Biomeditsinskaya Khimiya

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1. Trifonova O.P., Lokhov P.G., Archakov A.I.

Metabolic profiling of human blood.

Metabolomics is a novel â€œomicsâ€• branch of science intended for studying a comprehensive setof low molecular weight substances (metabolites) of various biological objects. Metabolite profilesrepresent a molecular phenotype of biological systems and reflect information encoded at the genomelevel and realized at the transcriptome and proteome levels. Analysis of human blood metabolicprofile is universal and promising tool for clinical applications because it is a sensitive measureof both endogenous and exogenous (environmental) factors affected on the patient's organism.Technical implementation of metabolic profiling of blood and statistic analysis of metabolite profilesfor effective diagnostics and risk assessments of diseases are discussed in this review.

DOI: 10.18097/pbmc20146003281

2. Vavilova T.P., Ostrovskaya I.G., Medvedev A.E.

Lecture: prospects of hormone analyses in saliva.

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3. Naryzhny S.N., Ronzhina N.L., Mainskova M.A., Belyakova N.V., Pantina R.A., Filatov M.V.

Development of barcode and proteome profiling of glioblastoma.

High grade glioma (glioblastoma) is the most common brain tumor. Its malignancy makes it the fourth biggest cause of cancer death. In our experiments we used several glioblastoma cell lines generated in our laboratory to obtain proteomics information specific for this disease. This study starts our developing the complete 2DE map of glioblastoma proteins. 2DE separation with following imaging, immunochemistry, spot picking, and mass-spectrometry allowed us detecting and identifying more than 100 proteins. Several of them have prominent differences in their level between norm and cancer. Among them are alpha-enolase (ENOA_HUMAN), pyruvate kinase isozymes M1/M2 (KPYM_HUMAN), cofilin 1 (COF1_HUMAN), translationally-controlled tumor protein TCTP_HUMAN, annexin 1 (ANXA1_HUMAN), PCNA (PCNA_HUMAN), p53 (TP53_HUMAN) and others. Most interesting results were obtained with protein p53. In all glioblastoma cell lines, its level was dramatically up regulated and enriched by multiple additional isoforms. This distribution is well correlated with presence of these proteins inside of cells themselves. At this initial step we suggest the panel of specific brain tumor markers (signature) to help creating noninvasive techniques to diagnose disease. These preliminary data point to these proteins as promising markers of glioblastoma.

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4. Avilova E.A., Andreeva O.E., Shatskaya V.A., Krasilnikov M.A.

The role of protein kinase PAK1 in the regulation of estrogen-independent growth of breast cancer.

The main goal of this work was to study the intracellular signaling pathways responsible for the development of hormone resistance and maintaining the autonomous growth of breast cancer cells. In particular, the role of PAK1 (p21-activated kinase 1), the key mitogenic signaling protein, in the development of cell resistance to estrogens was analyzed. In vitro studies were performed on cultured breast cancer cell lines: estrogen-dependent estrogen receptor (ER)-positive MCF-7 cells and estrogen-resistant ER-negative HBL-100 cells. We found that the resistant HBL-100 cells were characterized by a higher level of PAK1 and demonstrated PAK1 involvement in the maintaining of estrogen-independent cell growth. We have also shown PAK1 ability to up-regulate Snail1, one of the epithelial-mesenchymal transition proteins, and obtained experimental evidence for Snail1 importance in the regulation of cell proliferation. In general, the results obtained in this study demonstrate involvement of PAK1 and Snail1 in the formation of estrogen-independent phenotype of breast cancer cells showing the potential role of both proteins as markers of hormone resistance of breast tumors.

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5. Fadeeva Yu.I., Antipova N.V., Baskova I.P., Zavalova L.L.

Highly active fractions of the medicinal leech recombinant destabilase-lysozyme.

From the highly purified but lowly active recombinant protein Destabilas-Lysozyme (Dest-Lys) by use cation-exchange column TSK CM 3-SW chromatography, it was separated non-active fraction IV, contained 90% of protein. Fractions I, II and III, represented proteins with lysozyme and isopeptidase activities. Their lysozyme activity correlates with the activity of natural Des-Lys. The ratio of the activities in fractions I â€“ III is such, that maximal lysozyme activity is concentrated in fraction III, isopeptidase â€“ in fraction I. It is discussed the possibility of Dest-Lys different functions regulation is depended on the formation of protein complex forms

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6. Bondarenko V.M., Alexeev Yu.V., Mislavsky O.V., Ponomarev G.V.

Perspectives of disodium salt 2.4-di(1-metoxyethyl)-deuteroporphyrin â€“ IX (â€œdimeginâ€•) application for photodynamic therapy in non-oncologic cases.

Effects of disodium salt 2,4-di(1-metoxyethyl)-deuteroporphyrine-IX (Dimegin) and the light from Soret band (Â»395-405 nm) at the viability of microbial cells and at their potential to form microbial biofilms have been compared with traditional antiseptics. Irradiation of microbial cells of S. aureus, E. coli, C. albicans and others with diode light (power density 0.05 Wt/cm2) caused a bactericidial effect similar to that obtained with standard anticeptics (chlorhexidine and dioxidine). A comparative study of the effectiveness of Dimegin and Photoditazine (a soluble salt of chlorine e6) as photosensitizers have been performed using the test system of erythrocyte hemolysis in vitro under irradiation with light from the Sore band. Results have shown insignificant difference in the photodynamic effect with similar doses of absorbed light and preparation concentration.

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7. Sanzhakov M.A., Ipatova O.M., Prozorovskiy V.N., Medvedeva N.V., Torkhovskaya T.I.

Interaction of rifampicin embedded in phospholipid nanoparticles with blood plasma lipoproteins.

The drug formulations of antituberculous remedy rifampicin in nanoparticles less than 30 nm based on soy phosphatidylcholine and sodium oleate was elaborated in Institute of Biomedical Chemistry. The distribution of rifampicin in blood plasma fractions after incubation with this formulation and with free rifampicin was studied. This goal was stimulated by the literature data about activation of macrophages LDL receptors in cases of M. tuberculosis infection. Plasma was incubated 30 min with free rifampicin or rifampicin encapsulated into the nanoformulation followed by ultracentrifugation and subsequent rifampicin determination by HPLC in lipoprotein fractions. In the case of free rifampicin it appeared mainly in the plasma protein fraction and in HDL (41% and 38%, correspondentely). But after incubation of rifampicin in nanoparticles the drug redistribution was observed. Its proportion in these factions decreased 2-3-fold, and it was found mainly in LDL (60% as compared with 21% for free rifampicin). The increased association of rifampicin encapsulated into phospholipid nanoparticles with LDL is considered as facilitating factor for macrophages delivery and thus for antituberculosis efficiency as well

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8. Shelkovnikova T.A., Ustyugov A.A., Kokhan V.S., Tarasova T.V., Medvedeva V.K., Khrytankova I.V., Bachurin S.O., Ninkina N.N.

Study into molecular targets of a neuroprotective compound dimebon using a transgenic mice line.

In the present study we have used a transgenic mice overexpressing an amyloidogenic protein, gamma-synuclein, in the nervous system to address the effect of dimebon on proteinopathy progression. Neuroprotective effect of chronic dimebon administration in these mice at organismal level was confirmed by the increased lifespan. Using histological and biochemical approaches we have demonstrated that dimebon reduced the number of amyloid inclusions in spinal cord of transgenic animals and decreased the content of ubiquitinated proteins in detergent-insoluble fractions. These effects are likely to occur at the level of aggregated protein species, since transgene expression was not altered. Thus, pathological protein aggregation serves as one of dimebon targets in neurodegeneration.

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9. Savilov P.N.

Effect of hyperbaric oxygenation on metabolism of glutamine in the liver.

The effect of three-day course of hyperbaric oxygenation (HBO; 3 atm, 50 min, 1 session per day) on glutamine metabolism in the liver has been investigated in 72 adult albino rats. The content of ammonia, glutamate, glutamine, activity of glutamine synthetase (GS), phosphate-dependent glutaminase (PDG), and glutamate dehydrogenase (GDH) were studied in left (LLL) and median (MLL) lobes of the liver. The course of HBO had an inhibitory effect on all the enzymes studied. Inhibitory effect of hyperoxia on GDH activity persisted up to day 11 after the course of HBO in both lobes of the liver, while decreased glutamate normalized in both lobes. Reduced glutamine concentration normalized to day 4, and the concentration of ammonia and remained elevated for 11 days after the end of hyperoxic exposure. Inhibitory effect of hyperoxia on GS activity in LLL and MLL disappeared on day 4 and day 11 day after the end of the HBO course. PDG activity reduced by HBO in both lobes normalized to the day 4 day after oxygenation; however, on day 11 it selectively decreased in LLL, where simultaneous stimulation of GS activity was also observed. The results demonstrate different sensitivity of liver GS, PDG and GDH of normal rats to the inhibitory effect of HBO. Different dynamics of GS and PDG activity in LLL and MLL of oxygenated rats suggests functional heterogeneity of the glutamine cycle in hepatocytes of liver lobes after HBO

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10. Globa A.G., Alekseev Y.I., Arzumanyan V.G., Zaborova V.A., Guridov A.A.

The use of real time PCR for quantitative determination of some propionic bacteria residing on human skin.

A test system has been developed for determination of propionic bacterial species residing on human skin. This system developed in the real time PCR format is applicable for quantitative determination and also detection of genomes of the following Propionibacterium species: P. acnes, P. granulosum and P. avidum. This system was used for analysis of wash samples from the skin of 17 pentathlon sportsmen and 16 students. All three species of propionic bacteria were found in all skin wash samples. However, contamination with P. acnes was two times higher in control group than in the group of pentathlon sportsmen.

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11. Ivanenko N.B., Ivanenko A.A., Solovyev N.D., Navolotskii D.V., Pavlova O.V., Ganeev A.A.

Determination of Al, Be, Cd, Co, Cr, Mn, Ni, Pb, Se and Tl in whole blood by atomic absorption spectrometry without preliminary sample digestion.

Methods of whole blood trace element determination by Graphite furnace atomic absorption spectrometry (in the variant of Zeemanâ€™s modulation polarization spectrometry) have been proposed. They do not require preliminary sample digestion. Furnace programs, modifiers and blood dilution

factors were optimized. Seronormâ„¢ human whole blood reference materials were used for validation. Dynamic ranges (for undiluted blood samples) were: Al 8 Â¸ 210 Đ¼g/L; Be 0.3 Â¸ 50 Đ¼g/L; Cd 0.2 Â¸ 75 Đ¼g/L; Đ¡o 5 Â¸ 350 Đ¼g/L; Cr 10 Â¸ 100 Đ¼g/L; Mn 6 Â¸ 250 Đ¼g/L; Ni 10 Â¸ 350 Đ¼g/L; Pb 3 Â¸ 240 Đ¼g/L; Se 10 Â¸ 500 Đ¼g/L; Tl 2 Â¸ 600 Đ¼g/L. Precision (RSD) for the middle of dynamic range ranged from 5% for Mn to 11 for Se.
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12. Petrushova O.P., Mikulyak N.I.

Proteolytic activity of fetoplacental complex in normal and pathology.

The activity of angiotensin converting enzyme (ACE), carboxypeptidase N (CPN), and leucine aminopeptidase (LAP) has been investigated in the fetoplacental complex (FPC) in normal and placental insufficiency (FPI). ACE and LAP activities were significantly higher in the placental tissue than in maternal serum and umbilical vein serum. CPN activity was significantly lower in umbilical vein serum as compared to that of women in childbirth. Probably, the studied enzymes are involved in formation of reduced sensitivity of FPC of blood vessels during physiological pregnancy. In cases of placental insufficiency a significant increase of LAP activity was found in the placental tissue and umbilical vein serum. In addition, the pathological course of pregnancy caused a significant increase of CPN activity in serum of pregnant women in comparison to the norm. The obtained data suggest that during FPI proteolytic enzymes participate in the formation of compensatoty-adaptive reactions in the FPC. Results of this study are interesting in context of development of methods for prevention and correction of metabolic disorders in pathologies of pregnancy
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