

PROFESSOR JAN POTEPA RECEIVES FOUNDATION FOR POLISH SCIENCE PRIZE

Prof. Jan Potempa, head of the FBBB's Department of Microbiology, is one of four scientists awarded this year's Foundation for Polish Science (FNP) Prize. This year marks the 20th edition of the prize. The prestigious award, sometimes called the "Polish Nobel", is bestowed on "distinguished scientists for extraordinary achievements and scientific discovery that expands the boundaries of human knowledge and opens new perspectives for research, contributes significantly to the progress of civilization and culture in Poland and ensures that Poland plays an important role in the modern world's most ambitious undertakings." The prize is awarded in four categories: life and earth science; chemistry and materials science; mathematics, physics and engineering; and the humanities and social science.

The Foundation's Board chose Prof. Potempa for his characterization of a new family of bacterial proteases and for demonstrating



Prof. Potempa receives the statuette from the president of the Foundation, prof. Maciej Żylicz



Prof. Potempa's speech during the FNP Prize Award Ceremony

cont. p. 2 ▶

FACULTY CHRISTMAS GATHERING



phot. by Marcin Zawrotniak

The annual Faculty of Biochemistry, Biophysics and Biotechnology (FBBB) Christmas party was held for the third time, this year on December 20th. The get-together began with the Faculty choir singing a selection of Poland's most be-



phot. by Marcin Zawrotniak

autiful Christmas carols as well as the English "We wish you a Merry Christmas" and the African carol "Amezaliwa". This was met with great interest and lively applause. During an inter-

cont. p. 2 ▶

CONTENT

"Polish Nobel" for Prof. Potempa

Faculty Christmas gathering

New department of Molecular Biophysics

Grants

Conferences

Professorships

Honors, awards and fellowships

PhD theses

Implementation of the MBH project

Implementation of the MCH project

Mygen

Nobel

Guest lectures

It's past belief!

Publication list

► PROFESSOR JAN POTEPA RECEIVES FOUNDATION FOR POLISH SCIENCE PRIZE cont. from p. 1

their role in the development of periodontal disease. Prof. Potempa began his research on this new class of proteases, called gingipains, in the late 1990's. This area of study has proven immensely fruitful and has resulted in several dozen scientific publications.

The Foundation's report notes that, "Professor Potempa's discoveries have changed how we think about the genesis of periodontal disease. Their therapeutic potential is also highly rated. His results may lead to the development of more effective drugs to combat periodontal disease and consequently to reduced

risk for developing heart disease and rheumatoid arthritis."

The awards ceremony took place on December 7th, 2011 in the Royal Castle in Warsaw. Prize statuettes and diplomas were conferred by the FNP's Chairman of the Board, Prof. Andrzej Członkowski and by the FNP's President Prof. Maciej Żylicz. The Speaker of the Polish Senate, Mr. Bogdan Borusewicz, and the Minister of Science and Higher Education, Ms. Barbara Kudrycka, who wished to personally congratulate the awardees on such an important distinction, also participated in the ceremony.

► FACULTY CHRISTMAS GATHERING cont. from p. 1



phot. by Dominika Giza

lude in the singing, the Dean of the Faculty, Prof. Wojciech Froncisz, extended a greeting along with holiday wishes to all the participants. He also remarked on the importance of friendships in one's life, particularly workplace friendships, and stressed how the extraordinary atmosphere of this holiday gathering was a reflection of the spirit of friendship that reigns daily among the members of the Faculty. Thereafter an energetic round of applause resounded when Dr. Tomasz Panz congratulated Prof. Jan Potempa on winning this year's Foundation

for Polish Science Prize. Dr. Panz wished Prof. Potempa continued success and also presented him with a green gift – an anturium plant.

During the remainder of the party the participants shared in the breaking of the traditional Christmas wafer and exchanged Christmas greetings with each other in a truly cordial atmosphere of friendship. They also enjoyed the many delicacies, including the traditional borscht (beet root soup) and bigos (a type of cabbage stew), found in room D107 which was beautifully decorated under the

watchful eye of the event's organizer, Dr. Magdalena Tworzydło. While everyone, professors, researcher workers and students, tasted the fine foods, a special commission consisting of Prof. Marta Dziejdzicka-Wasylewska, Dr. Justyna Drukała and Prof. Zbigniew Madeja presented the "Holiday Costume" awards. First place was awarded to the Department of Traditional Biotechnology and the Circle of Peasant Matrons Gronostajowa 7 who persistently travel in search of the Christmas manger. Second place was taken by the unusual but cute couple of the angel holding the Faculty's bible and the devil with a pledge, and third place went to the red and white three-person St. Nicholas group. Next came a special viewing of a movie about the dream of an overly tired student working in one of the Faculty's laboratories. This movie was directed by Kasia Kmiotek and was made possible through the joint efforts of the Nobel and Mygen students' organizations which also contributed significantly in the organization of the entire gathering.

Our heartfelt gratitude goes out to all who, through their manifold participation in this event, once again contributed to making the Christmas party a cordial and memorable event.



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phot. by Dominika Giza



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NEW DEPARTMENT

The Faculty of Biochemistry, Biophysics and Biotechnology has a new organizational unit: the Department of Molecular Biophysics. The new department was created from the Laboratory of Spectroscopic Methods of Studying Biomolecules' Structure and Function through a decree of the Jagiellonian University's Rector on October 1st, 2011. It is headed by Prof. Wojciech Froncisz and is comprised of three research groups: molecular bioenergetics, EPR spectroscopy and systems biology. Nine full-time faculty members and eight graduate students work in the department.

Results of the NCN contests

On October 7th, 2011, the National Science Center's coordinators for the various fields of research made public the ranking of projects that have been accepted for funding within the scope of the March 15th, 2011 contest. This time a total of 9,096,665 PLN in grants was awarded to 16 Faculty of Biochemistry, Biophysics and Biotechnology scientists. Below is a list of the recipients of the grants with the titles of their projects. "General" category:

- Dr. Joanna Cichy – "The role of ADAM17 surface metalloproteinase in the regulation of the humoral response."
- Dr. Jarosław Czyż – "An analysis of interaction between prostate cancer, immune system cells and the endothelium in the region of the metastatic niche."
- Prof. Jerzy Dobrucki – "Correlation between H1 linker histone dynamics and the spatial architecture of chromatin in cellular nuclei."
- Prof. Halina Gabryś – "Light signal transfer from phototropins in higher plants."
- Dr. Witold Korytowski – "StAR protein-dependent prosclerotic transport of cholesterol hydroperoxides in macrophages."
- Prof. Jerzy Kruk – "The function of prenyl lipids in plant growth and stress response."
- Dr. Paweł Mak – "The role of *Candida* spp. aspartyl peptidases in the generation of hemocidines."
- Dr. Krzysztof Murzyn – "The structural and dynamic properties of a model gram-negative bacterial outer membrane."
- Dr. Beata Myśliwa-Kurdziel – "The molecular mechanisms of protochlorophyllide-LPOR-lipid reactions in prolamellar bodies and in model systems."
- Dr. Agnieszka Polit – "The reactions of dopamine receptors with G proteins – struc-

tural and kinetic aspects."

- Prof. Jan Potempa – "Peptidylarginine deiminase as a new *Porphyromonas gingivalis* virulence factor."
- Dr. Joanna Skrzeczyńska-Moncznik – "The role of granzyme B in the pathogenesis of psoriasis."

"Post-doctoral" category:

- Dr. Grzegorz Dubin – "Structural studies of proteinases with an unknown catalytic mechanism. Establishment of a unique joint Jagiellonian University and the Małopolska Biotechnology Center structural research team."
- Dr. Agnieszka Jaźwa – "Preventive multi-approach hypoxia-regulated gene therapy and induced pluripotent stem cell (iPS) therapy for the protection of ischemic tissue: an innovative approach to regenerative biomedicine."
- Dr. Krzysztof Pyrc – "*Porphyromonas gingivalis*: natural and regulatory defense mechanisms."

"International not co-financed" category:

- Prof. Kazimierz Strzałka – "Artificial membranes as a model system for studying the molecular mechanisms of diatom adaptation to changing temperatures."

The "Iuventus Plus" Program

On December 12th, 2011 the Ministry of Science and Higher Education announced the results of the "Iuventus Plus" contest. Among the recipients are 10 young doctors from the Faculty of Biochemistry, Biotechnology and Biophysics. Altogether almost 3 million PLN will be allocated for their research.

Below is a list of the recipients:

- Grzegorz Dubin – "Characterization of the molecular mechanism of precise substrate

cont. p. 4 ▶

GRANTS

- **GRANTS cont. from p. 3**
- recognition by staphylococcal epidermolytic toxins."
 - Tomasz Kantyka – "The pathophysiological role of human kallikrein 13 and its inhibitors in the context of interactions with the extracellular proteases of periodontal bacteria."
 - Mateusz Kwietniewski – "DNA Hypomethylation: a novel approach to the production of autologous anticancer transplants through the photodynamic effect."
 - Agnieszka Łoboda – "MicroRNA as a factor in the prevention of renal fibrosis: influence of heme oxygenase-1."
 - Sylwia Łukasiewicz – "Studies of nanoparticle/target cell interactions: optimization of nanotransporter function for target drug delivery."
 - Michał Markiewicz – "Molecular dynamics simulation studies of xanthone and phospholipid membrane reactions."
 - Krzysztof Pyrc – "Human NL63 and HKU1 coronavirus infection mechanisms."

- Wojciech Strzałka – "An analysis of reaction networks between the PCNA plant protein and select proteins involved in plant cell cycle regulation."
- Renata Szymańska – "The role of prenyl lipids in *Arabidopsis thaliana* hybrid discrepancies (differing ecotypes)."
- Halina Waś – "The role of heme oxygenase-1 (HO-1) overexpression in melanoma vascular mimicry."

The "Iuventus Plus" program is geared towards young scientists. Applicants must be under 35 years old. The proposed studies must represent a continuation of previous research that was published or has been accepted for publication in leading international scientific journals.

This year the program received 652 applications of which the largest group, a third of all applications, were in the natural sciences. Over 300 projects received funding from the Ministry.

CONFERENCES



XXXIX Faculty of Biochemistry, Biophysics, and Biotechnology Winter School

The FBBB's XXXIX Winter School will be held in Zakopane on February 4th–8th, 2012. The main

theme of this year's school will be modern trends in biochemistry, biophysics and cell biology. The school is dedicated to the memory of Prof. Stanisław Więckowski. This year's meeting is being organized by Prof. Jerzy Kruk from the Department of Plant Physiology and Biochemistry. Among those invited to attend are many international guests as well as scientists from various institutions in Poland. Participation in the Winter School is an excellent opportunity to familiarize oneself with the research being conducted at the FBBB, to network with colleagues from other institutions and to enjoy the beauty of Poland's winter capital. Further information may be found at the conference website: <http://wbbib.pl/zakopane2012>.

PROFESSORSHIPS

On November 21st, 2011 Dr. Jerzy Kruk received the nomination and title of professor from the President of Poland.

Jerzy Kruk graduated with a degree in biology from the Jagiellonian University's Faculty of Biology and Earth Sciences. He first began work at the Department of Plant Physiology and Biochemistry as an assistant and has continued there since 1987. There, under the supervision of his mentor, Prof. Stanisław



Jerzy Kruk receives the nomination and title of professor from the President of Poland

Więckowski, he carried out research which led to a doctoral degree in 1992. In 1993 he was

awarded a FEBS fellowship through which he carried out research in the Laboratory of Molecular Biophysics at the University of Utrecht. In 2001 Prof. Kruk obtained his habilitation. His thesis, entitled "Interaction of prenyl lipids with photosystem II", was selected for an award by Poland's Prime Minister.

Prof. Kruk's research mainly focuses on the various aspects of prenyl lipids: their role in plant stress response, biosynthesis, participation in signal transfer in plants, role in the neutralization of active forms of oxygen (such as singlet oxygen and the superoxide anion radical) and inhibition of lipid peroxidation.

In the course of his career, Prof. Jerzy Kruk has received the Jagiellonian University Rector's awards for scientific achievement on numerous occasions.

On October 5th, 2011 **Claudine Kieda** received her professorial nomination. Professor Kieda is employed at the National Center for Scientific Research (CNRS, Centre National de la Recherche Scientifique) in Orléans and also has ties with that city's university.

Prof. Claudine Kieda began her scientific career in the 1970's in the Weizmann Institute in Israel. She obtained her PhD in 1979 and her habilitation a year later. From 1981–1983 she worked as a postdoc in the National Institutes of Health in Bethesda, Maryland, USA. Her current research focuses on the mechanisms of angiogenesis.

Professor Kieda's collaboration with our Faculty goes back to 1994 (at that time with the Institute of Molecular Biology). She initiated the student exchange program with the University of Orléans and is also co-organizer of the Polish-French School. In 2006, Prof. Kieda received the Merentibus medal in recognition of great services rendered to the Jagiellonian University, and in 2009 she received the Polish Academy of Science's Mikołaj Kopernik medal. Prof. Claudine Kieda is also a knight of the Order of Polonia Restituta.



Claudine Kieda during the ceremony of professorial nomination

HONORS, AWARDS AND FELLOWSHIPS

Gold Cross of Merit for Dr. Joanna Cichy



President of Poland awarding Joanna Cichy the Gold Cross of Merit

Dr. Joanna Cichy from the FBBB's Department of Immunology was awarded the Gold Cross of Merit by Poland's President Bronisław Komorowski for her scientific and teaching activity. The prestigious public awards were conferred on distinguished women in Polish science during a December 14th ceremony dedicated to the memory of Maria Skłodowska-Curie and held to celebrate the closing of the year dedicated to the Polish Nobel prize winner.

Prof. Z. Wasylewski Foundation Award for Prof. Andrzej Kozik

The Board of the Prof. Z. Wasylewski Foundation for JU's Faculty of Biochemistry, Biophysics and Biotechnology voted to distinguish Prof. Andrzej Kozik, head of the Department of Analytical Biochemistry, with a monetary award for his tireless dedication and effort leading to the creation of the bachelor's and master's degree program in biochemistry at the FBBB. The award was conferred on October 18th, 2011 during a meeting of the Faculty's Board.

Jagiellonian University Rector's Awards

As is customary, in October the Rector of the Jagiellonian University bestowed awards upon distinguished employees of the university.

Honored lecturers from the FBBB include: Prof. Andrzej Klein (2nd degree individual award for achievement in teaching); Dr. Krzysztof Pyrc (2nd degree individual award for achievement in teaching and organizational activity); Dr. Joanna Cichy and Dr. Maria Rapała Kozik (3rd degree individual awards for scientific re-

cont. p. 6 ▶

► HONORS, AWARDS AND FELLOWSHIPS cont. from p. 5

search); Prof. Jerzy Kruk and Dr. Leszek Fiedor (1st degree team award for scientific research); Prof. Jan Potempa, Dr. Jacek Międzobrodzki, Dr. Grzegorz Dubin, Dr. Joanna Kozieł and Dr. Kinga Wójcik (1st degree team award for scientific research); Dr. Sylwia Kędracka-Krok and Dr. Ewelina Fic (2nd degree team award for scientific research); Prof. Józef Dulak, Prof. Alicja Józkowicz, Anna Grochot-Przęczek, Dr. Agnieszka Jaźwa, Dr. Agnieszka Łoboda and Dr. Halina Waś (2nd degree team award for scientific research).

Awarded members of the FBBB who are not university lecturers and who received a 2nd degree team award include: Ewa Marewicz, Aneta Sroka, Karol Stożek and Dr. Tomasz Kantyka. A 3rd degree team award was presented to Małgorzata Chrapała, Oliwia Bocheńska, Halina Kasprzyk, Barbara Czuba-Pelech, Halina Kołodziejka and Lidia Ciastoń.



Dr. Grzegorz Dubin



Dr. Agnieszka Jaźwa

Ministry of Science and Higher Education Fellowships to Agnieszka Jaźwa and Grzegorz Dubin

Dr. Agnieszka Jaźwa from the FBBB's Department of Medical Biotechnology and Dr. Grzegorz Dubin from the FBBB's Department of Microbiology were awarded the Ministry of Science and Higher Education's awards for distinguished young scientists.

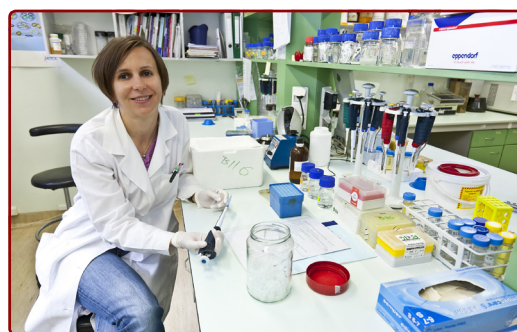
These fellowships have been awarded in recent years to scientists who are under 35 years old, conduct high quality research and have significant scientific achievements. Three times as many fellowships were awarded this year as last year. A total of 256 young scientists were chosen out of 793 applications.

L'Oreal Fellowships for Aneta Kasza and Anna Grochot-Przęczek

Two female scientists from our Faculty were awarded "L'Oreal Poland for Women and Scien-

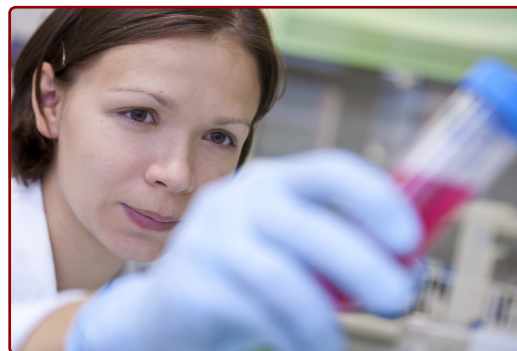
ce" fellowships this year. Through this contest, the well-known cosmetics firm has, for the last eleven years, awarded three habilitation fellowships and two doctoral fellowships to young female scientists. The awards ceremony took place on November 25th, 2011 at the Kopernik Science Center in Warsaw.

Dr. Aneta Kasza from the Department of Cellular Biochemistry received a habilitation fellowship for the project entitled "Regulatory gene expression mechanisms through proinflammatory cytokines and epidermal growth factor". Her studies will focus on the human gene PAI-1 and the Elk-1 transcription factor.



Dr. Aneta Kasza

Anna Grochot-Przęczek, MSc from the Department of Medical Biotechnology, received a doctoral fellowship. Her research concerns the use of proangiogenic marrow-derived cells in the therapeutic angiogenesis of ischemic extremities and the role of heme oxygenase-1 in this system.



Anna Grochot-Przęczek



The female scientists awarded "L'Oreal Poland for Women and Science" fellowships 2011

Joanna Jankowicz-Cieślak: "Identification of adaptation-specific differences in the mRNA expression profile of drought-stressed sweet potato (*Ipomea batatas*)". Supervisor: Dr. Jerzy Kruk. October 28th, 2011.

IMPLEMENTATION OF THE MOLECULAR BIOTECHNOLOGY FOR HEALTH PROJECT

As part of the implementation of the POIG "Molecular Biotechnology for Health" (MBH) project, a new histological laboratory was inaugurated in December 2011 at the Faculty of Biochemistry, Biophysics and Biotechnology. The new laboratory is equipped with a Shandon Excelsior ES vacuum tissue processor, a HistoStar embedder, a Microm HM 355S microtome with a water flow and an automated Veristan Gemini stainer. This equipment makes it possible to automate the routine steps necessary in the preparation and staining of paraffin-embedded and frozen tissue samples. Thus, they can greatly increase the speed and ease of applying histological and cytological techniques especially when these require the preparation of large numbers of samples. For now, the new devices are still placed on temporary workbenches but they can already be used for experiments.

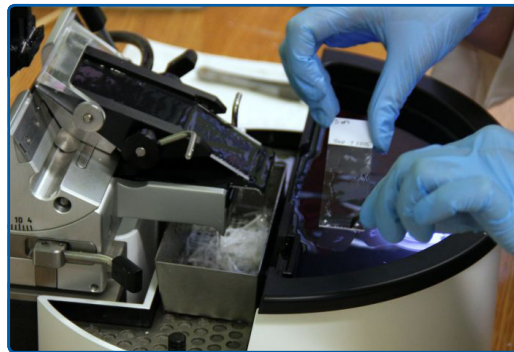
The tissue processor fully automates the preparation of histological samples from desiccation to saturation with paraffin. It allows for the simultaneous preparation of 220 (organized basket) or about 300 (random basket) cassettes. It is also capable of working with both xylene and xylene-free techniques.



HistoStar embedder

The embedder facilitates the embedding of samples in paraffin, provides a well-lighted workbench as well as a heating and cooling table. It is also equipped with a 5 liter paraffin container which makes it possible to carry out paraffin embedding during an entire day

without having to restock the compound. The embedder is compatible with the Excelsior processor but also capable of working with other cassette types and sizes. The prepared blocks can then be cut on the automated rotating microtome which allows for manual or automated



Microm HM 355S microtome with a water flow

electric cutting. Slices 0.5–100 µm thick can be obtained and block trimming is also possible.

The microtome features a water flow option as well as a lit container which makes unrolling samples easier. The prepared samples can then be stained on the stainer which is equipped for automated staining of histological and cytological samples. This device can carry out various types of staining as well as multiple staining protocols simultaneously.

Along with the laser microdissection system, the histology laboratory ensures the possibility of conducting histological studies based not only on immunohistological staining but also on gene expression analysis in select groups of cells harvested from heterogenic organs or tumors. The histology laboratory is housed in room 3.03 in the Department of Medical Biotechnology. An additional cryostat also allows for the preparation of frozen samples. We invite all interested parties to make use of the scientific equipment and will be happy to provide assistance during your first experiments.

Department of Medical Biotechnology



Shandon Excelsior ES vacuum tissue processor

CONSTRUCTION OF MALOPOLSKA CENTER OF BIOTECHNOLOGY COMMENCES

On October 9th, 2011, the Jagiellonian University signed a contract for the construction of the Malopolska Center of Biotechnology (MCB). The project's principle contractor is



The construction site of Malopolska Center of Biotechnology

Budimex S.A. On behalf of the University the contract was signed by the Rector, Prof. Karol Musioł, and by the Bursar, Dr. Maria Hulicka. Budimex S.A. was represented by the Head of the Department of General Construction South in Krakow, Mr. Paweł Ignacok. Budimex took possession of the construction site in early November. Currently work on the building's foundation is being carried out.

MCB will be built on the Campus of the 600th Anniversary of the Jagiellonian University Revival. The MCB project is made possible through European Funds contributed from the European Regional Development Fund. The investment will cost more than 89 million PLN and will be completed in 2013.

Justyna Supel

MYGEN

On November 18th–20th, 2011 "Mygen" Biotechnology Students' Association organized the 13th National Biotechnology Students' University Seminar. This year's event gathered 274 participants.



Poster session

The official inauguration of the conference, which included greeting the guests and a presentation of the conference sponsors, took place at the Faculty of Biochemistry, Biophysics and Biotechnology (FBBB) on Friday, November 18th. That day's most notable event was the inaugural lecture

of Prof. Claudine Kieda from the Centre National de la Recherche Scientifique in France. Prof. Kieda spoke about a project focusing on tumor growth.



Participants of XIII OASSB

The Seminar's scientific program was divided into six thematic blocks: Proteomics and bioinformatics; Biotechnology in medicine; Industrial and environmental biotechnology; Plant and animal biotechnology; Molecular biotechnology, biochemistry and genetics; and "Various". Some of the thematic blocks were preceded by brief lectures presented by invited guests: Prof. Dobiesław Nazimka, Prof. Wiesław Gruszecki and Dr. Paweł Zawadzki.

All of the lectures and presentations were given in English.

All of the seminar talks were attentively observed by a commission comprised of members of the FBBB to whom we would once again here wish to express our heartfelt gratitude: it was thanks to their diligent work and rating that winners were selected in each of the categories.

After conclusion of the official part of the conference, some of the participants enjoyed a tour of Krakow's Main Market Square Underground. The attendees, invited guests and organizers all gave very positive feedback on the conference.

In addition to organizing the conference, Mygen has also initiated teaching activities. We have organized workshops for the Faculty's students on the practical use of Origin software as well as other software packages for the analysis of macromolecular sequences. The workshops were taught by members of "Mygen" and would not have been possible without the kind help of Dr. Ryszard Gurbiel. There was a great deal of interest in the workshops, especially among 1st and 2nd year students, and we therefore plan to continue these activities in the next semester.

We are also presently preparing for the second "Life Sciences for High Schoolers" set of activities carried out in local high schools, which were very enthusiastically received last year.



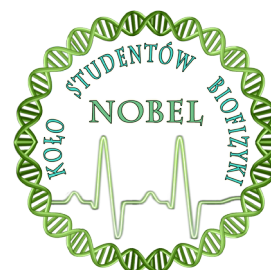
"Nobel" Biophysics Students' Association would like to invite all of the Faculty of Biochemistry, Biophysics and Biotechnology students and faculty to attend the "Students' Science Lounge", a series of monthly meetings during which students from our faculty will give brief presentations of their scientific interests or research. The best presentation at each meeting will be chosen by popular acclamation. Special prizes, courtesy of the FBBB's Dean, Prof. Wojciech Froncisz, will be awarded to the winner of each meeting and the winner of the grand finale meeting in June.

The first "Students' Science Lounge" will take place on January 11th, 2012 at 6pm in Room D107 (Faculty of Biochemistry, Biophysics and Biotechnology, ul. Gronostajowa 7). If you have an interesting topic that you would like to present

to your colleagues, please send your idea (full name, title of presentation, abstract) now to studencki_salon_naukowy@yahoo.com.

More information on this event can be found at the website <http://ksb-nobel.heliohost.org/salon/>.

Organizers of the Students' Science Lounge



GUEST LECTURES

October 19th, 2011.

Prof. David M. Knipe (Department of Microbiology and Immunobiology, Harvard Medical School, Boston, USA): "Herpes simplex virus vaccines and epigenetic control of lytic and latent infection". Invited by the Laboratory of Molecular Genetics and Virology.

November 15th, 2011.

Prof. Krzysztof Reiss (Stanley S. Scott Cancer Center, School of Medicine, Louisiana State University, New Orleans, USA): "Human polyomavirus JC and genomic instability in medulloblastoma". Invited by the Department of Cell Biology.



Prof. Krzysztof Reiss

November 18th, 2011.

Prof. Howard Halpern (Center for EPR Imaging in Vivo Physiology, Department of Radiation and Cellular Radiobiology, University of Chicago, USA): "Towards absolute in vivo oxygen imaging". Invited by the Laboratory of Tumor Radiospectroscopy and Radiobiology.

November 21st, 2011.

Prof. Marek Łoś (Department of Clinical and Experimental Medicine, Integrative Regenerative Medicine Center (IGEN), Linköping University, Sweden): "Attempts to target cancer (stem) cells – apoptin and salinomycin as examples". Invited by the Department of Medical Biotechnology.

November 23rd, 2011.

Prof. Ellen Puré (Wistar Institute, Philadelphia, USA): "The role of fibroblast activation protein (FAP) in matrix remodeling and disease". Invited by the Department of Immunology.

November 25th, 2011.

Prof. Jürgen Hescheler (President of the German Society for Stem Cell research, Institute of Neurophysiology, University of Cologne, Germany): "Induced pluripotent stem cells for basic research and clinical application". Invited by the Department of Medical Biotechnology.



Prof. Jürgen Hescheler

November 28th, 2011.

Prof. George Hajishengallis (School of Dental Medicine, University of Pennsylvania, Philadelphia /Group for Oral Health and Systemic Diseases, School of Dentistry, University of Louisville, USA): "Host-microbe interplay, homeostatic mechanisms and disease". Invited by the Department of Microbiology.

IT'S PAST BELIEF! "*MATERIA ELECTRONICA*"

In the constant effort to define what is life, to distinguish between what is living and what is not, we often confine our attempts to describing the "essence" of life. Some believed that life can essentially be reduced to "the mode of existence of protein bodies". Others curtailed it to the phenomenon of nucleic acids, especially DNA. I, however, would like to focus on the topic of electrons and, to paraphrase the infamous classic, to say that the essence of life is the independent existence of electrons. Independent meaning unpaired. One of the first people to note that there is an occurrence of one-electron oxidation and reduction reactions in living systems which consequently create a low, but significant steady-state level of free radicals with unpaired electrons was Leonor Michealis, Maud Menten's boss in Berlin. He arrived at this conclusion by a long path of tedious and time-consuming titration experiments and, above all, through careful analysis and observation. Not just by means of a pipette but also with his head which is an indispensable scientific tool. Michealis was intrigued by the fact that during a reductive titration of certain colorful compounds, a short-lived, transient and independent intermediate product sometimes appeared whose color could not have arisen from the mixture of colors of the initial and final products of titration.

Following Michealis' intuition, Barry Commoner applied, for the first time in history, electron paramagnetic resonance spectroscopy (at that time still a "baby" method) to detect unpaired electrons in living systems. He correctly assumed that if free radicals exist in living organisms, they must be detectable by EPR (what a trivial conclusion from today's perspective!) Needless to say, one of the first substances he tested was melanin, but that's beside the point. Commoner was correct to seek the main source of free radicals in the electron-processing organelles, i.e. mitochondria and chloroplasts. By the way, he came from a botany laboratory, and he carried out his experiments on seeds and leaves. Electron-botany stories appear numerous times in the history of EPR. In a spectacular way, for example, with "Berliner's celery" of which the first ever EPR-based tomographic image was made (and thus an answer to the question once posed by one of our botanist colleagues: what does the Faculty of Biotechnology need another EPR spectrometer for? There'll always be a use for it even for the botanists).

EPR presents a unique method for registering the "signal of life". In other words, it allows for the in vivo measurement of the processes which constitute the "essence" of life, that is the one-electron oxidation/reduction reactions and the stable levels of intermediate free radicals. This was noticed by the ecologists who, by trying to define life, had to inevitably make use of "materia electronica".

Przemysław M. Płonka

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cont. p. 12 ▶

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