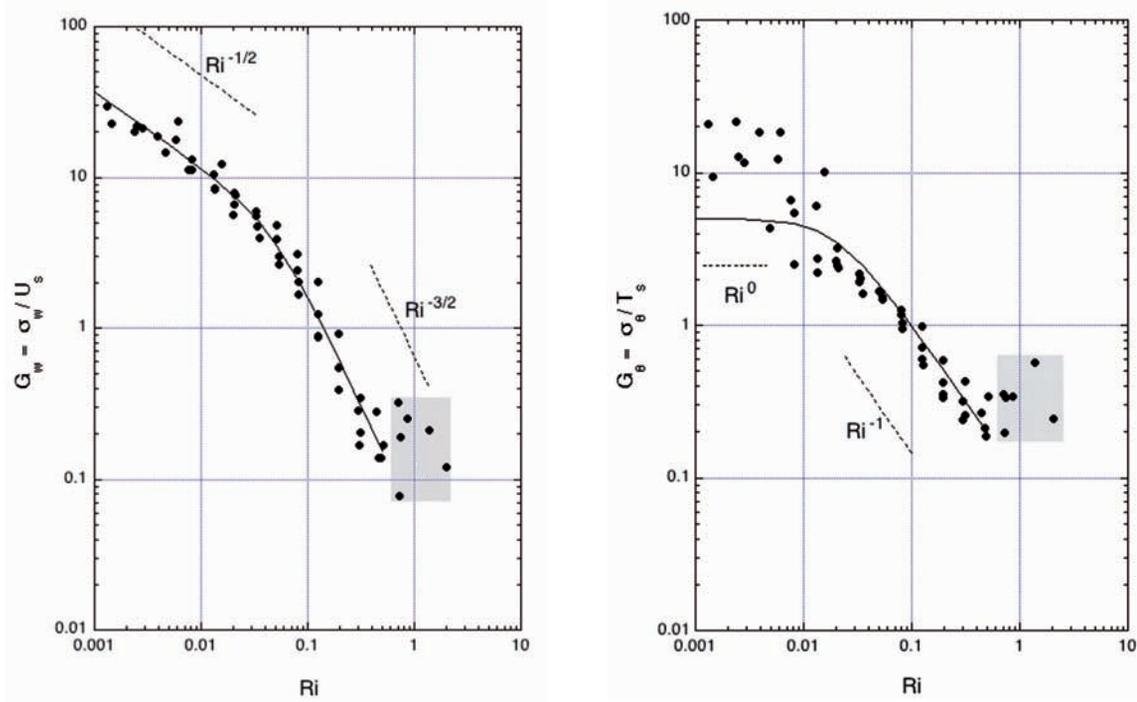


Fig. 1. A dependence of the bin-averaged values of the dimensionless standard deviations for (a) vertical velocity $G_w = \sigma_w / U_s$, and (b) temperature $G_\theta = \sigma_\theta / T_s$, on the Richardson number Ri . The solid lines are plotted based on Eqs. 4. Data points within the “extremely stable” domain are marked by the shaded box (Sorbjan, 2010)

$$G_w \equiv \frac{\sigma_w}{U_s} = \frac{1}{0.85 Ri^{1/2} (1 + 450 Ri^2)^{1/2}} \quad (4)$$

$$G_\theta \equiv \frac{\sigma_\theta}{T_s} = \frac{5}{(1 + 2500 Ri^2)^{1/2}}$$

in the range $0 < Ri < 0.7$ (Figure 1).

Comparison with numerical models

The assumption of linearity for the mixing length $l_o = \kappa z$ in the definition of scales (2) is acceptable only in a close proximity to the underlying surface. Above the surface layer, the following expression for the mixing length is more appropriate (Sorbjan, 2011):

$$l_o = \frac{\kappa z}{1 + \kappa z / \lambda} \quad (5)$$

where λ is a parameter that can be interpreted as the value of the mixing length near the top of the neutral boundary layer.

To test similarity expressions (4), for scales U_s and T_s defined by (2) and (5), the results of three numerical models were used, i.e. the single-column model of Sorbjan (2011), and two, high-resolution,

large-eddy simulation (LES) models (Beare et al., 2006). Large-eddy simulations are considered to be a very close representation of the boundary-layer turbulence. Profiles of the standard deviations, σ_w and σ_θ , diagnosed within the single-column model

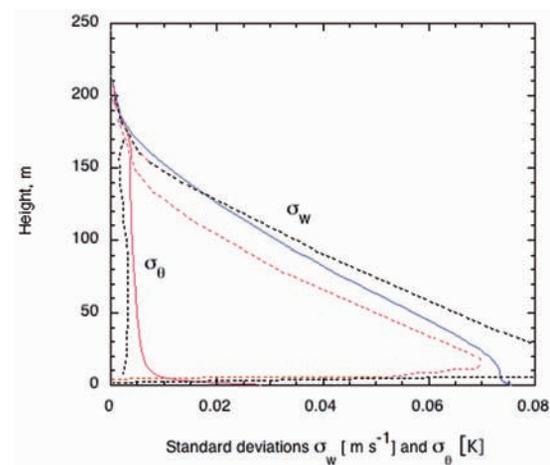


Fig. 2. A comparison of the diagnosed standard deviations of the vertical velocity and temperature, σ_w , σ_θ , obtained from a single-column model (solid lines), based on Eqs. (4), for (2) and (5), and two large-eddy simulations (dashed lines). Results of the Met Office LES model are marked by black dashed lines, those of the University of Hannover LES model are indicated by red dashed lines (Sorbjan, 2011)

are depicted in Figure 2. The figure shows a very good agreement of the diagnosed profiles [based on (4), (2), (5), and for $\lambda = 12$] with the LES profiles, which confirms the validity of the presented similarity approach in the entire boundary layer.

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The West Spitsbergen Current heat transport and divergence

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Most of the solar radiation absorbed by the Earth is stored in the upper layer of tropical oceans. This heat is transported by poleward surface currents and released into the atmosphere in the high latitudes.

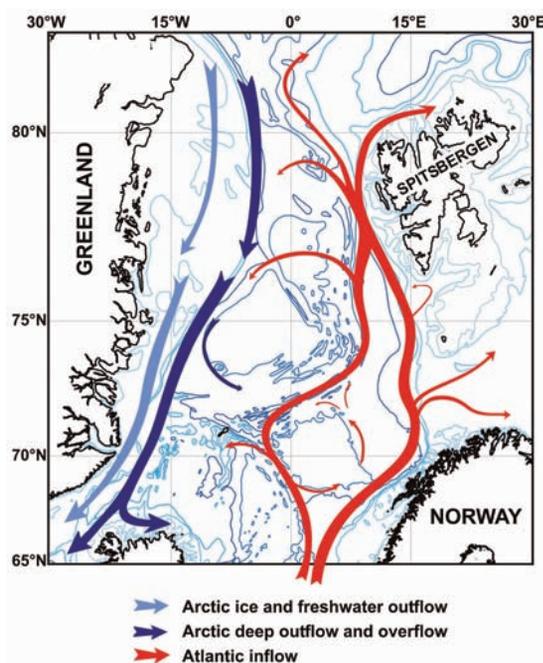


Fig. 1. The Nordic Seas circulation scheme. Warm Atlantic Water indicated in red

Since the cooled water is more dense, it sinks and initiates the deep loop of the oceanic Thermohaline Circulation. To understand global climate changes in response to natural and human generated forces, it is crucial to determine in what amount and by what pathways the oceanic heat advects throughout the global ocean. During the past decades, warming of the Arctic atmosphere has proceeded twice as fast as the global mean and this trend is likely to continue. A crucial role in this 'Arctic Amplification' is played by Atlantic Water (AW) flowing into the Nordic Seas along complicated pathways (Fig. 1). The Institute of Oceanology, Polish Academy of Sciences (IO PAS) has continued climate-oriented research in the Arctic since 1987. Our research helps us to understand the role of AW in climate change.

The IO PAS explores the West Spitsbergen Current (WSC), which is the northernmost part of the AW flow into the Arctic Ocean. Every summer, its research vessel the S/Y 'Oceania' operates between northern Norway and Fram Strait. Deep profiles of the temperature, salinity, sea current velocity and other water properties are measured at standard stations.

Significant variability in the AW properties has been observed over the last decade. Changes in AW

temperature, heat content, and northward transport have had a strong influence on the Arctic climate and ecosystem, sea ice extent, the melting and calving rate of glaciers. The 2006 northward advance of the AW was an unprecedented, never before observed phenomenon. The environmental effects of these warm and saline water advections were significant: the ice coverage of the western Spitsbergen fjords weakened, the area of the ice-free region north of Svalbard expanded, and changes occurred in the plankton community structure in that region.

To examine the relationships between changes in the AW properties and climate, time series of the mean AW temperature and the mean air temperature at the Polish Polar Station in Hornsund were compared (Fig. 2). The changes in AW temperature explain 72% of the yearly mean Hornsund air temperature variability.

Changes in AW properties lead to changes in the atmosphere, which confirms the ocean's primary climatological role in the high northern latitudes. This makes knowledge about the oceanic heat transport and heat fluxes from the ocean to the atmosphere so important. The data collected by IO PAS provide a good opportunity to analyze AW volume and heat divergence between latitudes 73°30' N and 78°50' N.

The Atlantic Water loses 4.4 GJ of heat for every meter of northward shift. The oceanic heat transported with AW by the northward baroclinic currents across the 73°30' N parallel diverges: 22% of the heat flows toward the Arctic Ocean through the Fram Strait, 53% flows westward to the western Greenland Sea, and 25% is transferred to the atmosphere (Fig. 3). This creates a yearly mean heat flux between the ocean and the atmosphere of $90 \text{ W}\cdot\text{m}^{-2}$, which is 70% of the NCEP/NCAR results for this region. The calculations show the importance of oceanic advection in general and the Thermohaline Circulation in particular to heat transport and warming the atmosphere in northerly latitudes.

The IO PAS plans to continue the S/Y 'Oceania' Arctic cruises. Every year of observation adds valuable data to the collected time series. The institute is also introducing modern technologies – autonomous ARGO floats have been launched in the Greenland Sea, we plan to continue this under the framework of the EuroArgo project. The profiling mooring collects time series of the WSC properties and dynamics; two moorings record data in the Spitsbergen fjords. Our ambition is also to introduce

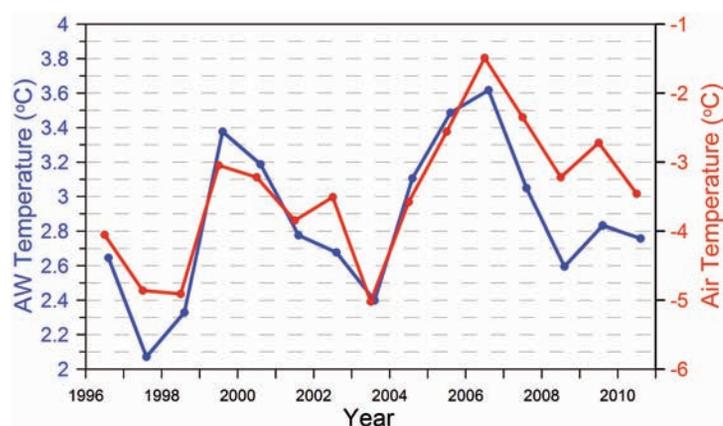


Fig. 2. The time series of the mean yearly Hornsund air temperature (red line) and Atlantic Water summer temperature at the section along the 76°30' N latitude

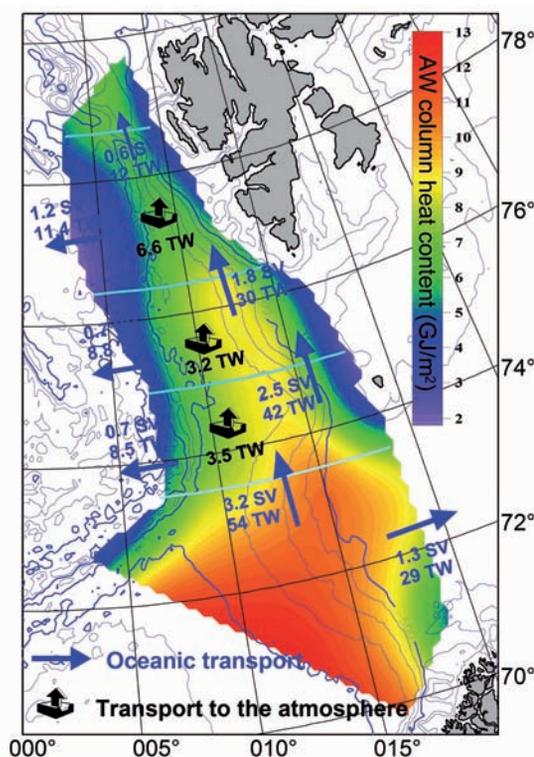


Fig. 3. Mean heat content stored in the AW layer (color scale), mean volume and heat transports in summers 2000-2007

the latest technology – autonomous, remote controlled vehicles (gliders) to perform sections cross the WSC four times per year. The Hornsund Base seems to offer a perfect location for a glider port.

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Revitalization of selected mineral rock deposits and its impact on the surrounding environment

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Increasing anthropopressure (human impact) on the environment leads to the permanent loss of its resources and decreases its value. Centuries of surface mining operations in Poland have had their share in this process. Mine decommissioning leaves behind large areas devoid of useful function. Given that areas of land for new investments, necessary to ensure the development of regions, are in ever shorter supply these days, the hidden natural, cultural, or historical potential of post-mining areas has been addressed. Appropriate use of this potential may become a driving force for the economic development of a region. Very important, however, is the appropriate choice of optimum directions of development for such areas, consistent with sustainable development, i.e. preserving harmony in the environment, satisfying the needs of local communities, and achieving economic efficiency.

The acquisition of raw rock by mining methods is mainly associated with the transformation of the landscape, the biosphere, and to a lesser extent, the atmosphere (noise, dust) and hydrosphere (surface waters). These transformations were particularly intense in the second half of the 20th century, due to the high demand for mineral resources, the development of infrastructure for their processing, and its accumulation in environmentally valuable regions. Despite strong pressure from industry, the biosphere has not been totally devastated. Vegetation

has been preserved in the form of patches and, in the abandoned quarries and their closest vicinity, it has been replaced by synanthropic flora, often rich in rare or endemic species. This is related to the uncovering of the specific bedrock, which was invaded by species of plants and animals typical for this type of subsoil. At the same time the exposed parts of the geological structure, characterized by various forms, enriched the landscape of the region. The appropriate use of these, along with the newly formed vegetation and cultural elements left in the surroundings, may help boost the attractiveness of regions and stimulate their development.

The increasing demand for new investment land generates a beneficial climate for efforts contributing to the recovery of post-mining areas. Restoring their useful function should be a priority for the regions in which they occur, since such areas have valuable resources in their interior and surroundings, often of a hidden nature, of aesthetic, cultural, historical, or sentimental value for the local society. Highlighting and utilizing these resources according to the needs of local societies can generate measurable environmental, social, and economic benefits. However, it is essential for adequate legal regulations to be introduced quickly and for available funding sources for such activities to be recommended.

Three quarries where Jurassic limestones were excavated, at different locations within the Kraków-

Częstochowa Upland (Kielnik-Olsztyn, Miękinia-Zachód, and Zakrzówek), were analyzed. They differ in terms of the natural and anthropogenic features of the environment (Pietrzyk-Sokulska, 2004), as well as their location, volume, abandoned buildings and technical equipment, etc. Two of these sites (Kielnik-Olsztyn and Miękinia-Zachód) have undergone a natural succession, creating ecological niches with vegetation typical for the existing bedrock, whereas one (Zakrzówek) has become spontaneously filled with water, creating a picturesque water reservoir of great depth (Pietrzyk-Sokulska, 2008).

In the Kielnik-Olsztyn quarry, situated at the center of the “Eagle’s Nest” Landscape Park and near the ruins of a medieval castle, an educational path has been created, with several information plaques explaining interesting elements of the region’s structure and geological history (e.g. cave, fossils, tectonics). A concept has also emerged for revitalization of the interior for recreational purposes (Fig. 1), which may possibly be funded by the municipality with support from EU funds.

A somewhat different decision was made with respect to the utilization of the former quartz porphyry quarry in Miękinia-Zachód. A teaching center and a modern renewable energy laboratory will be established here by the Krzeszowice municipality, in cooperation with the AGH University of Science and Technology (AGH-UST) and the Kraków University of Technology. The AGH-UST’s existing teaching center in a former foreman building near the quarry will, after modernization, along with the laboratory become an site for regional ecological and tourist activity for students and residents of the municipality and its neighborhood.

The Zakrzówek quarry located in south-western part of Kraków was worked until the 1990s, with Jurassic limestones being excavated for the “Solvay” Soda Plant. Once water pumping ceased after the quarry stopped operations, the water system restored its equilibrium, forming a 37m deep reservoir (Fig. 2) of crystal clear water. Its location near the center of Kraków, in a partly wooded and recreationally developed area, has made it a favorite place for strolling and other leisure time activities, for visitors from Kraków, elsewhere in Poland, and abroad. It has also caught the attention of film producers, who harness the beauty of this site (Fig. 3) as a setting for films. Moreover, diving aficionados have a base here.

The examples of revitalization briefly discussed here show that brownfield sites can be transformed



Fig. 1. Concept for an amphitheatre situated in a quarry (M. Bogdanowicz)



Fig. 2. Zakrzówek reservoir – bird’s-eye view (krakow.gazeta.pl)



Fig. 3. The picturesque Zakrzówek reservoir (E. Pietrzyk-Sokulska)

into areas of great natural, cultural, and educational value. If their brownfield potential is skillfully exploited, the regions in which they occur can benefit and develop. However, it should be noted that before implementation of a post-mining adaptation (revitalization) concept can proceed, there first has

to be a thorough analysis of the interior of the site (primarily in terms of environmental and anthropogenic factors), its closest vicinity, and the public demand. Often just modest “rearrangement” and supplementary work may suffice to change these areas into wholesome objects harmoniously incorporated into the surrounding landscape.

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Experimental investigation of pressure waves and strains in a simple net of elastic tubes

M. Gawor | J. Sobczyk | M. Tichoruk | Strata Mechanics Research Institute | Polish Academy of Sciences

One of the main activities of the Strata Mechanics Research Institute is researching in the metrology of fluid flow. Applying numerous original in-house solutions in the domain of new measurement methods and devices, the Strata Mechanics Research Institute focuses on the application of informatics and high technologies, mainly but not exclusively in the mining industry. In tandem with theory development and simulation, the Institute performs experimental research on objects of different scales – including porous media, nets of elastic tubes (as a blood vessel analogue), aerodynamic tunnels, and ventilation networks of underground mines.

The flow of liquid through elastic vessels is frequently an unsteady process. In fluid dynamics, Bernoulli's principle states that an increase in the speed of the fluid occurs simultaneously with a decrease in pressure, meaning that we can observe the collapse of an elastic vessel. On the other hand, the inertial forces of the flow lead to vessel expansion (swelling). The two phenomena taken together (vessel collapsing and vessel expansion) lead to self excited oscillations.

Recently, several experiments have been performed to obtain information on the deformations

of elastic tubes during pulsating flows. This research concentrated on the measurement method and the creation of an experimental model.

The experimental setup is presented in Figure 1. It consists of:

- a buffer container, responsible for maintaining a constant level of static pressure in the system (N);
- a pump (P), controlled by the computer;
- a model (M) – a simple net of elastic tubes and nonelastic tubes with pressure transducers;

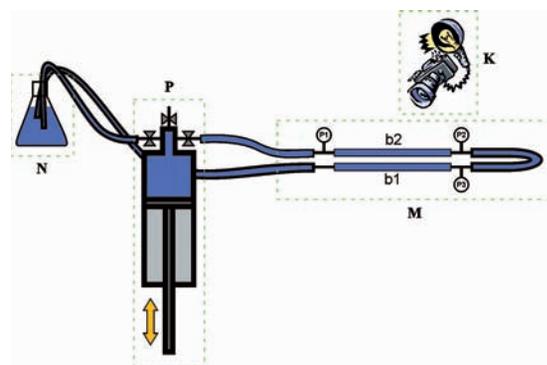


Fig. 1. The measurement setup: P1-P3 – the pressure transducers, N1-N2 – the simple net of elastic tubes made from thin rubber

- a measurement component for PIV (Particle Image Velocimetry): quick camera, lighting, trigger (K);
- the liquid (water with iodine);
- a component for synchronization of pressure sampling and photos;
- a data acquisition and processing component.

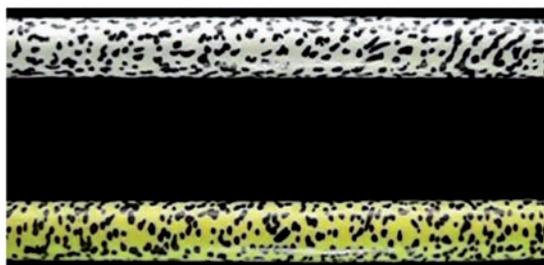


Fig. 2. The central fragment of elastic tubes N1 and N2. The tubes were painted with markers to apply the PIV method

The model presented in Figure 2 is quite simple, yet the investigation of its deformation is rather complex. We managed to determine:

- the speed of wave propagation on the distance between manometers;
- the frequency of the model's tubes;
- the dynamical properties of the model, depending on static pressure, flow frequency, and amplitude.

The application of the PIV method provided the analysis of tube deformations. The deformation depends strongly on the boundary conditions of the experiment. We observed different combinations of radial and axial deformation depending on the flow forcing method. Figure 3 shows some examples. The time evolution of deformations shows that deformations change direction (expansion and contraction) and value. The maximal value of deformation is about 0.1 – 0.6 mm with speed 0.2 cm/s to 1.2 cm/s.

The results show that preliminary experiments yield information important for modification of the model and measurement methods. Future plans call for the creation of a model more similar to blood vessels.

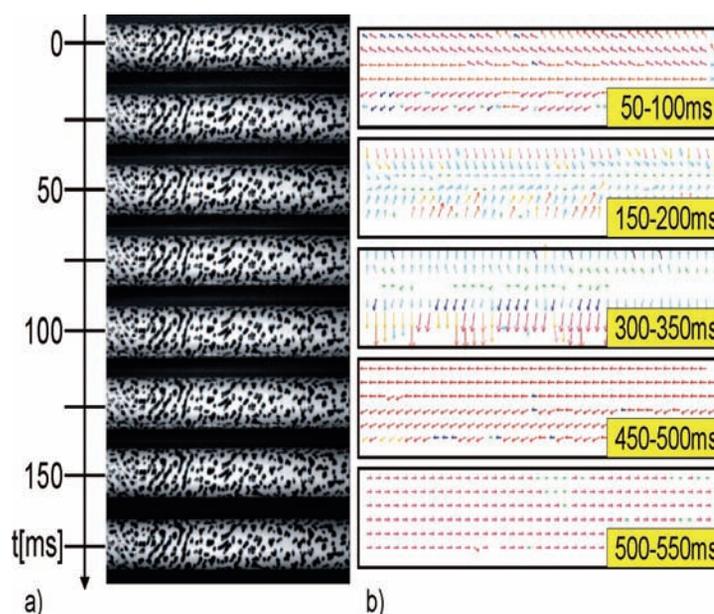


Fig. 3. Set of several photos taken by a quick camera. In section (a), a time scale indicates the moment when the photo was taken. In section (b), the pictures represent the displacement of markers (deformations of tube N1)

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The International Relations of the Polish Academy of Sciences

Prof. Władysław Włosiński – Laureate of a Chinese Government Award

On September 27, 2008 Prof. Władysław Włosiński, chairman of Division IV – Technical Sciences, Polish Academy of Sciences received a “Friendship Award” from the Government of the People’s Republic of China, bestowed to foreign experts for their contribution to the technological and civilizational development of China. Prof. Włosiński was nominated for this award by the Chinese Academy of Technical Sciences for his merits in cooperation with Chinese universities and science institutions.

The “Friendship Award” ceremony was held in the rooms of the National Assembly of the Repub-

lic of China and was attended by high-ranking Chinese officials, including the prime minister, other ministers, and parliament deputies.

Prof. Włosiński has been collaborating with Chinese research institutions since 1988. He is a lecturer and initiator of a school on the physical-chemical basis of material bonding, where he has trained over 80 specialists (including Chinese researchers) in the field of bonding modern materials with metals.



Friendship Award diploma



Golden medal



Minister of Technology confers the Award to Prof. W. Włosiński

The initiative to train researchers in this field gave rise to Polish-Chinese cooperation in exchanging engineering knowledge. Between 1990-2003, more than 20 Chinese young researchers were trained in bonding ceramic, composite, and multilayer materials at the Welding Engineering Department of the

Faculty of Production Engineering, Warsaw University of Technology. Three of them have defended their doctoral theses and hold high-ranking university positions (a dean, the director of an institute, and a professor at the Beijing University of Technology). The Polish researchers participate in this exchange as well, traveling to study at Chinese universities, exchanging scientific knowledge, specialist literature, and technologically advanced apparatus.

In 2005 the Chinese Academy of Technical Sciences appointed Prof. Włosiński as a foreign member.

Annual Report staff



Chinese Prime Minister congratulates the laureates

The Polish-Chinese Center for Dialogue of Scientists and Engineers

W. Włosiński | Polish-Chinese Dialogue Center of Scientists and Engineers | Polish Academy of Sciences

On 31 December 2010, the Polish Academy of Sciences and the Chinese Academy of Engineering signed an agreement to create the Polish-Chinese Center for Dialogue of Scientists and Engineers (PCCDSE).

The PCCDSE constitutes an auxiliary unit of the Polish Academy of Sciences and a unit of the Chinese Academy of Engineering in Beijing. The aim of the center is to promote scientific and technical collaboration and the exchange of researchers. The PCCDSE's ambition is to overcome formal and bureaucratic barriers to scientific and economic cooperation between Poland and China. In the future the PCCDSE's activity will help bolster the expansion of Polish-Chinese cooperation in various areas of scientific, social, and economic development.

Since its establishment, the Center for Dialogue has concentrated on promoting the exchange of young researchers (mainly PhD students) and the joint implementation of research projects in the fields of new energy technologies, particularly renewable energy, greenhouse gas emissions reduction, as well as advanced materials technology and information technology, supporting processes of sustainable development. The PCCDSE will also deal with

other topical and important issues raised by its partners.

The following forms of work already exist and will be extended in the future:

- the exchange of scientific information,
- joint seminars, symposia, and scientific meetings (the first one – about the exchange of doctoral students and the need for computerized communications and urban infrastructure solutions – was



Fig. 1. The opening of the first Polish-Chinese seminar entitled “ECO-Mobility,” organized by the PCCDSE together with Warsaw University of Technology and the Motor Transport Institute in Warsaw



Fig. 2. Visit to the laboratories and presentation of achievements in the field of ecological vehicles

held on 09 May 2011, whereas the next event will be held on 16 and 17 June 2011; the topics include ECO-mobility, technology innovation, and new remanufacturing processes),

- short-term exchanges of scientists and engineers to become familiar with ongoing research and development plans.

Other forms of cooperation will cover specific issues of interest to both partners, such as joint scientific publications, organizing workshops on current issues, inviting famous professors or experts to give lectures, and the development and submission of applications for European and bilateral projects.

The PCCDSE-led cooperation is based on high scientific standards and concentrates mainly on advanced research issues.

The seminar ushers in a new type of Polish-Chinese cooperation on joint scientific research work and potential joint implementations (applications).

It also represents a proposed Polish-Chinese scientific exchange, with particular emphasis placed on young scientific personnel, including PhD students. Proposed topics of the seminar concentrate on the problems of ECO-mobility and concern selected problems of:

- implementation of new functional materials in transport and medicine and new remanufacturing processes,

- municipal transport PRT (Personal Rapid Transit),

- a new electric car concept that can be operated by both physically fit and handicapped persons,

- a vertical holding and movement assisting system (or “exoskeleton”),

- innovative vehicles boosting the mobility of handicapped persons (including innovative wheelchairs capable of coping with certain obstacles, as well as off-road vehicles designed for disabled persons),

- innovative medical technologies restoring mobility (ultramodern external orthopedic stabilizers, “ecological” endo-prostheses made of new materials, and orthopedic implants made of innovative materials,

- unification of product projects to enable their implementation both in China and in Europe.

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Educational and Promotional Activity within the Polish Academy of Sciences

Poland Marks the International Year of Chemistry

J. Chrostowski

In November 1911, Maria Skłodowska-Curie became the first scientist ever to win the Nobel Prize twice. To date, she remains the only individual in the small, elite group of double Nobel laureates to have won in two different fields of science: first physics, then chemistry. The 100-year anniversary of the Nobel Prize in chemistry to the Polish-born Curie, for her discovery of the elements polonium and radium, has proven to be an excellent pretext to attract greater public attention to chemistry's contribution to the development of human civilization and the field's key role for the functioning and advancement of modern societies.

The International Year of Chemistry 2011 (IYC 2011) was decreed three years ago by the United Nations, at the request of UNESCO and the International Union of Pure and Applied Chemistry. In Poland and France, the celebrations are of a special caliber: both the French and Polish legislatures declared the year 2011 to be the Year of Maria Skłodowska-Curie (MSC-100). Polish President Bronisław Komorowski gave his honorary patronage to the celebrations in Poland, as did President Nicolas Sarkozy in France.

The official opening of the celebrations of the International Year of Chemistry 2011 took place at UNESCO headquarters in Paris on 27-28 January. The ceremony brought together people of science and various representatives of organizations and institutions dealing with chemistry from around the world. Poland's presence was ensured by representatives of the Polish Academy of Sciences, Polish academic centers, and the Polish Chemical Society. The next day, in the presence of members of the Polish and French scientific and political elite, the French President inaugurated the celebrations of the 100th anniversary of the Nobel Prize in chemistry awarded to Maria Skłodowska-Curie.

The organization and coordination of the various ceremonies and events related to the International Year of Chemistry 2011 and the Year of Maria

Skłodowska-Curie will be handled by the national academies of sciences in the individual countries. In Poland such coordination is the responsibility of the Committee on Chemistry of the Polish Academy of Sciences (PAS). Prof. Michał Kleiber, President of the Polish Academy of Sciences, is the chairman of the Honorary Committee for the celebrations, whereas Prof. Janusz Lipkowski chairs the PAS Committee on Chemistry.

Apart from stressing the importance of chemistry in solving the global challenges of civilization, the objective of the International Year of Chemistry 2011 is to boost interest in chemistry-related topics among young people and to stimulate collaboration between scientific and research institutes. These objectives are being pursued through various chemistry-related events, organized both by local communities and in cooperation with many chemistry-related institutions and organizations.

One of the most important events included in the Polish celebrations is a science-themed meeting entitled "The Role of Chemistry in the Development of Civilization," organized on 2-3 June on the



Science-themed meeting organized on the premises of the Institute of Physical Chemistry and the Institute of Organic Chemistry in Warsaw (Z. Pakulski)

premises of the PAS Institute of Physical Chemistry and the PAS Institute of Organic Chemistry in Warsaw. Under the media patronage of TV Biznes, Polish Radio Channel One, the portal Onet.pl, and the science-themed magazines *Wiedza i Życie* and *Świat Nauki*, numerous chemistry-related institutions took part in preparing the celebrations, including the PAS Institute of Organic Chemistry, the PAS Committee on Chemistry, the Faculty of Chemistry at Warsaw University, the Polish Institute of Nuclear Chemistry and Engineering, the Faculty of Chemistry at Warsaw University of Technology, the PAS Institute of Physical Chemistry, the Faculty of New Technologies and Military Chemistry at the Warsaw Military University of Technology, the Faculty of Mathematical and Natural Sciences and School of Hard Sciences at the Cardinal Stefan Wyszyński University, the PAS Institute of Catalysis and Surface Chemistry, the Polish Institute of Industrial Chemistry, the Materials Engineering Faculty of the Warsaw University of Technology, the Polish Pharmaceutical Institute, and the Faculty of Chemical and Process Engineering at Warsaw University of Technology.

The first day of the celebrations of IYC 2011 and MSC-100 on the premises of the PAS Institute of Physical Chemistry and the PAS Institute of Organic Chemistry was an opportunity for meetings between representatives of the worlds of science and industry, meant to demonstrate the great potential that lies inherent in the Polish community of chemists. The concepts presented included the notion of establishing a Mazovian Valley of Green Chemistry – a consortium of chemistry-related institutions meant to make it easier for young researchers to establish spinoff companies and to secure venture capital funding.

On the second day of the celebrations in Warsaw, the organizers opened up exhibition tents accessible to all interested parties. The sunny June weather encouraged the public to pay visits. Primary school pupils, who came in sizeable numbers, had the chance to take part in a magical tournament entitled “the Harry Potter of Chemistry” – a kind of urban game in which three-member teams vied to win a trophy, along the way familiarizing themselves with the nuances of producing various elixirs, tracking down hints placed around the exhibition grounds, and resolving chemistry riddles. Junior high and high school students took part in individual competitions and lectures on chemistry. Various chemistry experiments were continuously being performed at the exhibit stands. They included exploding volcanoes, liquids that “magically” change color, a pharaoh’s slithering snakes, miniature cyclones, and chemical gardens featuring multicolor “plants” growing before visitors’ very eyes. Visitors also had a chance to test their own personal level of radioactivity.

Celebrations of the 100-year anniversary of Maria Skłodowska-Curie’s Nobel Prize in chemistry will draw to a close in the final days of November, at Warsaw’s Royal Castle. There will be conferences and symposia concerning the challenges of chemistry in the 21st century and the role of women in science. The International Year of Chemistry 2011, in turn, will be officially concluded in Brussels in December.

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The Institutes of Organic and Physical Chemistry, Polish Academy of Sciences – From Past to Present*

Z. Pakulski | Institute of Organic Chemistry, Polish Academy of Sciences

On 2-3 June 2011, celebrations of the International Year of Chemistry and the Year of Maria Skłodowska-Curie were held at the joint premises of the PAS Institute of Physical Chemistry (IPC) and the PAS Institute of Organic Chemistry (IOC)

at Kasprzaka Street in Warsaw. Alongside the two host Institutes, the organizers included leading Warsaw scientific and research institutions: the Faculty of Chemistry, Warsaw University of Technology; the Faculty of Chemistry, University of Warsaw; the

* The author is grateful to Prof. Janusz Jurczak for his extensive help in collating and compiling materials.

Institute of Chemistry and Nuclear Technology, Faculty of New Technologies and Chemistry, Military University of Technology; the Faculty of Mathematics and Science, School of Sciences, Cardinal Stefan Wyszyński University; the Industrial Chemistry Research Institute; the Faculty of Materials Science and Engineering, Warsaw University of Technology; the Pharmaceutical Research Institute; the Faculty of Chemical and Process Engineering, Warsaw University of Technology; and the PAS Institute of Catalysis and Surface Chemistry in Kraków. The presentation of the organizers' scientific achievements was accompanied by a science picnic for children, teens, and young adults.

It is worth taking this opportunity to recall the history of both the Institutes, whose fates have been linked not just by their shared headquarters at Kasprzaka Street, but also by a long period of successful cooperation. They also share similar backgrounds: both were founded at the same time as the first chemistry institutions operating under the auspices of the Polish Academy of Sciences, they have since then both educated several generations of outstanding scientists, and they are both renowned as leading chemistry institutions in Poland.

When we examine the position of science practiced in Poland against global achievements, it is clear that chemistry and physics consistently score the highest ratings – with Poland falling somewhere in the middle of the top twenty countries in these fields (1).

It is rather surprising that in spite of the limited resources dedicated to scientific research in post-war Poland, this greatest international success has been achieved in two disciplines requiring the highest financial outlays. As I am not an expert on physics and its history, I shall focus on the subject that is close to my own heart – chemistry. It seems that the answer to the question of what reasons lay behind our achievements is, in case of chemistry, as obvious as it is trivial. This success is due to the efforts of outstanding scientists who fully devoted themselves to their work regardless of the historical upheavals faced by our country. They were also able to pass their passion onto their students by founding numerous scientific schools in Poland.

In order to fully understand the development of Polish chemistry, we must look back towards the turn of the twentieth century. When Poland was under partition, occupied by three neighboring powers, only the culturally autonomous Galicia had Polish higher education institutions: in Kraków (the

Jagiellonian University) and Lwów (the Franciscan University, renamed the Jan Kazimierz University in 1919). As a result, chemists were forced to look for work elsewhere, mainly in Russia, Switzerland and at German universities. However, this brought numerous benefits. At the time, German and Russian chemistry were clear leaders across Europe, and this gave Polish scientists an opportunity to work at the very best laboratories and with the very best scholars of the era. Once they became independent researchers themselves, they took care to draw other Poles into their laboratory staff. Many of them capitalized on their success, and their hard work earned them a place in the history of chemistry, giving their names to numerous chemical reactions (2). The names of August Freund, Bronisław Radziszewski, Julian Braun, Stefan Niementowski, Tadeusz Miłobędzki, Marcel Nencki, Bernard Napieralski, Kornel Radziewanowski and Stanisław Kostanecki are particularly notable here (3). For many of them the dream of returning to their home country and working at Polish universities came true after Poland regained independence in 1918.

Mentioning Maria Skłodowska-Curie at this point in our tale seems to be but a simple formality. Although she was based in France throughout her scientific career, she always stressed her Polish roots and frequently hosted Polish researchers in her laboratory.

During the interwar period, numerous scientific institutions opened throughout the country, led by professors working at what were by then Polish universities in Lwów, Kraków, Warsaw, and Wilno (Vilnius) (4). Chemists were also keen to get involved in the political life in the recovering country. Ignacy Mościcki, professor at the Lwów Polytechnic, inventor of an innovative method of nitric acid production and President of the Republic of Poland between 1926-1939, is perhaps the most notable in this regard. Other outstanding chemists involved in public life were Prof. Wojciech Świątosławski, Minister of Religion and Public Education between 1935-1939, and Eugeniusz Kwiatkowski, minister and deputy prime minister, author of the concept of maritime trade development, constructor of the Gdynia port and co-creator of the Central Industrial Region.

The Second World War brought enormous human and material losses to Polish chemistry. Many experts on chemistry died during the war as a result of persecution by the occupants and during the Warsaw Uprising, while much laboratory equip-



Prof. Wojciech Świętosławski

ment and many university buildings were destroyed. Teaching was also interrupted (5). As such, the reconstruction of chemistry faculties became a pressing issue after the war.

Although the foundation of the Polish Academy of Sciences in 1951 was a political decision, the subsequent formation of several institutes operating under its patronage turned out to be auspicious for Polish science. Numerous scientists were attracted by the didactic autonomy and the freedom to fully immerse themselves in scientific work and expand their areas of research. In 1954 the PAS Presidium founded the first chemistry institutions: the PAS Institute of Physical Chemistry and the PAS Organic Synthesis Department. They both played a deciding role in shaping 20th century chemistry in Poland.

In the early days, the research staff members of both Institutes continued working at universities throughout the country. The founders and first directors of the IPC were Profs. Wojciech Świętosławski (University of Warsaw), Stanisław Bretsznajder (Warsaw University of Technology), Bohdan Kamiński (Jagiellonian University), Michał Śmiałowski (Warsaw University of Technology), Włodzimierz Trzebiatowski (Wrocław University of Technology), Wiktor Kemula (University of Warsaw), Stefan Minc (University of Warsaw), Kazimierz Gumiński (Jagiellonian University), Włodzimierz Bobrownicki (Wrocław University

of Technology), and Andrzej Waksmundzki (Maria Skłodowska-Curie University in Lublin). The Institute also employed four associate professors, 12 lecturers and 39 junior scientific and technical staff. Its statute provided for seven research institutions: the Departments of Structural Research (W. Trzebiatowski), Analytical Methods (W. Kemula), Physical Chemistry of Basic Organic Raw Materials (W. Świętosławski), Physical Chemistry of Surface Phenomena (B. Kamiński and A. Waksmundzki), Physical Chemistry of Electrode Processes (M. Śmiałowski), Electrochemistry (S. Minc), and Physicochemical Fundamentals of Technology (S. Bretsznajder, W. Bobrownicki) (6). The selection of such outstanding scientists as research team leaders undoubtedly contributed to the Institute's success.

The number and names of the scientific teams changed through several reforms over the years, although the rule to appoint renowned scientists as their leaders remained. Outstanding contributors to the Institute's research achievements include Prof. Bogdan Baranowski (Department of Physical Chemistry of Solids), the inventor of high-pressure synthesis of new materials, in particular hydrides; Prof. Zbigniew R. Grabowski (Department of Photochemistry and Spectroscopy), an expert on the excited states of molecules; Prof. Wojciech Zielenkiewicz (Department of Calorimetry), a specialist in calorimetry research; and Prof. Janusz Lipkowski (Department of Physicochemistry of Supramolecular Complexes), co-creator (together with Prof. Janusz Jurczak, PAS Institute of Organic Chemistry) of the Polish school of supramolecular chemistry.

The first director of the IPC was Prof. Wojciech Świętosławski (1955-1960). Subsequent directors were Profs. Michał Śmiałowski (1960-1973), Wojciech Zielenkiewicz (1973-1990), Jan Popielawski (1990-1992), Janusz Lipkowski (1992-2003) and Aleksander Jabłoński (2003-2011). The position was recently taken over by Prof. Robert Hołyst.

Both Institutes are supported by expert Scientific Boards. They work to maintain the high standard of research carried out at the Institutes, as well as looking after the qualifications of staff appointed to scientific positions and researchers applying for academic titles. The Chairman of the Scientific Board also plays an important role in shaping science policy. At the IPC the position has always been filled with outstanding scientists: Wojciech Świętosławski, Włodzimierz Trzebiatowski, Adam

Bielański, Marian Kryszewski, Włodzimierz Kołos, Jerzy Haber, and Tadeusz Skośkiewicz.

To begin with, the individual laboratories were located at the university faculties that employed the directors of the Institute's departments. This created obvious problems in interactions between the academic and administrative staff based at the Staszcz Palace in Warsaw. As a result, a resolution was passed in the late 1950s to build a new headquarters for the Institute. Construction work started at Kasprzaka Street in Warsaw in 1959; the first research laboratories moved into the new buildings in 1962. The library holding the collections of both the Institutes opened three years later; today it is one of Poland's best scientific libraries.

During the 1960s, certain Departments were devolved from the IPC to create independent Institutes. This resulted in the Department of Structural Research in Wrocław becoming the PAS Department of Physicochemical Structural Research in 1963, to be renamed the PAS Institute of Low Temperatures and Structural Research the following year. It currently bears the name of Prof. Włodzimierz Trzebiatowski. In 1968, the Department of Physical Chemistry of Surface Phenomena gave rise to the Independent Department (now Institute) of Catalysis and Surface Chemistry in Kraków, now named after Prof. Jerzy Haber.

One of the IPC's key areas of focus is education of the next generation of researchers. So far the Institute has awarded over 330 PhD degrees in chemical sciences, plus 80 DSc (*habilitation*) degrees.

The PAS Department of Organic Synthesis was founded in 1954. Its first director was Prof. Osman Achmatowicz, who initiated Polish research into natural products. In 1957, the directorship was taken over by Prof. Tadeusz Urbański (7). The Department included 13 laboratories located in several large academic centers, with faculty directors acting as laboratory leaders. Three of the laboratories were at the Warsaw University of Technology (led by Profs. Stanisław Malinowski, Wanda Polaczkowa, and Tadeusz Urbański), with a further two each at the University of Warsaw (Profs. Osman Achmatowicz and Wiktor Lampe), Technical University of Łódź (Profs. Bolesław Bochwic and Eligia Turska) and Wrocław University of Technology (Profs. Edward Rabek and Zdzisław Tomasik). Individual laboratories were also established in Kraków (Prof. Jan Moszew, Jagiellonian University), Gdańsk (Prof.



The institutes' premises in a photo from the 1920s, with the buildings of the Warsaw Gasworks in the background

Zygmunt Ledóchowski, Gdańsk University of Technology), Poznań (Prof. Jerzy Suszko, Adam Mickiewicz University), and Gliwice (Prof. Włodzimierz Kisielow, Silesian University of Technology). The research scope of the PAS Department of Organic Synthesis was very broad, covering subjects such as catalysis, synthesis of heterocyclic compounds, alkaloid chemistry, structural research, as well as petrochemistry and polymers.

The Department's first significant international achievement was the International Symposium of Nitro Compounds, held under the auspices of IUPAC in 1963. Materials from the event were published in the journal *Tetrahedron*, confirming the conference's high profile.

The 1960s brought significant organizational changes. The first took place on 18 November 1964, when the PAS Department of Organic Synthesis was renamed the PAS Institute of Organic Chemistry. The new name captured the broad scope of research conducted at the institution. The Institute's



Prof. Osman Achmatowicz



Prof. Tadeusz Urbański

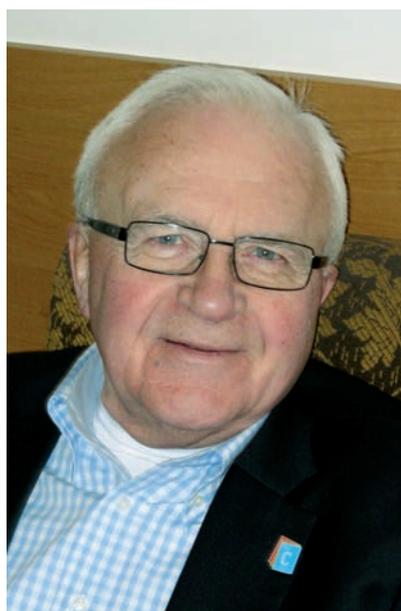


Caricature of the Scientific Board of the Institute of Organic Chemistry in 1967 drawn by Prof. Zdzisław Tomasiak

first director was Prof. Tadeusz Urbański, who held the position until 1967. He conducted wide-ranging research into the synthesis and properties of nitrogen bonds in heterocyclic and nitro compounds. He was succeeded by Prof. Marian Kocór (1967-1972), a proponent of isoprene chemistry, one of the key subjects at the IOC for many years. Prof. Paweł Nantka-Namirski (director between 1972-1979) worked on the synthesis of new drugs based on nitro derivatives of aromatic compounds. Prof. Mieczysław Mąkosza (1979-2004) was the Institute's longest-serving director and was succeeded by Prof. Marek Chmielewski who held the post until 2011. The post is currently served by Prof. Sławomir Jarosz, an expert on the synthesis of higher sugars, glycomimetics, and saccharose modification.

Once again, the Institute's Scientific Board plays an important role in its operation. The IOC has always strived to work with the best Polish scientists, with Profs. Jan Michalski, Tadeusz Urbański, Jerzy Wróbel, Marian Mikołajczyk, and Janusz Jurczak having served as chairman of the Scientific Board. The position is currently held by Prof. Mieczysław Mąkosza.

Reforms in 1964 introduced new structures to the Institute's Departments and Laboratories. Warsaw was home to the Departments of Organic Synthesis (Prof. Tadeusz Urbański), Physical Methods and Analysis (Prof. Janusz Dąbrowski), Chemistry of Natural Products (Prof. Osman Achmatowicz), Biologically Active Compounds (Prof. Marian Kocór), and Theoretical Foundations of Organic Technology (Prof. Stanisław Malinowski). Institu-



Prof. Janusz Jurczak



Prof. Mieczysław Mąkosza

tions in other locations included the Departments of Heteroorganic Compounds (Prof. Jan Michalski, Łódź) and Physical Chemistry of Polymers (Prof. Eligia Turska, Łódź), and the Laboratories of Alkaloids (Prof. Jerzy Suszko, Poznań), Petrochemistry I (Prof. Włodzimierz Kisielow, Gliwice) and Petrochemistry II (Prof. Zdzisław Tomasiak, Wrocław).

All the Warsaw-based laboratories were established in "temporary" facilities adapted for the purposes of organic chemistry research at Kasprzaka Street, hosted by the IPC. As is often the case, this

temporary setup has turned out to be permanent; the Institute is still headquartered at the pavilions dating back to the mid-1960s, now rather the worse for wear. Numerous attempts to move the Institute to a building meeting the standards of organic synthesis laboratories have so far been unsuccessful. Ongoing financial restrictions mean that ambitious plans to build new headquarters remain unrealized.

The departments located outside Warsaw became independent between 1966-1970, giving rise to new, excellent institutes in their own right. The Department of Heteroorganic Compounds was transformed into the PAS Centre for Molecular and Macromolecular Research in Łódź. The Centre also included the Department of Physical Chemistry of Polymers, which later became the Polymer Research Center (run jointly by the Ministry of Higher Education and PAS). The Laboratory of Petrochemistry I was the precursor of the PAS Department of Carbochemistry.

The Poznań Alkaloid Laboratory was first transformed into the Stereochemistry of Natural Products Laboratory, and later into a Department and finally PAS Institute of Bioorganic Chemistry. The Wrocław Department of Petrochemistry (Laboratory of Petrochemistry II) was incorporated into the PAS Institute of Low Temperatures and Structure Research; it was the last unit outside Warsaw to become independent, in 1986.

Since its inception, the PAS Institute of Organic Chemistry has been involved in the education of the next generation of researchers. Since 1966 the Institute has offered Poland's oldest doctorate program, founded on the initiative of Profs. Osman Achmatowicz Jr. and Aleksander Zamojski. The curriculum includes lectures and seminars alongside laboratory work. Previous directors of studies have included Profs. Osman Achmatowicz Jr., Michał Witanowski, Janusz Jurczak, Sławomir Jarosz, Witold Danikiewicz, with Jarosław Jaźwiński currently holding the post. During the 1980s, Prof. Mieczysław Mąkosza made the decision to build a housing facility on site (using only the Institute's own funds), allowing the Institute to hire in doctoral students from most academic centers in Poland and abroad. This significantly improved the exchange of ideas and helped researchers create an extensive networks of contacts. So far the IOC has promoted 330 PhDs and awarded 64 DSc (*habilitation*) degrees.

Throughout the Institute's history, its main research focus has been on organic synthesis. As well

as the previously mentioned scientists, the research team was supported by numerous renowned scholars. Osman Achmatowicz Jr. and Aleksander Zamojski developed a total method of synthesizing sugars from furyl alcohol. Prof. Zamojski also conducted pioneering work on the synthesis of sugars using the Diels-Alder reaction and the synthesis of bacterial sugars. He is the founder of the Polish school of sugar chemistry and one of the pioneers of teaching stereochemistry in Poland.

The application of very high pressures in organic synthesis has been a Polish specialty since the mid-1970s. The research was initiated by Prof. Janusz Jurczak, who specialized in studying the effects of pressure on the courses of stereochemical reactions. He is also the author of two methods of synthesizing macrocyclic receptors, known globally as the ICHOPAN 1 and ICHOPAN 2 methods. Prof. Marek Chmielewski expanded the chemistry of sugars by using them to obtain beta-lactam antibiotics. Prof. Jerzy Wicha was highly rated for his work on steroid synthesis.

Prof. Mieczysław Mąkosza's numerous achievements include the introduction of phase transfer catalysis reactions to organic synthesis, which has wide-reaching laboratory and industrial applications; he also discovered aromatic vicarious nucleophilic substitution.

Organic synthesis is impossible without effective analytical methods. The Institute can also boast significant international achievements in nuclear magnetic resonance spectroscopy, in particular using ^{14}N nitrogen. This research was initiated by Prof. Michał Witanowski, supported by Prof. Lech Stefaniak. The Mass Spectrometry Team led by Prof. Witold Danikiewicz has also achieved major successes in recent years.

The Institute collaborates extensively with industry. It works closely with the pharmaceutical company Tarchomińskie Zakłady Farmaceutyczne, resulting in the development of the antibiotic Tarcefoksym. The manufacturing technology of Debelizine, a popular herbal treatment for kidney stones, has also been developed at the IOC. Work is currently ongoing on the synthesis of new statins – compounds that reduce cholesterol levels – and cardiac drugs.

No discussion of the history of both Institutes is complete without including their "daughter" – the CHEMIPAN R&D Laboratories, established on 1 January 1972. CHEMIPAN has been involved in the production of scientific equipment (supported



Plans for new headquarters of the Institute of Organic Chemistry and Institute of Physical Chemistry

by the IPC) and in chemical synthesis (together with the IOC). The production of analytical standards for gas chromatography and other high-purity substances commenced in the 1970s. Until the early 1990s, CHEMIPAN was Poland's only producer of deuterated compounds. It also introduced several industrial processes to chemical plants (including Elana Toruń, Azoty in Jaworzno, and Zakłady Papiernicze in Świeć). The manufacturing technology of the popular glue Cyjanopan was also developed at CHEMIPAN. It works very closely with the pharmaceutical industry, focusing on the production of pheromones, widely used in the protection of forests against pests. CHEMIPAN has never received subsidies or credit; when required during planning and implementation of new production, it seeks specialist assistance and equipment from its parent institutes.

Both Institutes fit perfectly into Poland's new political and economic realities. They are effective at obtaining funds and the latest equipment, and the high quality of research generated there is frequently published in top academic journals. Both Institutes consistently rank very high in the Ministry of Science and Higher Education's ratings of research institutions. They are also involved in educating

the next generations of researchers and discovering new talent by awarding PhDs and engaging in the work of universities (not just in Warsaw), offering students the option to complete their undergraduate dissertations. However, the issue of building a new headquarters for the Institutes remains unresolved. In spite of extensive renovation, the old laboratory buildings are increasingly struggling to meet the demands of researchers and do not have sufficient space to accommodate the state-of-the-art equipment and growing number of employees. It is to be hoped that, despite various financial issues, the plans for new headquarters will be implemented in the near future.

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The “Polish Nobel Prizes” for 2010

This year’s prizes of the Foundation for Polish Science (FNP) were won by Prof. Anna Wierzbicka, Prof. Tomasz J. Guzik, Prof. Tadeusz M. Krygowski. Informally known as the “Polish Nobel Prizes,” 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.



J. Lerner

Anna Wierzbicka is Professor of Linguistics at the Australian National University. Her 1972 book *Semantic Primitives* launched a new meaning-oriented approach to linguistics, radically different from the then-dominant Chomskyan framework. This approach has borne fruit in empirical findings about conceptual and linguistic universals (cf. Goddard & Wierzbicka, eds., *Semantic and Lexical Universals*, 1994, and *Meaning and Universal Grammar*, 2002, both Amsterdam: John Benja-

mins). The search for such universals has led to the creation of the Natural Semantic Metalanguage (NSM) and to the identification of 64 universal human concepts corresponding to the “alphabet of human thoughts” once envisaged by Leibniz. As numerous publications by Anna Wierzbicka and colleagues show, this set can serve as a common measure for comparing meanings and ideas across languages, cultures and epochs.

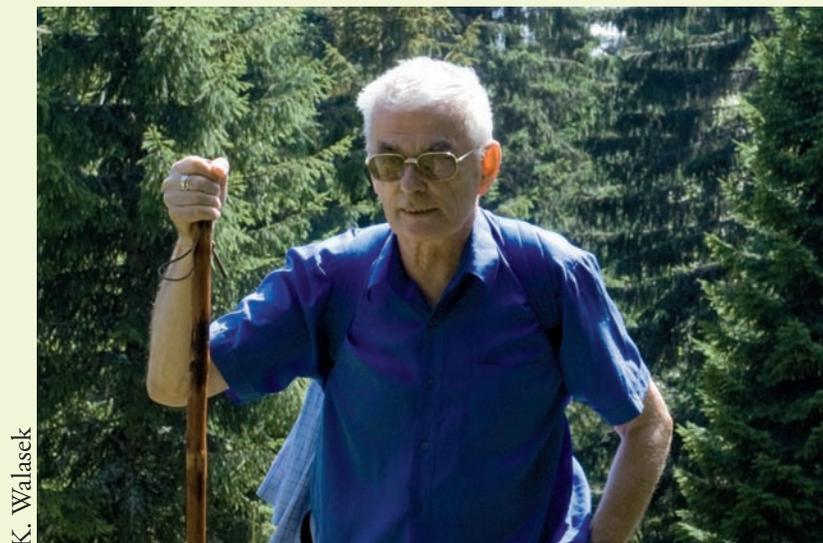
In 2010 this work earned Wierzbicka not only the Polish Science Foundation’s Prize for the Humanities and Social Sciences but also with the Russian Academy of Science’s Dobrushin Prize, usually awarded only to mathematicians. Throughout her career, Wierzbicka has been building bridges between linguistics and other disciplines including anthropology, psychology, philosophy, and cognitive science, and her work has appeared in the top-ranking journals of all these disciplines. The NSM theory addresses fundamental questions concerning language, culture and cognition, and contributes productively to applied fields such as lexicography, language teaching, moral education, and cross-cultural communication.

Wierzbicka’s latest books are (in English) *Experience, Evidence and Sense: The hidden cultural legacy of English* (OUP, 2010), (in Polish) *Semantyka: Jednostki Elementarne i Uniwersalne* (Lublin, UMCS Press, 2010) and (in Russian) *Semantičeskie universalii i bazisnye koncepty* (Moskva: Jazyki Slavjanskix Kul’tur, 2011).



Prof. Tomasz J. Guzik is a physician-scientist who has described the critical importance of the immune system in the pathogenesis of hypertension and accompanying vascular dysfunction. Prof. Guzik currently heads the Department of Internal and Agricultural Medicine at the Jagiellonian University School of Medicine in Kraków. Prof. Guzik trained clinically and earned a specialization in internal medicine and allergic diseases. His scientific interests are, however, focused on vascular biology, hypertension, and clinical immunology. He graduated from the Jagiellonian University School of Medicine in 1998 and continued his post-graduate studies at the University of Oxford, from which he received the degree of Master of Science in Molecular Medicine. It was at Oxford that his great interest in vascular medicine was born, while working with an outstanding scientist, the current director of the Cardiovascular Research Center at Oxford University, Prof. Keith Channon. In 2007, in collaboration with Prof. D. Harrison from Emory University, Prof. Guzik published a seminal paper in *Journal of Experimental Medicine* that demonstrated that severe hypertension and vascular dysfunction do not develop in the absence

of T lymphocytes. Using advanced molecular biology techniques, he described the major mechanisms of T cell involvement in this process. These findings have been replicated by several groups and created a significant new area of research in the field of hypertension. This observation may also lead to the identification of novel drug targets in the treatment of hypertension, a disease that affects 30% of populations in developed countries, with a further 30% being pre-hypertensive. In spite of a vast amount of research in the field the major mechanisms remain unclear and Prof. Guzik's research may advance that knowledge. Prof. T. Guzik's second major scientific interest is the translational medicine approach to understanding the role vascular oxidative stress in the pathobiology of human vasculature. He was first to identify mechanisms of vascular superoxide anion production in human vessels and demonstrated the clinical importance of this phenomenon in 2000. Prof. Guzik published several papers in this field, which have been cited over 3000 times. Several of his papers have been cited more than 200 times and his Hirsh index is currently 27.



K. Walasek

Prof. Tadeusz Marek Krygowski (emeritus from the Department of Chemistry, Warsaw University) has worked mostly in the field of physical and theoretical organic chemistry, concentrating on the structural chemistry of π -electron compounds. Most organic compounds contain cyclic or acyclic π -electron fragments, which determine to a great degree their chemical, physical, physicochemical, and biochemical properties. The HOMA (Harmonic Oscillator Model of Aromaticity) aromaticity index introduced by Prof. Krygowski together with Dr. Jerzy Kruszewski [*Tétr. Lett.* 1972, 3938] allows the degree of π -electron delocalization to be estimated quantitatively, directly from the molecular geometry. Contrary to other aromaticity indicators, HOMA applies both to whole molecules or to any of their π -electron fragments. HOMA has been successfully applied to: fullerenes, DNA-bases, derivatives of porphyrins, the study of π -electron delocalization of strained molecules, and other areas of structural chemistry. Most of the applications of HOMA have been presented in articles

in *Chem. Revs* 2001, 101, 1385; 2005, 105, 3482 and 2005, 105, 3513. Another recent important achievement [*PCCP*, 2011, 13, 3737], the result of cooperation with A. Ciesielski, M.K. Cyrański, M.A. Dobrowolski and A. Balaban, and concerns the derivation of fundamental rules in the field of aromaticity: the Hückel $4N+2$ rule, and the Clar classification of benzenoid hydrocarbons. This was achieved directly from the connectivity matrix by a combination of the graph-topological approach and a perturbational method. Prof. Krygowski has authored more than 300 scientific publications which have received ~6500 citations, 15 of them having been cited more than 100 times.

Prof. Krygowski has served as a visiting professor at universities in Guelph (Canada), Nantes (France), Linz/D (Austria), BeerSheba (Israel) and Busan (S.Korea). He was president of the Polish Chemical Society and chairman of the Subcommittee on Structural and Mechanistic Organic Chemistry of IUPAC.

Polish Academy of Sciences in 2010

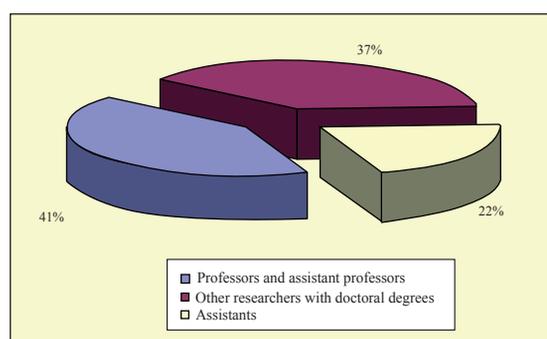
Sources of financing for the Academy and its scientific institutions

The primary source of funding for the Polish Academy of Sciences and its institutions in 2010 came from the state budget. This funding, PLN 54.7 mln, was allocated for the Academy's corporate activity as well as for maintaining centers constituting the infrastructure of the scientific community. Funds for the Academy's scientific institutions were allocated to their statutory activities and research projects completed through the end of 2010.

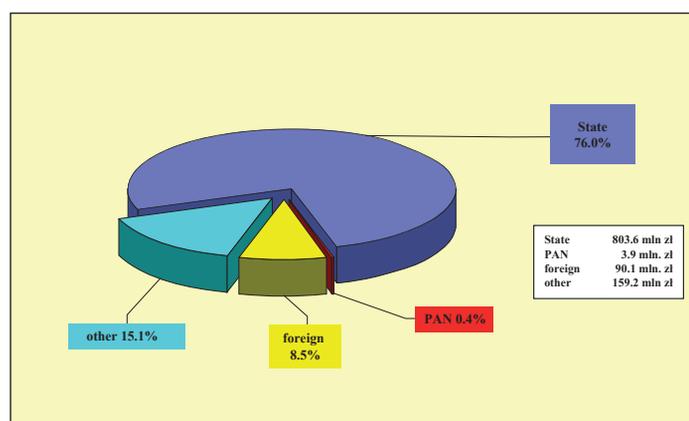
Staff

In 2010 the Polish Academy of Sciences employed a staff of ca. 9,200 individuals, almost 8,400 (92%) of them in institutes and scientific units without legal personality. The institutes and scientific units without legal personality employed 3,900 researchers, that is 1,600 professors, 1,400 researchers with doctoral degrees, and 900 assistants. The remaining staff, i.e. 800 individuals (8%), were employed in its supporting institutions – independent libraries, Archives, the Museum of the Earth, experimental stations, etc.

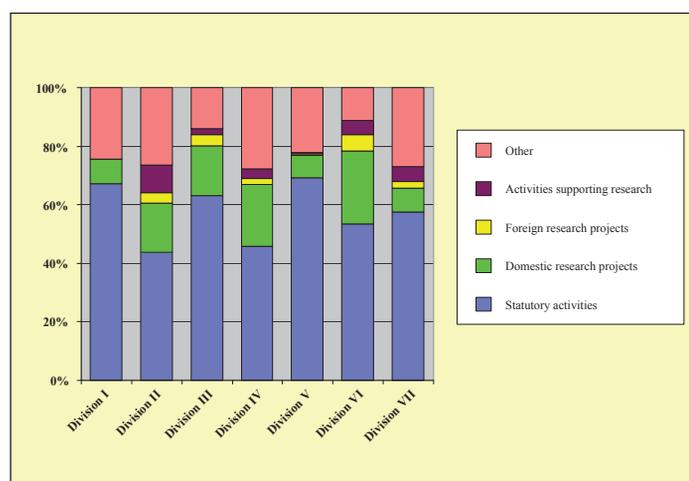
Research staff in Academy's institutes and scientific units without legal personality in 2010



Sources of financing for the Academy's institutions in 2010



Breakdown of funding by type of activity pursued by the Academy's institutions in 2010



Activities of the PAS committees in 2010

Conferences	428
Conference participants	50 837
Lectures, conference reports, articles	15 931
Expert reports and opinions	60
Journal titles	230

Scientific degrees and titles granted in the units of PAS in 2010 (by PAS division)

	Scientific degrees and titles		
	Doctorate degrees	DSc (<i>habilitation</i>) degrees	Professorship nominations
Division I	18	12	7
Division II	38	17	4
Division III	35	18	11
Division IV	12	9	4
Division V	11	7	1
Division VI	16	12	2
Division VII	15	10	4
Total	145	85	33

Didactic activity of PAS scholars in institutions of higher education in 2010 (by PAS division)

	The number of people teaching in universities
Division I	492
Division II	129
Division III	317
Division IV	162
Division V	60
Division VI	80
Division VII	85
Total	1 325

Foreign Scientific Centers

■ CENTER FOR HISTORICAL RESEARCH OF THE POLISH ACADEMY OF SCIENCES 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.panberlin.de
Director: Robert Traba

■ SCIENTIFIC CENTER OF THE POLISH ACADEMY OF SCIENCES 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: Zygmunt Nikodem

■ SCIENTIFIC CENTER OF THE POLISH ACADEMY OF SCIENCES IN PARIS

CENTRE SCIENTIFIQUE DE L'ACADÉMIE
POLONAISE DES SCIENCES A 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: Jerzy Pielaszek

■ SCIENTIFIC CENTER OF THE POLISH ACADEMY OF SCIENCES 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 OF THE POLISH ACADEMY OF SCIENCES 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@ycn.com
internet: www.viennapan.org
Director: Bogusław Dybaś

■ PolSCA – POLISH SCIENCE CONTACT AGENCY

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

Scientific Institutes and Branches of the Polish Academy of Sciences



Scientific Units

Division I Social Sciences

- **Institute of Archeology 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)¹
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 History of Science** (Warszawa)²
e-mail: ihn@ihnpan.waw.pl
www.ihnpan.waw.pl
- **Institute of the Polish Language** (Kraków)
e-mail: ijp@ijp-pan.krakow.pl
www.ijp-pan.krakow.pl
- **Tadeusz Manteuffel Institute of History** (Warszawa)
e-mail: ihpan@ihpan.edu.pl
www.ihpan.edu.pl

¹ The Research Center for Mediterranean Archaeology and the Center for Studies on Non-European Countries of the Polish Academy of Sciences were dissolved on August 31, 2010. The two centers formed the basis for establishing the new Institute of Mediterranean and Oriental Cultures, which began operations on September 1, 2010.

² On May 17, 2011 the Institute of the History of Science changed its name into Ludwik and Aleksander Birkenmajer Institute of the History of Science.

Division II Biological Sciences

- **Center for Ecological Research**
(Dziekanów Leśny)
e-mail: cbe@cbe-pan.pl
www.cbe-pan.pl
- **Department of Antarctic Biology** (Warszawa)
e-mail: zba@arctowski.pl
www.arctowski.pl
- **Institute of Anthropology** (Wrocław)
e-mail: zapan@antro.pan.wroc.pl
www.anthro.pan.wroc.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 Ichthyobiology and Aquaculture**
(Gołysz)
e-mail: zigr@bb.onet.pl
www.fish.edu.pl
- **Institute of Nature Conservation** (Kraków)
e-mail: okarma@iop.krakow.pl
www.iop.krakow.pl
- **Institute of Systematics and Evolution of Animals** (Kraków)
e-mail: office@isez.pan.krakow.pl
www.isez.pan.krakow.pl
- **European Regional Centre for Ecohydrology** (Łódź)
e-mail: erce@erce.unesco.lodz.pl
www.erce.unesco.lodz.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

Division III Mathematical, Physical, and Chemical 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: sekretariat@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 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 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
- **Jerzy Haber Institute of Catalysis and Surface Chemistry** (Kraków)¹
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

Division IV Technical 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 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

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

- **Maciej Nałęcz Institute of Biocybernetics and Biomedical Engineering** (Warszawa)
e-mail: ibib@ibib.waw.pl
www.ibib.waw.pl
- **Robert Szewalski Institute of Fluid-Flow Machinery** (Gdańsk)
e-mail: imp@imp.gda.pl
www.imp.gda.pl
- **Systems Research Institute** (Warszawa)
e-mail: ibs@ibspan.waw.pl
www.ibspan.waw.pl

Division V Agricultural, Forestry, and Veterinary Sciences

- **Bohdan Dobrzański Institute of Agrophysics** (Lublin)
e-mail: agrof@demeter.ipan.lublin.pl
www.ipan.lublin.pl
- **Botanical Garden – Center for Biological Diversity Conservation** (Warszawa)
e-mail: ob.sekr@obpan.pl
www.ogrod-powsin.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 Genetics and Animal Breeding** (Jastrzębiec)
e-mail: panighz@atos.warman.com.pl
www.ighz.edu.pl
- **Institute of Plant Genetics** (Poznań)
e-mail: office@igr.poznan.pl
www.igr.poznan.pl
- **Jan Kielanowski Institute of Animal Physiology and Nutrition** (Jabłonna)
e-mail: office@ifzz.pan.pl
www.ifzz.pl
- **Research Station for Ecological Agriculture and Preservation of Native Breeds** (Popielno)
e-mail: popielno@pan.pl
www.turysta.net.pl/atrakcje/pan

Division VI 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

Division VII Earth and Mining Sciences

- **Institute of Environmental Engineering** (Zabrze)
e-mail: ipis@ipis.zabrze.pl
www.ipis.zabrze.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 Oceanology** (Sopot)
e-mail: office@iopan.gda.pl
www.iopan.gda.pl
- **Mineral and Energy Economy Research Institute** (Kraków)
e-mail: centrum@min-pan.krakow.pl
www.min-pan.krakow.pl
- **Museum of the Earth** (Warszawa)
e-mail: muzeumziemi@mz-pan.pl,
sekretariat@mz-pan.pl
www.mz-pan.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

Branches

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

Shared scientific 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 Laboratory of High Magnetic Fields and Low Temperatures** (Wrocław)
e-mail: intlab@alpha.ml.pan.wroc.pl
<http://alpha.mlspmint.pan.wroc.pl>
- **International Institute of Molecular and Cell Biology** (Warszawa)¹
e-mail: secretariat@iimcb.gov.pl
www.iimcb.gov.pl

¹ The Institute was established pursuant to the act passed by the Parliament on June 26, 1997. It has been functioned as an independent scientific unit since January 1999. According to the decision of PAN President, the Institute is supervised by the chairman of Division II Biological Sciences.

Scientific and Task Force Committees

Task Force Committees

Committees affiliated with the Presidium of the Academy

- **The Committee on Biotechnology**
ul. Stefanowskiego 4/10, 90-924 Łódź,
Instytut Biochemii Technicznej,
Politechnika Łódzka
e-mail: STANB@p.lodz.pl
- **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 Ergonomics**
ul. Grzegorzeczka 20, 31-531 Kraków,
Collegium Medicum, Uniwersytet Jagielloński
e-mail: mmpokors@cyf-kr.edu.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 Polar Research**
ul. Księcia Janusza 64, 01-452 Warszawa,
Instytut Geofizyki PAN
e-mail: kbp@igf.edu.pl
- **The Research Committee on Human Migrations and on Polish Diaspora**
ul. Banacha 2B, 02-097 Warszawa,
Szkoła Wyższa Psychologii Społecznej
e-mail:
- **The Committee for Research on Threats**
ul. Chodakowska 19/31, 03-815 Warszawa,
Wydział Psychologii,
Szkoła Wyższa Psychologii Społecznej
e-mail: kbz@swps.edu.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 Committee on Spatial Economy and Regional Planning**
Pałac Kultury i Nauki, 00-901 Warszawa,
e-mail: kpsz@pan.pl
- **The Committee on Water Management**
ul. Podleśna 61, 01-673 Warszawa,
Instytut Meteorologii i Gospodarki Wodnej
e-mail: maciej.maciejewski@imgw.pl
- **The “Poland 2000 Plus” Forecast Committee**
Pałac Kultury i Nauki, 00-901 Warszawa,
e-mail: komprog@pan.pl
- **The Council for Scientific Societies**
Pałac Kultury i Nauki, 00-901 Warszawa,
e-mail: rtn@pan.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

Committee affiliated with Division IV

- **The Committee on Production Engineering**
ul. Ozimska 75, 45-370 Opole,
Politechnika Opolska
e-mail: r.knosala@po.opole.pl

Scientific Committees at the Divisions of the Academy

Division I Social Sciences

- **The Committee on Art Studies**
ul. Długa 26/28, 00-950 Warszawa,
Instytut Sztuki PAN
e-mail: knos@onet.eu
- **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 Demographic Studies**
al. Niepodległości 162, 02-554 Warszawa,
Instytut Statystyki i Demografii,
Szkoła Główna Handlowa
e-mail: ewaf@sgh.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 Ethnological Sciences**
ul. Św. Marcina 78, 61-809 Poznań,
Uniwersytet im. A. Mickiewicza
e-mail: vorbrich@amu.edu.pl
- **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 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 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 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**
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- **The Committee on Pedagogical Sciences**
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- **The Committee on Political Sciences**
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- **The Scientific Committee on Ancient Culture**
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- **The Committee of Biochemistry and Biophysics**
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- **The Committee on Botany**
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- **The Committee on Cell Biology**
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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 Microbiology**
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■ **The Committee on Neurobiology**

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■ **The Committee on Parasitology**

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■ **The Committee on Crystallography**

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■ **The Committee on Mathematics**

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■ **The Committee on Physics**

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Division IV Technical 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
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■ **The Committee on Biocybernetics
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■ **The Committee on Civil Engineering
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- **The Committee on Electrical Engineering**
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- **The Committee on Electronics and Telecommunication**
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- **The Committee of Informatics**
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- **The Committee on Machine Building**
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- **The Committee on Metallurgy**
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- **The Committee on Metrology and Research Equipment**
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- **The Committee on Agrophysics**
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- **The Committee on Animal Sciences**
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- **The Committee on Biology of Domestic Animal Reproduction**
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Division VI Medical Sciences

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- **The Committee on Human Development**
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- **The Committee on Human Genetics and Molecular Pathology**
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- **The Committee on Human Nutrition Science**
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- **The Committee on Immunology and Etiology of Human Infections**
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■ **The Committee on Rehabilitation,
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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 Management
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■ **The Committee on Maritime Research**
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■ **The Committee on Mineralogical Sciences**
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■ **The Committee on Mining**
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■ **The Committee on Quaternary Research**
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