Alexander von Humboldt
Stiftung/Foundation

TECHNOLOGIES OF THE 21st CENTURY: BIOLOGICAL, PHYSICAL, INFORMATIONAL AND SOCIAL ASPECTS

The 2nd St.-Petersburg HUMBOLDT-KOLLEG CONFERENCE

St.-Petersburg, Russia
October 7–9, 2008

ABSTRACTS

ENERGY AND FUEL – TRADITIONAL AND ALTERNATIVE SOURCES

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We will discuss in this talk current status and perspectives of different energy sources, paying attention to traditional and non-traditional fuels and other energy suppliers. The control on energy and supply of it in sufficient for the mankind amount is the key existentialistic issue.

The current main energy sources, particularly those of liquid fuel are quite limited and distributed unevenly among different regions on the Earth. This is why the problem of energy and fuel is not a pure scientific problem but is as well of great political and social importance. Control on energy supply means control upon the future of a given country or a nation, or, perhaps, of all of them. The solution of energy problem is impossible without considerable efforts and successes of science (physics, chemistry, biology etc) and technology, but requires very big investments that are possible only with participation of the leading states.

We will discuss many sources of energy – from wood, coal, oil and gas to nuclear fission and fusion, to wind, tides, direct use of solar energy, and internal heat of the Earth. The rapidly increasing demand for liquid fuel and its increasing prices stimulate the search for alternative sources of energy. This is a must not only for energy-poor, but also for energy-rich countries. For the development of alternative sources will dictate scientific and technological progress, while extensive use of existing sources will preserve or even generate backwardness.

Particular attention will be given to the use of hydrogen and alcohol for vehicles. While use of hydrogen helps to get rid of additional carbon dioxide exhaust, alcohol produced from plants is of great general ecological importance. The development in the direction of bio-fuel can really alter the face of our civilization.

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MATHEMATICAL MODELLING OF DYNAMICS OF MECHANISMS OF FABRIC TRANSPORTATION IN SEWING MACHINES TAKING IN THE ACCOUNT THE CHANGES OF MATERIALS THICKNESS DURING SEWING

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The movement of materials for the set length of a stitch in sewing machines is realized as a result of interaction between toothed rack and a clamping pawl. Communication of a clamping pawl with ground off materials is unilateral (not keeping). In the case of increasing of frequency of sewing machine main shaft rotation the infringements of contact between a clamping pawl and materials are possible during the transportation. It leads to the regimes of work with vibration and

impacts, it can lead to damage of sewing materials by the toothed rack and, finally, to defects of a sewing joint.

In this report the research of dynamics of a clamping paw are presented. The dynamic and mathematical models were developed considering the following characteristics: not keeping communication between a clamping paw, sewing materials toothed rack; constructive peculiarity of the connection between a clamping paw and a rod; nonlinearity of elasto-dissipative properties of sewing materials; changes of thickness of sewing materials during their passage under a clamping paw; turn of the toothed rack and a clamping paw with regard to the needle plates. Algorithms and a special software were developed. The software MATLAB was using for simulation of a clamping paw dynamics. On the basis of the researches some engineering recommendations aimed to perfection of a design of mechanisms of materials transportation in sewing machines were given.

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THE FATE OF HUMAN WILD-TYPE AND MUTANT FIBRILLARIN IN LIVING *HeLa* CELLS FOLLOWING EXPOSURE TO HgCl$_2$

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Fibrillarin (321 aa in human) is a key mobile nucleolar protein that is involved in methylation and processing of pre-rRNA. Fibrillarin serves as an autoantigen in human scleroderma diseases and also is targeted by autoantibodies raised in genetically susceptible mice by regular administrations of sublethal doses of HgCl$_2$. Human fibrillarin contains two cystein residuals (Cys99 and Cys268), which are thought to be responsible for the protein binding to Hg(II). These interactions induce migration of fibrillarin from the nucleolus to the nucleoplasm, where the protein is thought to be cleaved by nuclear proteasomes; the latter leads to production of cryptic T-cell determinants. In the present study we tested the idea that binding of Hg(II) to SH-groups of Cys99 and Cys268 modifies fibrillarin properties in living cells. To reach the goal, we created plasmids encoding human fibrillarin fused to GFP, where the both cysteins were substituted by serine residuals (Cys99/268> Ser99/268). A plasmid encoding the wild-type human fibrillarin coupled with GFP was used for control. HeLa cells were transiently transfected with the plasmids, and the mobility of the wild-type and mutant fibrillarin fusions were analyzed by FRAP and confocal laser scanning microscopy.

In nucleoli of control HeLa cells, wild-type fibrillarin was located in foci coincident with endogenous fibrillarin revealed with anti-fibrillarin antibody 72B9 as well as with BrUTP-positive sites - the markers of on-going rRNA synthesis. In nucleoli, a mobile fraction of fibrillarin was 61±5 %. Treatment of HeLa cells with 40-75 μM HgCl$_2$ for 1.5-2 h resulted in migration of endogenous fibrillarin and fibrillarin/GFP from nucleoli to discrete foci in the nucleoplasm, in the arrest of rRNA synthesis and diminished the mobile fraction of fibrillarin to 43±5 %. Unexpectedly, in nucleoli of control (untreated) cells, the location and mobility of mutant fibrillarin/GFP were similar to those of wild-type fibrillarin. Treatment of cells with HgCl$_2$ did not prevent the migration of fibrillarin from nucleoli to the nucleoplasm, and maintained the protein mobility (55±3 %) similar to the values obtained for wild-type

fibrillarin/GFP in non-treated HeLa cells. These results for the first time showed that Cys99 and Cys268 per se do not interfere with fibrillarin reaction to mercury, but play a role in the maintenance of the protein dynamic properties in living human cells.

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PHOTOIONIZATION OF FIXED-IN-SPACE MOLECULES
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The last decade was marked by a broad application of different coincidence techniques which allow selecting the processes with a well defined direction of the molecular axis in space from the photoionization of an ensemble of randomly oriented molecules in a gas phase. The direction of motion of the fragment ion(s) gives the direction of the molecular axis at the moment of photoionization provided the photoionization process results in a strongly repulsive final molecular ion state [1,2]. The corresponding theoretical consideration of these processes will be presented in this talk.

The study in coincidence of the Auger -electron and the photoelectron in the molecular frame gave the opportunity to clarify the long-standing question of whether the K-shell vacancy created in a homonuclear diatomic molecule by absorption of X-ray photon is localized on one atom, or is delocalized over both, that is described as gerade (g) or ungerade (u) state. The recent experiment for N_2 molecules [2] supported by calculation shows that the photo- and Auger-electron form a quantum entangled Bell state, and the core hole is better though of as being delocalized. Calculations in the g/u basis correctly reproduce all observed angular distributions.

When both the photo- and the Auger-electrons are detected at a definite angle, the interference terms contribute, and the angular distribution does not possess the inversion symmetry. After integration over the ejection angles of either photo- or Auger-electron, the interference term disappears, and the result is equal to incoherent sum of two contributions from the g and u hole states. Even though these states differ in energy by only 0.1 eV, they can be separated in the photoelectron spectra, and the recent measurements of the angular distributions of photoelectrons from the delocalized $1\sigma_g$ and $1\sigma_u$ shells separately agree quite well with the theoretical prediction. Another evidence of the delocalized character of the hole states in N_2 molecule is the existence of the Cohen-Fano oscillations in the ratio of the partial cross sections of the $1\sigma_g$ and $1\sigma_u$ shells discovered recently in the experiment in a good agreement with the theoretical calculation.

Another situation takes place in Ne_2 dimers where the internuclear distance is substantially larger than in N_2. Here the energy splitting between the $1\sigma_g$ and $1\sigma_u$ shells is negligibly small, and the considerations in the g/u and R/L bases are equally justified. There is no way to distinguish between these two descriptions experimentally.

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MOLECULAR SUPERCONDUCTORS: CHEMISTRY MEETS PHYSICS

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Quasi-two dimensional organic conductors based on BEDT-TTF (bis(ethylenedithio)tetratiafulvalene) molecule were first synthesized in the end of 80ties following even earlier theoretical prediction of a possibility of high-temperature excitonic superconductivity in organics [1]. While the highest superconducting transition temperature reached in these materials is about 13 K, they are now actively studied as models of strongly correlated electron systems. Depending on strength of electron-electron interaction and filling of the conductance band, these compounds can be Mott insulators with antiferromagnetic order, charge-order insulators, superconductors, and metals.

We use infrared optical reflectance spectroscopy to study the dynamical response of charge carriers in the metallic state close to an ordered insulating one. Investigating BEDT-TTF based compounds with a half-filled conductance band, we observe how the effective mass of charge carriers increases on approaching a transition between metal and Mott insulator by increasing electronic correlations. An optical gap opens on the insulating side, suggesting a first-order phase transition. Our study of a quarter-filled superconductor with T_c=8 K give evidence both for a fluctuating charge order and a superconducting gap, suggesting that superconductivity in this material can be mediated by charge order fluctuations.

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A NEW LOOK AT THE FINITE FIELD FOURIER TRANSFORM

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The discrete Fourier transform (DFT) of length n of a vector f in the finite field GF(2^m) is the vector

$$F=\mathbf{W}f,$$

where $\mathbf{W}$ is a Vandermonde matrix over GF(2^m), the length of the DFT n divides 2^m-1, *?* is the DFT kernel.

Presently, a number of DFT algorithms over the real or complex field is known, but translation of these algorithms to finite fields is not always possible. Furthermore, a DFT algorithm specially constructed for a particular finite field may be better than an algorithm translated from another field.

The cyclotomic algorithm [1] and the recursive algorithm [2] turn an n-point DFT into several different cyclic convolutions. The length of the cyclic convolutions is m or a divisor of m.

The DFT algorithm for $n=2^m-1$ over GF(2^m) consists of two stages:

1. The first stage is calculation, which consists of approximately n/m m-point cyclic convolutions.

2. The second stage is multiplying the binary matrix by the vector over GF(2^m).

The complexity of the first stage is about $n \log n$ multiplications and additions over elements of GF(2^m). The complexity of the second stage is about $2 n^2 / \log n$ additions over elements of GF(2^m).

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PHOTOACOUSTIC CHARACTERIZATION AND IMAGING OF NEAR-SURFACE MECHANICAL STRESSES IN SOLIDS

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Photoacoustic effect is used now by various evaluation methods in defectoscopy, spectroscopy, trace analysis and medicine. The main attention in these applications are paid to object characteristics which are responsible for photothermal transformations, such as absorptance in spectroscopy or thermal diffusivity and bulk structure in defectoscopy. Thermoelastic properties, e.g., thermal expansion coefficient, were considered to be constant. Recent studies showed that photoacoustic methods based on the detection of acoustic waves in solid objects are sensitive to the dependence of the thermoelastic parameters on internal mechanical stresses.

The application of the photoacoustic thermoelastic effect for the diagnostics of mechanical stresses is considered at present with growing interest. The main advantage of the photoacoustic method as compared to other residual stress measurements lies in its nondestructive and universal character and high spatial resolution. Our experiments demonstrate the influence of stress on the photoacoustic signal in various materials. The obtained results can be used for an estimation of sensitivity of the photoacoustic method to mechanical stresses in ductile and brittle materials. As ductile material we have investigated metals and nano-structured metals. At this, the signal increase for the nano-structured metals took place, which was due to the influence of crystallite size on the thermal expansion coefficient.

The sensitivity of photoacoustic microscopy to mechanical stresses in ceramics and metals is studied by analyzing experimental results on the photoacoustic signal behavior under various external loading, annealing, and mechanical treatment.

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MIXED-METAL COMPLEXES DESIGN: USING ASYMMETRICAL LIGANDS TO CREATE LINKED CLUSTER SYSTEMS "TRANSITION METAL – GROUP 13 METALS"

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Synthesis of nano-scale molecular assemblies containing transition and non-transition metals in different oxidation states with defined composition and structure attracts significant attention stimulated by both purely academic and practical reasons. Molecules containing metal centers of drastically different nature seem to have a good chance to show unusual chemical and physical properties. The target architecture of the molecular assembly may be constructed by the design of the link ligand that connects metal centers.
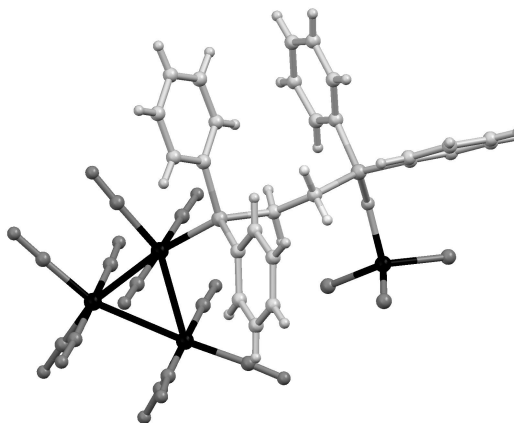
Specific size, properties, and structural features of transition metal clusters give the possibility to use the cluster complexes as versatile building blocks for the synthesis of complicated macromolecules. The following low-nuclear neutral carbonyl clusters of groups 8, 9 metals were chosen to create the compounds wanted: $M_3(CO)_{12}$; M = Ru, Os; $M_6(CO)_{16}$, M = Rh. The gallium(III) chloride was chosen as the non-transition metal center in high oxidation state. The choice of the linker was dictated by the nature of metal centres, and asymmetrical bifunctional phosphines $(C_6H_5)_2P(CH_2)_nP(O)(C_6H_5)_2$ looked to be ideal to create linked cluster systems "transition metal – group 13 metals".

The carbonyl clusters with asymmetrical phosphine ligands $M_x(CO)_y((C_6H_5)_2P(CH_2)_nP(O)(C_6H_5)_2))$ have been produced. The structure of the compounds was

described as the one-substituted carbonyl cluster with asymmetrical bifunctional ligand that has oxygen function free. These compounds are building blocks that are ready to use to form the title molecular assemblies.

Six new stable linked cluster compounds $[M_x(CO)_y((C_6H_5)_2P(CH_2)_nP(O)(C_6H_5)_2))GaCl_3]$; M = Ru, Os; x = 3; y = 11; n = 2, 3; M = Rh; x = 6; y = 15; n = 2, 3 were synthesized. The structure of the new compounds was defined on the basic of the spectroscopic data set (^{31}P NMR spectroscopy, IR spectroscopy, FAB$^+$ mass spectrometry). The solid state structure of the $[Os_3(CO)_{11}((C_6H_5)_2P(CH_2)_2P(O)(C_6H_5)_2))GaCl_3]$ compound was investigated by X-Ray and has confirmed the new macromolecules description on basic of the spectroscopic data (see the picture on the right hand side).

The very interesting phenomenon was found in the new linked compounds. This phenomenon is strong interaction between metal centres through connecting chain ligand. The phenomenon has electronic nature and being now investigated by DFT calculation.

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COMPUTER MODELLING OF BIOLOGICAL MEMBRANES

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Every living cell is surrounded by the plasma membrane that serves as a selectively permeable barrier between the cell and the extracellular environment. Biological membranes play an important role in a variety of cellular processes as they govern or mediate numerous cellular functions. Understanding the exceptionally complex functionality of biomembranes is hence one of the fundamental challenges in biological research.

On the other hand, a thorough understanding of the membrane's structure is crucial from the perspective of biomedical applications as the interaction of a drug molecule with specific membranes is a generic feature of the delivery of drugs into the cell. Therefore, manipulating the structure and properties of cell membranes may be a key to numerous applications in the biosciences, pharmaceuticals, and biotechnology.

In general, biomembranes represent complex self-assembled structures consisting mainly of lipids and proteins. Due to their complexity, most experimental studies have focused on simplified model lipid bilayers. This work has successfully been complemented by atomic-scale

computer modelling that provides unprecedented molecular-level insight not accessible through experiments. Importantly, over the past few years, there has been significant progress in this field and molecular modelling has become an irreplaceable tool for studying biomolecular systems.

Here we highlight some recent developments in the area of atomistic computer simulations of biological membranes. These include computational studies of pore-mediated ion leakage across protein-free phospholipid membranes [1-3], simulations of asymmetric phospholipid membranes [4-6], *in silico* observations of lipid transmembrane translocations (flip-flops) [7-8], the molecular-level insight into the interactions of phospholipid membranes with salt ions [4,9,10] and with small amphiphilic solutes such as dimethylsulfoxide [11], and atomistic computational studies of cationic lipid membranes as novel non-viral vectors for DNA delivery [10,12]

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EVIDENCED BASED TREATMENT OF OPIOID DEPENDENT PATIENTS: TREND TOWARDS DIVERSIFICATION

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Both clinical experience and neurobiological evidence indicate that opioid dependence is a chronic relapsing disorder. Treatment objectives depend on the pursued goals: crisis intervention, abstinence-oriented treatment (detoxification and relapse prevention), or agonist maintenance treatment. The high quality of solid evidence in the literature demonstrates that there are numerous effective interventions available for the treatment of opioid dependence. Crisis intervention, frequently necessary due to the high rate of overdoses, can be effectively handled with naloxone. Abstinence-oriented interventions are effective only for a minority of motivated patients in stable living conditions who have adequate social support. Agonist maintenance treatment is considered the first line of treatment for opioid dependence (Haasen & van den Broink 2006). Efficacy has been shown in numerous studies for methadone and buprenorphine treatment, while maintenance with other agonists – slow release morphine, codeine, diamorphine – is also becoming available to a greater extent. The German randomized controlled trial on

diamorphine maintenance treatment has demonstrated superior efficacy compared to methadone maintenance treatment for severely dependent opioid addicts, thereby confirming similar results from Switzerland, the Netherlands and Spain (Haasen et al. 2007). Maintenance treatment with diamorphine should be made available for the small group of treatment resistant severely dependent addicts, while other harm reduction measures can serve to engage those opioid addicts not in treatment (van den Brink & Haasen 2006). In conclusion, opioid dependence is a chronic relapsing disease that is difficult to cure, but there are very effective treatments available to stabilize them and reduce harm, thereby increasing life expectancy and quality of life.

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ASTRONOMY IN THE 21ST CENTURY: MACRO VERSUS MICRO SCALES

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In my talk I would like to illustrate how some complicated questions arising in laboratory experiments on the Earth can be answered through astrophysical investigations. The subject of my presentation is X-ray pulsars. There objects were discovered at the end of the last century (about 40 years ago). They are rotating magnetized neutron stars in close binary systems. A total number of neutron stars in our Galaxy is expected to be about a billion. These are the most compact objects in the Universe. Actually, a neutron star of 10 km size can be considered as a single nucleus containing 10^{53} nucleons. It possesses tremendous gravitational potential and extremely strong magnetic fields on the surface and, therefore, appears to be a unique laboratory to study matter under extreme conditions providing us with information on macro and micro processes in astrophysical plasma.

The period of a dozen from a hundred presently discovered X-ray pulsars exceeds a few hundred seconds. As shown in paper [1], there objects (usually referred to as long-period X-ray pulsars) are a product of complicated magneto-rotational evolution of neutron stars on a time scale of a few millions years. One of the key factors which determines the evolutionary tracks of these objects is the mechanism of interaction between the stellar magnetic field and the surrounding material. As shown in [1], the existence of the long-period X-ray pulsars suggests that the magnetospheric boundary of these stars remains stable with respect to interchange-type plasma instabilities on a very long time scale. This result has a number of useful consequences for astrophysics as well as plasma physics. In particular, it represents an indirect justification that the commonly used theoretical approach to explanation of plasma instabilities is basically correct. Moreover, it shows that physical conditions in which the interchange instabilities of the boundary separating magnetic field and high-temperature plasma are suppressed can be realized in the nature. Finally, it emphasizes a important role of other type of plasma instabilities in the processes of energy release which can be realized in the laboratory experiments. As shown in paper [2], an application of methods developed for studies of the long-period pulsars to isolated neutron stars allows us to solve a number of other puzzling astrophysical problems. In particular,

it provides us with a natural explanation of a lack of success in searching for the old accreting isolated neutron stars in the nearby vicinity of the Sun.

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DEVELOPMENT OF COMPLEX GENE-THERAPY MEDICATION FOR REPARATION OF WIDE SPECTRUM OF TISSUE DAMAGES.

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Naked plasmid DNA injected into skeletal muscle is taken up by muscle cells and the genes in the plasmid are expressed. Among the non-viral techniques for gene transfer in vivo, this method is especially simple, inexpensive, and safe. However, the relatively low expression levels attained by this method have limited its applications for uses. We develop original method based on nucleotide sequences gene optimization for high gene expression in plasmid. This effect was also demonstrated in vivo on mouse (BALB/C) model. It was shown that in vivo expression of synthetic VEGF, EGF, FGF genes increased in comparison to that of native sequences near 7-10-fold. The results demonstrated that synthetic gene transfer into muscle is far more efficient than DNA injection of native genes and provides a potential approach to systemically delivering growth factors for basic research in human gene therapy in the field of tissue regeneration.

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INVESTIGATION OF BETA-1 ADRENO-BLOCKERS ON THE GROWTH OF RETINA TISSUE EXPLANTS

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Using the method of organotypical cell culture the effects beta-1 adreno-blockers and noradrenalin on the growth of retina tissue explants of 10-12 day old chicken embryos were investigated. The data obtained shows that the application of beta-1 adreno-blockers metoprolol (from 10^{-10} М to 10^{-4} М), and atenolol (from 10^{-8} М to 10^{-4} M) affects the growth of retina tissue explants within these wide concentrations ranges. Noradrenaline was investigated in the range of concentrations from 10^{-12} М to 10^{-9} М. In maximal concentration (10^{-9} М) noradrenaline totally inhibited the growth of retina tissue explants. After application of noradrenaline in low concentration (10^{-12} М), a statistically significant stimulating effect of $40\pm2\%$ (n=25; p<0.05) was registered for explants growth. For the first time, it has been shown that atenolol (10^{-6} М and 10^{-4} М) has a stimulating effect on the growth of retina tissue explants (34% and 43%, correspondently). Metoprolol (10^{-6} М and 10^{-4} М) inhibited the growth of the retina explants. Its application in the concentration of 10^{-8} М had no effects. Combined application of noradrenaline 10^{-12} М and atenolol 10^{-4} M resulted in a summation of the effects. Simultaneous application of noradrenaline (10^{-12} М) and metoprolol (10^{-8} М) lead to an increase in retina cell tissue growth of 37%. It is tempting to suggest that the existence of a stimulating effect of noradrenaline, in this case on explants of 10-12 days old chicken embryos, is due to its binding to the other types of adrenoreceptors of retina tissue.

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POSSIBLE MECHANISMS OF NOCICEPTIVE SIGNALS CODING: ROLE OF SLOW SODIUM CHANNELS

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Hodgkin-Huxley type model of the nociceptive neuron membrane was developed with special reference to the description of the slow sodium channels characteristics ($Na_v1.8$). These channels are responsible for the generation of higher level frequency firing which transfers information about the painful stimuli. The characteristics of slow sodium channels were approximated using patch-clamp experimental data. Taking into account of $Na_v1.8$-channel slow inactivation allowed us to reproduce on the model the phenomenon of nociceptive neuron membrane adaptation to maintained stimulating current and to describe the range of adequate and painful stimuli.

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SYNTHESIS OF SIX-BAR PATH GENERATORS

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The paper presents the problems of analitical-optimization synthesis of six-bar linkages having two motionless hinges. There are three types of such linkages consisting of dyads: Stephenson-I and two variants of Watt-I mechanisms. Each mechanism has two working couplers; accordingly the total number of possible kinematic diagrams of path or moving generators is six. Each of these six-bar linkages has 15 constant parameters of its kinematic diagram, and also several additional parameters: value of initial angular coordinate of an input link, signs of mount assembles for both dyads, etc.

The initial data for the mechanism synthesis are N triplets of numbers: $\{x, y, \varphi\}$, where x and y are coordinates of a point on the given trajectory, φ is corresponding value of an angle of an input link relative rotation. The principal condition of synthesis is a reproduction by the synthesized mechanism the required motion of a coupler point along the given trajectory. Quality of the principal condition realization is estimated on the maximal deviation from the given curve. Additional conditions of synthesis are some constructive restrictions and also a condition of favorable movement transfer in the synthesized mechanism.

The synthesis problem consists in definition of all kinematic diagram constant parameters values which are shared on assigned, varied and calculated. Four link sizes which set the base four-bar kinematic chain concern to assigned parameters only. The suggested synthesis algorithm is executed stage by stage and based on use of original interactive and analytical techniques.

For definition of varied parameters the technique named «Automatic Scanning of Coordinates» [1] is used. The technique is intended for interactive numerical search for a minimum of an implicitly given functions complex. Generally these functions depend of two searching (scanning) parameters. The method is based on automatic narrowing of scanning area in a zone of the found minimum with simultaneous reduction of scanning parameters steps. Results are visually represented on the personal computer display as the rectangular form histogram consisting of cells, each of which corresponds to a knot of scanning grid. Color of each cell shows a degree of realization of the synthesis principal and additional conditions.

For definition of calculated parameters the analitical-optimization technique named «Synchronous Motion of Points» [2] is used. The method is based on a known problem of a circular least-squares point searching. For cases when one of a synthesized kinematic chain link has a motionless hinge, the problem was reduced to one equation of the ninth degree in length of this link. The method allows finding up to five unknown parameters of a synthesized chain.

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DISTRIBUTION OF SYLLABO-TONICISM IN EARLY MODERN EUROPEAN VERSE[i]

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Syllabo-tonic versification appeared during the 17th and 18th centuries in the literary poetry of most European countries. Its main principle is the regular alternation of strong and weak positions in a line of verse (such as iambic or trochaic verse). This new system replaced the earlier syllabic and purely tonic versification.

Of particular interest is a study of distribution of this new versification from West to East, from Dutch to German and later to Russian poetry[2]. An important research component is the study of the influence of Dutch and German iambic verse on later European poetry. The Dutch experience at the end of 16th and the beginning of the 17th century had a revolutionary effect on the history of verse. It influenced the development of German syllabo-tonicism. The formation of iambic verse in Russian 18th century literature owes much to the influence of German and, possibly, Dutch verse[3].

It is necessary of investigate the typology of the mechanisms in the formation of the syllabo-tonicism in closely related languages, such as Dutch and German, and more distant languages like German and Russian. In the course of research the hypothesis that language similarity does not predetermine a similarity in versification mechanisms was put forward and has so far been confirmed: versification in closely related languages (Dutch and German) may be quite different, and in more distant languages (German and Russian) it can be similar.

Daniel Heinsius, a Dutch poet and philologist from Leiden, was the founder of the theory of syllabo-tonic in the Netherlands. Later, apparently under his influence, Martin Opitz developed a similar theory and practice in Germany. Many researchers acknowledge a Dutch influence on the work of German authors. But the formal aspects of this influence have not been closely studied. The study of this relationship conducted by us yields interesting results.

Samples of German (by M. Opitz) and Dutch (J. Vondel) iambic tetrameter from the beginning of the 17th century display the same tendency: intensification of the third ictus stress in comparison with the second. This tendency is even stronger in German iambics; it sets Opitz's versification apart from later German verse.

Moreover we can find similar traits in the evolution of Dutch and German iambics. By the mid 17th century another tendency can be observed. It leads to rhythmic alternation: a decline in the stressing of third ictus in comparison to the second. This is accompanied by the decline of the stressing in the first ictus. This tendency can be seen in Dutch, as well as in German poets in the same period, which leads to the hypothesis that early German iambics developed under the influence of Dutch sources. It is likely that German authors borrowed from Dutch not only the metre (iamb), as was thought, but also its rhythmic structure. Nevertheless results of research show that similar tendencies in German verse could arise not only under the influence of foreign sources, but also within the framework of the national language[4].

The analysis of the rhythmic structure of verse has to be carried out with the help of a formal (quantitative) method. This study is based on the so-called "Russian method"[5]; the scholars in this circle include Andrej Belyj, Boris Tomashevskij, Andrei Kolmogorov, Mikhail Gasparov, Marina

Krasnoperova and others. M. Krasnoperova is the author of the theory of reconstructive simulation of versification which forms the methodological basis of the present research[6]. The application of this method makes possible a comparative studying of deep versifications mechanisms in different languages.

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ROLE OF OUABAIN IN REGULATION GROWTH OF DIFERENCE TISSUE
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Using the method of organotypical cell culture experimental data on explants of liver and cardio tissue of 10-12 days old chicken embryos was obtained supporting the hypothesis that chelate complex ouabain-Ca^{2+} modulates the transducer function of Na^+, K^+-ATPase. The experiments were made on 330 explants of liver and 300 explants of cardio tissue. Ouabain were investigated in a wide range of concentrations from 10^{-4} M to 10^{-11} M, EGTA from 10^{-5} M to 10^{-2} M. Ouabain (10^{-8} M) totally inhibiting the growth cardio tissue explants, in the dose 10^{-6} M steroid blocked the growth liver explants. The growth cardio tissue explants ouabain (10^{-10} M) stimulated on 33%. EGTA (10^{-3} M) inhibited on 45% the growth both tissues. After the cultivation in media involved ouabain (10^{-6} M) and EGTA(10^{-3} M) we obtained the growth liver explants was totally inhibited. The investigation of influence of ouabain (10^{-8} M) and EGTA (10^{-3} M) on the growth cardio tissue we reiterated control result. These results suggest that for modulation transducer function of Na^+, K^+-ATPase necessary complex of oubain-Ca^{2+}. Removal of free Ca^{2+} ions from the cell culture media has no effect on the pump function of Na^+, K^+-ATPase.

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MICROSTRUCTURES OF SCALAR TURBULENT FIELDS

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At high Reynolds numbers *Re* (ratio of inertial forces to viscous ones) the turbulent fields consist of many vortex structures of different scales. The largest vortices are comparable with the macro sizes of the flow. The smallest vortices are the vortices discovered in a famous theoretical paper written by Anrey Kolmogorov in 1941. The theory called as K41 predicts that the ratio of largest vortices to smallest ones is proportional to $Re^{3/4}$. For instance, the smallest vortices in the pipe flow of the diameter 0.1 m at relatively low Reynolds number 10^4 are of the order of 0.01 mm whereas the largest ones are about a few cm. When the scalar turbulent fields are considered the flow is more complicated. Scalar fields can be created by injection of any scalar carrier (dye, salinity, temperature, etc.) into the turbulent flow. As shown by Batchelor the smallest scalar structures are 30 times less than smallest Kolmogorov vortices. These estimations show the difficulties of turbulence modelling. The theory of the developed turbulence has to describe the whole range of structures and their strong nonlinear interaction. A detailed experimental study of these structures became possible in the last two decades when the non intrusive methods of flow laser diagnostics such as PIV (particle image velocimetry) and LIF (laser induced fluorescence) have been developed.

Figure. Sample of the scalar turbulent field. LIF measurement [1].

The main focus of the present paper is the study of fine structures of passive scalars in the liquid phase using highly resolved PLIF (planar laser- induced fluorescence) measurements. The study measurements were performed with the spatial resolution 31*?m* and the time resolution 10 Hz..

From evaluation of LIF data the scalar dissipation rate and its statistical properties are calculated and analyzed. Special attention is paid to study of multifractal nature of the scalar dissipation field. Another important aspect is the study of isotropy. Results of the present experimental investigations are important for the further development of turbulence models. They also can be used for estimation of mixing efficiency in various mixer devices used in chemical and food industry.

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PATRONAGE AND CLIENTELE IN EARLY MODERN RUSSIA: A COMPARATIVE RESEARCH IN EUROPEAN CONTEXT

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The proposed paper deals with a phenomenon which has so far attracted little attention of the scholars: the problem at issue is an informal system of protection (patronage) which existed in the 16th- and 17th-century Russia. Informal relations in any society remain in obscurity but they can be detected in private correspondence and other unofficial texts. The 16th- and 17th-century private letters explored by the author provide some insights into every day activities and power relations in Muscovy before Peter the Great. The agenda of the present research includes studying the language of patron-client relations, as well as forms and functions of patronage at that period. Comparing this phenomenon to its analogues in other European countries, the author comes to a conclusion that patronage in the West and in the East of Europe had many features in common, although its Russian variant lacked some political forms and functions which were essential for the French or British systems of patronage in the seventeenth century.

(In 2007, this research was supported by Alexander von Humboldt Foundation).

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A DOUBLE-BLIND, PLACEBO CONTROLLED RANDOMIZED CLINICAL TRIAL OF LONG ACTING IMPLANTABLE FORMULATION OF NALTREXONE (PRODETOXONE) FOR HEROIN DEPENDENCE: RESULTS OF INTERIM ANALYSIS

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Heroin addiction and HIV have spread rapidly in Russia during the last ten years. Agonist treatment is not permitted but naltrexone is approved for use. The major problem with oral naltrexone formulation is suboptimal compliance. Long acting sustained release formulations of naltrexoxne (injectable or implantable) might improve compliance and in turn increase efficacy of heroin addiction treatment.

Aim: To test the efficacy of long acting surgically implantable formulation of naltrexone (Prodetoxone) vs. oral naltrexone and placebo for relapse prevention to heroin addiction.

Methods: 190 heroin addicts who recently completed detoxification at addiction treatment units in St. Petersburg, Russia and gave informed consent were randomized to a 6 month course of biweekly drug counseling and one of three medication groups: Naltrexone implant (every other month) + Oral placebo daily (NI+OP) (66 subjects), Placebo implant (every other month) + Oral naltrexone (PI+ON) (50 mg/day) (62 subjects), and double placebo (implant and oral) (PI+OP) (62 subjects). Medications were administered under double-dummy/double-blind conditions. Urine drug testing and brief psychiatric evaluations (depression, anxiety, anhedonia, and craving for heroin) were done at each biweekly visit with more extensive evaluations at 3 and 6 months. Oral medication compliance was evaluated using a urine riboflavin marker.

Results: 218 patients were asked if they would be interested in participating, 207 met the study entrance criteria, 192 gave informed consent and 190 were randomized. Kaplan –Meier survival analysis revealed a significantly greater retention in NI+OP group compared to two other groups (p<0.001). At the end of six months 54.5% of patients of NI+OP group had not relapsed compared to 17.7% in PI+ON group and 12.9% in PI+OP group (p<0.001). No differences in the number of heroin positive urines or either one of psychometrics between groups were found. Treatment effectiveness score summarizing both heroin positive and missing urines was significantly better in NI+OP group. The number of side effects was limited with no difference between groups. The number of surgical complications (basically wound infections) was slightly higher in NI+OP group.

Conclusion: Long acting sustained release naltrexone implant is safe and more effective than oral naltrexone and placebo for treatment retention and relapse prevention to heroin dependence.

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NEW APPROACHES FOR TREATMENT OF PATHOLOGICAL PAIN

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Nociceptive system as a physiological sensory system processes information using consecutive stages which involve recognition (detection) of a noxious stimulus, its ñoding and the transmission of that information to the brain. For most of us, pain is temporary, the perception of a transient sensory experience induced by noxious (damaging) stimuli. However, for patients with pathological pain, the pain experience is unending, with little hope for therapeutic relief. Many diseases are commonly accompanied by such pathological pain, which can become chronic and are often unresponsive to conventional analgesic treatment. Pathological pain can also be characterized as an amplified response to normally innocuous stimuli, and an amplified response to acute pain. Nociception is an evoked response specific to tactile-, chemo-, and thermo- tissue receptors that occurs when the level of stimulation (mechanical, thermal or chemical) applied exceeds its physiological capability and become damaging (harmful).

Nociceptive dorsal root ganglion neurons (small neurons with high density of tetrodotoxin-resistant TTXr sodium channels) were investigated using whole-cell patch-clamp method. It was shown that in the membrane of a sensory neuron exists a signaling pathway that involves three neighboring molecules: opioid-like membrane receptor, sodium pump as a signal transducer and TTXr ($Na_v1.8$) channel [1]. Each of these membrane molecules is a putative pharmacological target controlling nociceptive signal detection and coding.

Results obtained by pharmacological approach show that gamma-pyrone derivatives can be very effective substances in modulating nociceptive signals due to activation of the described membrane mechanism. The physiological data obtained in our *in vitro* and *in vivo* experiments show that their analgesic action is very specific and is not accompanied by harmful side effects.

The second approach based on the membrane mechanism under discussion is the application of low-power infra-red (IR) irradiation for pain relief. Our patch-clamp experiments have shown that low-power IR irradiation could diminish the effective charge transfer in the activation gating system of TTXr channels. This effect depends on the wave length. Resonance response is found for the $\lambda = 10.6$ mkm, which was generated by a CO_2 laser. The effect was blocked by ouabain, the specific blocker of the sodium pump. The data presented here confirm the prediction that Na, K –ATPase is strongly involved in the process of nociceptive signal coding. The obtained results have implications in the fields of chronic pain treatment using lower-power laser therapy which is also of the great importance for practical medicine. Clinical application of these two approaches could result in the relief of peripheral pain syndromes of various etiologies.

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ROLE OF ADSORBATE SOLVATION AND REACTIVITY IN GAAS(100) SURFACE PASSIVATION AT SEMICONDUCTOR/ELECTROLYTE INTERFACE

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With decreasing size of the active regions of semiconductor devices the importance of methods for chemical and electronic passivation of semiconductor surfaces increases. A central issue thereupon is the reduction of semiconductor surface reactivity. Our research focuses on connecting the atomic structure and electronic properties of passivated semiconductor surfaces with chemical reactivity of adsorbates. A way to achieve this is consideration of chemical and electronic processes at semiconductor/electrolyte interfaces because the reactivity of the adsorbate prior to its adsorption can be changed considerably through interaction with solution species (solvent molecules, ions).

As it was shown by quantum-chemical calculations, reactivity of solvated anions (e.g. HS^-, Cl^-, CN^-) depends essentially on composition of the solvation shell. In particular, the hydrated ion could be slightly electrophilic, whereas the ion solvated by alcohol molecules is strongly nucleophilic. In this connection, the model for interaction of anions solvated by different solvents with GaAs(100) surface is proposed. According to this model, the nucleophilic and electrophilic ions solvated by alcohol and water molecules, respectively, would interact with different sites and at semiconductor surface forming thus surfaces with different atomic and electronic structures.

Experimentally this model was verified by the example of GaAs(100)/sulfide solution interfaces. The HS^- ions were adsorbed on a surface from different solvents (water and various single-based alcohols). It was found that such an adsorption results in formation of As–S bonds with solvent-dependent ionicity. Besides, these surfaces possess different ionization energy, which depends on solvent where adsorption was proceed; though no traces of solvent molecules are found in XPS spectra. After adsorption of sulfide-ions solvated by different solvents, the electronic properties of semiconductor surfaces become strongly dependent on solvent, as was demonstrated by Raman scattering spectroscopy and photoluminescence. The experimental results obtained agree well with the predictions of the model.

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HIGH SPEED DATA COMMUNICATIONS: ENERGY CONCERNS AND NANOTECHNOLOGY SOLUTIONS

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There is a continuous increase in bandwidth demand in the modern fiber optic data networks. Furthermore, at speeds ~10Gb/s, which are becoming common for the mainstream applications at short and medium distances, already 10 m-long copper links suffer from

significant power dissipation. Thus a broad penetration of optical cables at very short distances is happening right now.

Transceivers based on t quantum well (QW) Vertical Cavity Surface Emitting Lasers (VCSELs) are traditionally used in the very short reach (<300m) optical networks. QW VCSEL, representing a micro-resonator device, is characterized by low power dissipation, while being highly reliable and cost efficient transmitter. Low power consumption of VCSELs is a must for applications in datacenters, which already absorb 1.5% of the total electricity produced in the USA in 2006 (the consumption doubles each 5 years).

At the same time continuous silicon scaling resulted in a dramatic input-output (I/O) bandwidth demand for the processor chips. Signaling rate of 27Gb/s is required for chip-to-chip electrical signal transmission to address memory and peripherals for the 45 nm node. Furthermore, data speeds of 17 and 20Gb/s are on the roadmaps of Fibre Channel standard for Storage Area Networks and Infiniband interconnect standard, respectively.

Surprisingly, QW VCSELs appeared to be not reliable at transmission speeds significantly above 10Gb/s, and there is a quickly growing bandwidth bottleneck, which is already taking its tall in numerous key applications and causing delays in standardization schedules.

Quantum Dot (QD) lasers were first demonstrated in 1993 [1]. Since that time advantages of a complete three-dimensional quantum confinement of carriers in QDs were properly understood allowing several strategic device applications [2].

We will explain how Quantum Dot nanostructures can provide a solution to this dramatic challenge in modern datacommunication industry.

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SNP-INDUCED RELAXATION IN LYMPHATIC VESSELS OF BOVINE MESENTERY

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It was shown previously that the presence of spontaneous conrtactility vasomotion in lymphatic vessels of bovine mesentery. Smooth muscle cells (SMC) of lymphatic vessels produce regular spontaneous contractions which provide a leading mechanism of lymph flow. Previous data were demonstrated that smooth muscle of bovine mesenteric lymphatic vessels generated small spontaneous transient depolarizations (STDs) and larger action potentials (APs) with a long plateau, which initiate spontaneous phase contractions. The endothelium plays an important role in modulating lymphatic pumping through the release of nitric oxide (NO) and

others substances. The aim of this work is to examine the effect and mechanism of action of NO donor on electric and contractile activity of lymphatic smooth muscle in vitro.

Our study was performed on ring segments in the width 1 mm and whole lymphangions of bovine mesenteric lymphatics in diameter 1 - 1,5 mm. Contractile and electric activities of smooth muscle cells were recorded with using of the mechanoelectrical transducer and by method of single sucrose gap.

We show here that sodium nitroprusside (SNP) in wide range of concentrations (10^{-9}- 10^{-3} M) caused decrease of frequency and amplitude of phasic contraction of smooth muscle cells up to complete arrest of spontaneous phasic activity. Tone of lymphatic vessels was slightly decreased. Suppression of electric activity of smooth muscles was shown as hyperpolarization and decrease velocity of STDs. Frequency, amplitude and duration of action potentials were decreased in dose-dependent manner synchronously with contractile activity.

Ring segments of lymphatic vessels precontracted with a high concentration KCl (40 mM) relaxed in response to SNP. Pretreatment of lymphatic vessels with soluble guanililcyclase inhibitor, methylene blue (10^{-5} M) caused significant reduction of SNP-induced relaxations in the precontracted lymphatic vessels. SNP-induced hyperpolarizations were inhibited (by about 85%) upon application of the ATP-sensitive K^+(K(ATP)) channel blocker, glibenclamide (10^{-5} M).

These results suggest that NO produced by the perfusion physiological solution with SNP was able to decrease the tonic contraction of lymphatic vessels and inhibit their spontaneous phasic activity. This effect was associated with a hyperpolarization of smooth muscles and decrease magnitude of STDs and action potentials. SNP-induced inhibition of lymphatic pacemaker and contractile activity occurs in the following sequence: SNP > NO > soluble guanylyl cyclase > cGMP > ATP-sensitive K^+ channel > increase output K^+ from a cell > hyperpolarization of cell membrane > reduction of an input Ca^{2+} and Ca^{2+} release from intracellular stores > relaxation SMC lymphatics.

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ENDOGENOUS OUABAIN CONTROLS ANALGESIC FUNCTION OF SODIUM PUMP

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It is well-known that sodium pump is the regulator of cell metabolism and sodium-potassium exchange. But it was found previously that the sodium pump of mammalian sensory neuron was also involved in the mechanism of membrane signalization as a signal transducer (Krylov et al., 1999). This function is fulfilled by Na/K-ATPase as an intermediate chain inserted

among opioid-like receptor and tetrodotoxin-resistant ($Na_v1.8$) sodium channel. The simple consequence of this finding is a prediction that endogenous ouabain should directly affect Na/K-ATPase. The sodium should transduce this signal to slow sodium channels responsible for nociceptive signals cording. Investigation of this membrane mechanism should disclose the analgesic properties of endogenous ouabain. The prediction was tested at three levels with an extremely low (endogenous) concentration of this substance. At the membrane level in patch-clamp experiments it was shown that ouabain (1 nM) decreased the effective charge transfer in activation gating system of slow sodium channels ($Na_v1.8$) responsible for cording of nociceptive signals. Ouabain (in the same concentrations) strongly controls the sensory neurite growth of organotypical cell culture (tissular level of investigations). And, finally, it is shown by *in vivo* inflammatory pain test experiments on rats that ouabain (0,3 mg/kg) has pronounced analgesic and sedative effects at spinal and supraspinal levels.

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LENTIVIRUS AS A TOOL FOR LINEAGE-SPECIFIC GENE MANIPULATIONS

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The trophectoderm (TE) of blastocysts, the first epithelium established in mammalian development, (1) plays signaling, supportive, and patterning functions during preimplantation development, (2) ensures embryo implantation into the uterine wall, and (3) gives rise to extraembryonic tissues essential for embryo patterning and growth after implantation. We show that mouse TE, itself permissive to lentiviral (LV) infection, represents a robust nonpermeable physical barrier to the virus particles, thereby shielding the cells of the inner cell mass from viral infection. This lentiviral feature will allow modulations of gene expression in a lineage-specific manner, thus having significant applications in mouse functional genetics.

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LONG-TERM FATE TRACING OF CELL POPULATIONS IN LIVING EMBRYOS USING TRANSGENIC ANIMALS"

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In early 70s of the XX century quail-chick chimeras (the method suggested by Nicole Le Douarin) became an innovative tool for mapping the fate of individual cell populations in the avian embryos and later led to important discoveries of the embryonic origin of all major organs in this model system. Recent decade has seen a dramatic increase in the interest to the embryonic origin of organs and tissues in other models of developmental biology. This interest was technically supported only with relatively relevant tools like injection of lipophilic dyes DiI and DiO, and later on more powerful tools, like injections of fluorescent dextran conjugates, and retroviral infections. Disadvantages of these methods were either quick disappearance/weakening of the marking signal due to dissolving of the injected material in the course of cell divisions, or inability to mark precisely the tissue (organ) of interest. Thus, they either could not provide enough longevity for the marking, or could not allow absolute exactness of marking. Most recently, the lentiviral infections and transplantation of tissue from the transgenic donor to the wt host became the symbols of a renaissance of the long-term fate mapping of embryonic, especially muscular and skeletal, tissues. Transgenic technologies along with the involvement of fluorescent marking with GFP, RFP/dsRed, Cherry proteins provide a very useful tool for such a kind of research, since they allow combination of exact tissue transplantation with life-long marking. Additionally, they provide a unique opportunity to trace the pathways of the migrating cells in vivo. In this talk I present several examples of use and disuse of those methods from my own experience and the work of others, particularly in the studies of neural crest and mesoderm fate mapping in amphibian and avian embryos.

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RECENT ACHIEVEMENTS IN THE FIELD OF QUANTUM DOT LASERS

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Self-organised Quantum Dots (QDs) are very advantages as active medium for a variety of semiconductor optoelectronic devices. Some unique properties of QD lasers like ultralow threshold current density and its high temperature stability had been predicted in theoretical works in 80s but their experimental demonstration became possible much later owing to continuous improvement in material quality and device design. At present the performance of traditional QD devices (distributed feedback lasers, mode locked lasers, vertical cavity surface emitting lasers, amplifiers, etc.) is rapidly improving and new exciting applications like low noise comb QD lasers emerge. In this paper we report on recent results in the filed of various quantum dot optoelectronic devices. We will mainly focus on 1.2-1.3 μm lasers on GaAs substrates.

High power operation. The QD lasers show high differential quantum efficiency, a record value of h_{dif}=88% for 1.8 mm long broad area lasers is achieved. Temperature independent performance is demonstrated from -20? to 90?C in devices with p-type modulation doped active region. Maximal output power for a 150 ?m wide device exceeds 11 W at room temperature in continuous wave (CW) mode. Single mode lasers show CW output powers >700 mW.

Reliability. Ridge-waveguide lasers have been subjected to accelerated ageing at 65 and 85^0C. No sudden failure was found during 2070 h test. Activation energy of 0.79eV was estimated suggesting the 40^0C lifetime > 10^6h.

Directly modulated QD lasers. Low threshold current density, low temperature sensitivity and high modulation speed make 1.32 µm distributed feedback (DFB) QD lasers very attractive as light sources for telecom applications. Threshold currents below 19 mA for operating temperatures up to 70?C and output power of 10 mW at 25?C (6 mW at 70?C) are obtained. Error-free 10 Gbit/s transmission over 21 km fiber with an extinction ratio of 8.5 dB at room temperature (5.1 dB at 70?C) is demonstrated. Thus, directly modulated uncooled QD DFB lasers are very promising for cost-effective telecom applications in the entire 1.3 µm band as required for short and medium distance metropolitan networks.

Widely tunable lasers. A tuning range exceeding 160 nm at a central wavelength of 1200 nm is demonstrated for QD gain chip in external cavity configuration at operation currents above 1 A. Output powers exceeding 200 mW are achieved in this spectral range in single spatial mode regime.

Low noise comb-lasers. Individual modes of a Fabry-Perot QD laser can be used as independent optical channels for Dense Wavelength Division Multiplexing. Ten longitudinal modes of a QD laser emitting near 1265 nm were sifted out using a tunable filter and each of them was independently tested. Relatively intensity noise of a mode was less then 0.3% in the 0.001-10GHz frequency range. Each mode after spectral filtering was modulated at 10Gb/s by a 2^{31}-1 pseudorandom binary non-return-to-zero sequence using external $LiNbO_3$ modulator. A bit error rate less than 10^{-13} was measured for an individual mode. Thus, an edge-emitting QD laser can serve as compact and cost-effective optical source for high bandwidth parallel optical interconnects.

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RECONSTRUCTING THE NEW FRAGMENT OF PLINY THE ELDER'S *DE DUBIO SERMONE*

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The paper deals not so much with the new instruments of the scientific research as with the results of an investigation, where these instruments have been used. When reconstructing an ancient literary or scientific work, the researcher must pay particular attention to the lexical means used by a certain ancient author. The terms proper to the author reveal often a particular manner to approach the subject discussed. It is necessary, however, to collect many samples by later authors, where a lot of related terms appear. Our material would be not representative

enough, and some important link would be lacking, if we could not use the modern electronic search.

Charisius, Roman grammarian of the 4th c. A.D., presents in his great treatise many theories of verbal voices, which he has found by predecessors. No one of these theories has been attributed surely to any known Roman grammarian. It seems, we can now attribute the earliest theory to Pansa (1st c. B.C) or to some contemporary, the second theory to Remmius Palaemon (1st c. A.D.) with much probability, the third to Pliny the Elder (23/24-79 A.D.) and the forth to Terentius Scaurus (floruit 117-138 A.D.).

The theory, which we attribute to Pliny, distinguishes only three voices 'activum', 'passivum', 'habitivum' (Char. 211.25 ff.). No attention is payed to the forms of verbs, only their signification is observed. The particular meaning of the inner process is attributed to the voice called 'habitivum', the term calling to the mind the stoic notion of 'hecton'. This daring approach to the grammatical matters, the use of ontological categories in the grammar let us think of the manner proper to Plinius the Elder. Indeed, the grammarian Pompeius Maurus (5th c. A.D.) refers to Plinius, as he explain, how the species of the verbal voices can be reduced to two principal voices, the active and the passive (GL V 227.25). It is to be remarked, that the most of the Roman grammarians distinguished at least fives voices. When exposing the opinion of Plinius, Pompeius uses a particular Latin term 'abusive' (i.e. "not in the proper sens", GL V 227.31), its Greek model 'katachrestikos' is to be seen in the paragraph in question of the manual by Charisius (213.19 B.).

Consentius, another grammarian of the 5th c. A.D., reproduces the theory of three voices nearly as faithfully, as Charisius does (GL V 365.29 ff.). He uses another term proper to the technical vocabulary of Plinius: "extrinsecus" (366.9-11). The use of this term by Plinius is well testified by Palladius in the chapter on the pronoun (GL IV 137.11-13).

THE TECHNIQUE OF THE 21ST CENTURY FOR THE TRANSPORT PROCESSES STUDY IN AN HUMAN INTESTINAL EPITHELIA

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The determination of absorption and membrane digestion of nutrients in humans, in general, and Na^+-dependent absorption, in particular, is elaborated methodically insufficiently. These facts are an obstacle to both modern clinical diagnostics of malabsorption and development of correcting diets. The method of measurement of Na^+-dependent nutrient absorption by measuring the short-circuit current (SCC) response amplitude upon addition of these substances in a mucosal solution is a widely used method [1].

We have essentially improved a SCC technique. The following parameters may by derived from a single SCC response on nutrient addition [2]: (i) SCC response amplitude (A) in $\mu A/cm^2$ (as usual) and two new values, introduced by us: (ii) relative initial velocity of effect development (α) in 1/s, determined as a ratio of initial velocity of effect development and response amplitude; (iii) relative initial velocity of effect wash-out (?) in 1/s, determined as a ratio of initial velocity of effect wash-out and response amplitude. Measurement of all three pointed out parameters characterizing the single response of SCC on nutrient addition allows to calculate kinetic parameters for sodium-dependent nutrient transport (Kt, Amax) and unstirred layer thickness in the vicinity of preparation surface (L):

$Kt = Cî /[v?(?/?) – 1]$; $\grave{A}max = A(Cî + Kt)/Cî$; $L = (? /2) \cdot v?D/ v?v?(? \cdot ?)$,

where Ñî - concentration of added nutrient, Êt - transport constant for nutrient, Àmax - maximal response amplitude of SCC, L - unstirred layer thickness, D - the diffusion coefficient for the added nutrient. Magnitudes of SCC responses on nutrients additions to mucosal solution (A) are used as a measure of Na^+-dependent nutrient absorption.

During the specimen (the biopsies obtained by gastrointestinoscopy) life time in Ussing chamber it is possible to measure both the kinetic parameters and the layer thickness at least for 5-10 nutrients (i.e. disaccharide, glucose, 2-3 amino acids and 5-6 small peptides). For the first time the nutrients absorption spectrum can be obtained for single preparation.

Thus, a method suitable for the study of the nutrients absorption spectrum and membrane digestion both in individuals and in a population was suggested for clinical diagnostic laboratory. This technique is the only one allowing to record online dynamics of absorption as well as: (a) diagnose impairments of molecular mechanisms of absorption; (b) select optimal dietotherapy for the patient; and (c) test drugs, both new and those already on the market.

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MODIFICATIONS OF HYPOTHALAMIC CRH AND VASOPRESSIN EXPRESSION IN DEVELOPMENT OF DEPRESSIVE-LIKE STATES IN RATS

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Numerous preclinical and clinical studies suggest that impaired hypothalamic-pituitary-adrenal (HPA) axis functioning may be involved in the pathophysiology of depressive disorders. According to one of the theories presumably explaining the mechanisms of depression, the reason of the HPA axis dysregulation and as a result, some core symptoms of this mental diseases, is located in the hypothalamus, secreted corticotropin-releasing hormone (CRH) and vasopressin – the main neuroendocrine effectors of the HPA system. But it is not obvious what changes of hypothalamic CRH and vasopressin synthesis and secretion might lay in the basis of the depression development. Animal models of depression have some advantages versus clinical studies in terms of finding out the neuroendocrine mechanisms underlying different types of depression.

The aim of the present study has been to examine a putative role of hypothalamic CRH - and vasopressin-producing centers in the development of depressive-like states in Wistar rats. Experimental models of different types of depression have been applied, including the "learned helplessness" and Time Dependent Sensitization (TDS) paradigms. The "learned helplessness" paradigm is considered to be one the most reliable models of melancholic (endogenous)

depression. TDS ("stress-restress" paradigm) is considered to be a valid model of post-traumatic stress disorder (reactive depression). Using immunicytochemistry changes in CRH- and vasopressin-immunoreactivity in the paraventricular nucleus of hypothalamus (PVN) were detected on the 1st, 5th and 10th days after the exposure of animals to footshock in the "learned helplessness" paradigm and to mild re-stress in TDS model.

Our findings indicate that:

1. The early stage of depressive-like state development in the models of major depression and PTSD applied is characterized by significant increase of CRH expression in the parvocellular PVN subdivision, suggesting to be the reason of HPA abnormalities observed.
2. Over-expression of CRH in magnocellular subdivision of PVN is implicated in the development of depressive-like state of reactive type but not of endogenous type one.
3. Hypothalamic vasopressin apparently is not involved in the early period of depressive-like state development in both animal models employed. Reactive depression development is accompanied by hyper-expression of vasopressin in magnocellular subdivision of PVN on the 10th day after resress exposure, suggesting its implication in the pathogenesis of PTSD in the delayed period.

In conclusion, our data give evidence about common and specific mechanisms of endogenous and reactive depression development and might be useful in working out new differential approaches in the therapeutic treatment of different types of depression.

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RISK-MANAGEMENT AS A SAFETY IN BANK ACTIVITY

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The substantial growth of volume and change of character of financial services forms recently the new demands to the risk-management in the banking sphere. It concerns not only western, but also the Russian banks, which basically paid attention to credit risk and risk of loss of liquidity. With change of a market situation in sphere of banking services, it is necessary to consider alongside with these risks also the market and operational risks. Supervision authorities, from their side, should pay also the big attention to an estimation of models on risks-management of bank and cooperate with banks with the purpose of achievement of public understanding of problems of banking risk-management. At the market-focused approach the attention of regulation authorities should be concentrated to stimulation of improvement of control systems by risk in banks.

The operational risk-management becomes the important modern practice of risk-management in financial institutions. The most noticeable appearance of the operational risk concerns to lacks of systems of the internal control and corporate management. Similar lacks can lead to significant financial losses owing to errors, swindle or untimely reaction. The threads of appearing of the operation risks are very high in the banking business. Basel Committee of

Banking Supervision marked, that according to the results of the analysis of activity of the sufficient number of the foreign banks, 20 % of all losses of these banks make charges on neutralization of losses from operational risks - and this level is rather high, in spite of the high professional and educational levels of foreign bank experts.

Interests of the company can be subjected to risk by actions of the personnel which exceeded the powers either has made unethical or risky acts. Other aspects of operational risk mention global failures in systems of information technologies and such events, as, for example, fires, failures and accidents.

The increased interest to management to the operational risk has led to increase in the budgets allocated for its measurement, monitoring and the control, and also over transfer of the responsibility for management of operational risk to newly formed or existing risk-management divisions.

The international bank regulators constantly take measures on improvement of risk-management procedures in the banks. One of last regulating acts is « International Convergence of Capital Measurement and Capital Standards: a Revised Framework», known among experts as Basel II. This regulating act influences on the risk-management of the Russian banks regarding development of strategy and the order of management of risks, especially on the risk-management of small banks.

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NEW FINDINGS OF EXTRAEMBRYONIC NUTRITION AND PLACENTAL ANALOGUES IN THE PHYLUM OF AQUATIC COLONIAL ORGANISMS (BRYOZOA).

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Bryozoa are a mainly marine phylum of invertebrate animals with a long fossil history stretching back to the Ordovician. Bryozoans form colonies that are frequently a conspicuous part of the sessile epifauna in many marine habitats, from the shallow intertidal to depths exceeding of 8000 m. They are suspension feeders, ingesting living and non-living particles from the surrounding medium. Many species are structurally significant in seafloor biotopes, forming bushy and coral-like growths that are ecologically important as habitats for a wide range of other organisms.

More than 6000 Recent species of Bryozoa are presently known, and up to 80% of species in modern bryozoan fauna belong to the order Cheilostomata (Class Gymnolaemata). At present, 40 families comprising about 100 genera of cheilostomates are recorded only from the northern seas, whereas in tropical and southern-temperate waters biodiversity of bryozoans is much more extensive.

Bryozoa are unique among invertebrates in possessing placenta-like analogues and extra-embryonic nutrition (EEN) in all major classes of this phylum. Extant representatives of both classes Stenolaemata and Phylactolaemata are placental, and the extra-embryonic nutrition has been recently discovered to be wide-spread within class Gymnolaemata too. There are few examples of the EEN among gymnolaemate order Ctenostomata. In the gymnolaemate order

Cheilostomata 18 families and 29 genera exhibit extra-embryonic nutrition. Comparative anatomical study showed that placental analogues occur within both external brood chambers (ovicells) and internal brooding sacs. Transport of nutrients from the maternal organism to the embryo is obviously combined with opposite transport of wastes from the embryo to its mother. Nourishment is by an absorbtion from the brood chamber liquid. Further ultrastructural research is necessary to show what cell-mechanisms are involved in the EEN.

New pattern of sexual reproduction involving the EEN has been recorded among gymnolaemates, suggesting possible scenario for the evolution of oogenesis and brooding in this group. The pattern of distribution of matrotrophy and reproductive strategies within the phylum strongly supports the idea of independent evolution of the EEN in all three bryozoan classes and possibly several times within both gymnolaemate orders. I speculate that extra-embryonic nutrition could confer an advantage to species with fast-growing ephemeral colonies, and that evolution of the variety of reproductive patterns contributed to the success of Bryozoa by offering a range of mechanisms for resource allocation, potentially increasing competitive ability of the group in general.

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DAS PROBLEM DES VERHALTNISSES ZWISCHEN DER WISSENSCHAFT UND DER TECHNIK IN DER PHANOMENOLOGISCHEN PHILOSOPHIE

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In der phanomenologischen Philosophie wird das traditionelle Verstehen des Verhaltnisses zwischen dem Begriff der Wissenschaft und dem der Technik wesentlich transformiert. Dem gewohnlichen Vorstellen nach erforscht die Wissenschaft das Allgemeine, das an sich selbst ist. Sie sucht dabei das zu erkennen, *was* und *wie* es eigentlich an sich selbst *ist*. Hingegen schafft die Technik das Einzelne, das zuerst nicht ist, sondern durch die technische Tatigkeit zu seinem Sein kommt. Seinerseits hat die Wissenschaft als Tatigkeit sein Ziel an ihr selbst, sondern die technische Tatigkeit hat sein Ziel au?er ihr selbst, und zwar in einem einzelnen zu schaffenden Gegenstand.

Dementsprechend wird die Wissenschaft traditionell als der Grund fur technische Tatigkeit behandelt. Es ist dabei zu bemerken, dass solche Behandlung durch die Umkehrung des Verhaltnisses zwischen der Wissenschaft und der Technik, die in der neuzeitlichen Philosophie seit Francis Bacon vollzogen war, nicht zerstort war. Das neuzeitliche Verstehen forderte die Unterordnung der Wissenschaft der Praktik und somit der technischen Tatigkeit nur in dem Sinn, dass die Praktik und die Technik nur das Gebiet der Anwendung der reinen wissenschaftlichen Kenntnisse sein mussten. Und doch war die Wissenschaft noch der Grund und die Bedingung der technischen Praktik geblieben, welche sie durch ihre allgemeinen Ergebnisse nur ermoglicht hat. Obzwar ist die Wissenschaft schon in der Neuzeit der Technik als eigenes Telos deren untergeordnet, beherrsct jedoch die Wissenschaft die Technik als ihre Arche.

Ausschlie?lich in der phanomenologischen Philosophie war es von neuem mit der neuen philosophischen Methode revidiert. Am meisten haben den Beitrag dazu E. Husserl und M. Heidegger geleistet. Der Ansicht Husserls nach haben die moderne Wissenschaften ihren eigentlichen Sinn verloren und nur zur Kunst und somit zur Technik, weil diese ihrem

ursprunglichen Sinn nach die Kunst (die Techne) bedeutet, und zwar zur Technik der Erfindung geworden. Und das, was wir heute die Wissenschaften nennen und fur das Vorbild der Wissenschaftlichkeit halten, ist nicht mehr als die Sammlung der „theoretischen" Kunste, d.h. der Techniken. Diese erwecken nur den Schein der Wissenschaftlichkeit, indem sie nur einzelne leere Formeln schaffen, ohne eigentlichen inhaltlichen Sinn deren zu verstehen. Heidegger hat diese Position verstarkt, sofern er behauptet hat, dass die Technik der Wissenschaften uberhaupt zugrunde liege. Und nicht nur als das Ziel der Wissenschaften, wie es schon in der Neuzeit war, sondern auch als das Prinzip (die Arche), das als ontologische Bedingung nur die Wissenschaftlichkeit als solche ermoglicht. Also sind die Wissenschaften, die das, was an ihm selbst ist, in das, was und wie es ist, zu erkennen beanspruchen, nur das Ergebnis der apriorischen technischen Beziehung des Menschen zum Seienden im Ganzen, die in das Bestellen dessen liegt. Heidegger nennt dieses totale Bestellung des Seienden „das Gestell": „Wir nennen jetzt jenen herausfordernden Anspruch, der den Menschen dahin versammelt, das Sichentbergende als Bestand zu bestellen – das *Ge-stell*". [1]

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THE PROBLEMS OF INTRODUCING IN RUSSIA THE FUNDAMENTAL PRINCIPLES OF BANK SUPERVISION

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Credit risk can result in some negative sequences for the bank; it can even lead to the liquidity risk occurrence. The American mortgage crisis is the confirmation of this fact.

The optimization of bank supervision (the harmonization of economical and supervisory demands to risk evaluation) is very important.

The Russian bank system is similar to the European (universal) model, but it has some specific features. (So in Europe the security market is getting the basic source of means[1]) These specific features of the Russian economy and bank system must be taken into consideration when introducing in Russia the fundamental principles of bank supervision worked out by the international bank community.

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EFFECTS OF PYRIDONES ON SENSORY NEURON MEMBRANE: PATCH-CLAMP STUDY

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Effects of two ?-pyridone derivatives: 5-hydroxy-2-hydroxymethyl-?-pyridone (AK1) and 5-hydroxy-1-methyl-?-pyridone-2-carboxylic acid (AK2) on nociceptive membrane of cultured root ganglion cells were investigated by the whole-cell patch-clamp technique. Experiments were carried out with the aid of apparatus-program setup including an EPC-7 amplifier, PC and a system of automation of physiological studies elaborated in our laboratory.

Our results demonstrate that the application of these substances to the external side of the membrane induces changes in currents of TTX-resistant slow sodium channels ($Na_v1.8$), responsible for the nociceptive signals coding. The most important parameter that controls the neuron excitability is effective charge transfer (Z_{eff}) in activation gating system of these channels. It was shown that both substances (10^{-6} M) decreased the effective charge transfer in the activation gating system from control value of 6.8 ± 0.4 (n = 22) to 4.7 ± 0.3 (n = 14) for AK1 and for AK2 the charge transfer decreases to 4.9 ± 0.4 (n = 18). These effects have been blocked by the non-specific opioid receptor antagonist naloxone.

Basing on the results obtained, the suggestion is made that both agents bind to the opioid-like receptor. Their ability to decrease the excitability of slow sodium channels makes it possible to propose their analgetic effect for the investigations *in vivo*.

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NEW NON-OPIOID SYNTHETIC ANALGESIC: RESULTS OF INVESTIGATIONS

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Drug safety and pharmacokinetics of a new non-opioid analgesic were investigated according to the permission of Russian FDA. Thirty-two healthy volunteers took part in the investigation. The volunteers were separated into three groups according to their dosage level of the injected medicine: 10, 20 and 60 mg per day. The duration of the course of i.v. injections was 10 days

During the investigations, no negative side effects were observed. Drug-dependence, miosis, etc. were not indicated.

Data obtained proved that the medicine is safe for humans. These results support the results obtained during preclinical tests.

Pharmacokinetics were investigated on 12 healthy volunteers. The blood clearance rate obeyed three-exponential behavior. Principally, the results were the same as those obtained previously on dogs using the same testing procedure.

The MRT parameter is in the diapason of from 0.5 to 1.0 hour. The clearance rate is equal to 1000 ml/kg/h. Volume of the steady-state distribution equals $V_{ss} = 500$-800 ml/kg. Initial value of the distribution volume is $V_0 = 150$ ml/kg.

We suppose that the first (fast) exponential phase of the pharmacokinetics reflects the high affinity of the substance under investigation to neuronal membranes with the receptor target during the process of ligand-receptor interaction. This interaction at the level of the whole organism leads to the relief of pathological pain. The second and the third exponent pharmacokinetic phases reflect utilization within the organism by metabolic reactions.

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THE ROBUST PLANNING IN ANALYSIS OF CALIBRATION MODELS.

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In the given work, planning of one-factor experiment is considered. The most important and widespread practical appendix of the given mathematical problem is the calibration of devices.

At level of planning of experiment the following questions solved: a choice of argument; a choice of a zone of an arrangement of supervision; a choice of the statistical plan.

Usually as argument appoints parameter having a smaller error of measurement. The zone of an arrangement of argument supervision of should exceed a range of measurements of the device on 20 %. The total number of calibrations tests of the device is chosen preliminary from a range of 20-40 tests.

At planning of experiment for the purpose of selection of linear regression model, it is necessary to have optimum supervision knots. In work of the most important the interpolation problem is. For these purposes, the D-optimum plan is used. According to this plan all supervision break into 2 groups of equal volume and settle down in the beginning and the end of a range of supervision. However, the optimum plan is sensitive to deviations of regression model properties and presence of outliers. In these conditions in work is presented the compromise plan that is deprived the specified lacks and traces tendencies of the optimum statistical plan.

For this purpose, total number of supervision breaks into groups with equal number of supervision in group. Let's notice that the specified groups settle down in a vicinity of knots of the optimum plan. In particular, 24 supervision are recommended to be divided into 8 groups on 3 supervision in each group. Thus 4 groups of supervision are located in a zone of smaller optimum knot and 4 groups – in a zone of knot with great value.

As show calculations by a method of the statistical modeling, the given compromise plan concedes to the D-optimum plan for 10 %. Let's notice that usually used plan with a uniform arrangement of points does not possess property of robustness and concedes to the optimum plan for 30 %.

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COMPARISON OF PROCEDURES OF EXCEPTION OUTLIERS BY A METHOD OF MONTE-CARLO.

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As shows the analysis of calibration tests of measuring devices, the data can contain from one to four outliers. Procedure of an exception of outliers should work effectively in following conditions:
- rather small volume of sample,
- presence at sample of several outliers,
- the number of outliers in sample is not known in advance,
- a variety of laws of distributions of probabilities of the basic set of samples.

In these conditions by methods of statistical modelling had been investigated the efficiency of consecutive procedures and the block procedure by Rozner.

In consecutive procedures following statistics were used:
- criterion of Smirnov-Grubbs (GR),
- criterion of a selective excess (EX),
- the median analogue of criterion of Grubbs (MED).

In the block procedure by Rozner following statistics were applied:
- the greatest students deviation (ESD),
- an estimation of type of the truncated average (RST).

By the results of calculations, the Rozner's block procedure is chosen as the most effective in the conditions of the analysis.

This procedure tests group of outliers in volume up to the maximum size of the sample. The basic advantage of procedure of Rozner is its high efficiency at any number of outliers up to their maximum number.

The analysis of efficiency of considered procedures is carried out by a method of computing experiment:
- at the sample volumes by 10, 15, 20 elements,
- on a class of distributions of type of a mix,
- at the maximum number of outliers in sample.

Efficiency of separate procedures at each combination of factor's influencing was estimated under the scheme "success-refusal" as an average from the results received in 10 series on 1000 calculations in each series.

The outliers which surpassing in absolute size level 3 sigma was considered as smooth outliers. Big outliers is the supervision which is overstepping the bounds 5 sigma. The random contamination was entered so that on each possible number of outliers it was about identical number of samples.

Calculations have shown that the best procedure is the block procedure of Rozner that excludes the big emissions almost authentically. Calculations have shown that efficiency of procedures strongly depends on volume of sample and volume of contaminations. At volumes of sample more than 20 supervisions the efficiency of Rozner procedure not below 80 % at a strong sample contamination by outliers and with the considerable variation of laws of distribution of probabilities.

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THERMAL AND MECHANICAL DECOMPOSITION OF LINEAR AND STAR SHAPED MACROMOLECULES WITH A FULLERENE CORE

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The modifications of linear macromolecules with fullerene are expected to be of high interest for biological applications [1] (e.g. due to improved solubility of fullerene due to its specific interactions with the dissolved macromolecule). Well characterized linear and star-shaped macromolecules exhibit peculiar dynamics both in the solutions and in the bulk state resulting in the phenomena of stretching, coiling, chain scission etc. I will discuss the results of the novel experimental approach [2] to study the thermal desorption as well as fractoemission spectra of the numerous neat polymers (PS, PMMA, PTFE, PVP, PTMBA etc.) as well as homo- and hetero- shaped star macromolecules with a fullerene C_{60} core subjected to various external influences (thermal, mechanical, electron etc.).

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DAS GE-STELL. VOM WESEN DER TECHNIK IM XXI. JAHRHUNDERT

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Das Ge-stell ist ein Wort, das schon mehr als ein halbes Jahrhundert eine philosophische Bedeutung hat. Vor 55 Jahre hat der beruhmte deutsche Philosoph Martin Heidegger (1889-1976) in seinem Aufsatz „Die Frage nach der Technik" das Wort „Ge-stell" fur die Bezeichnung des Wesens der modernen Technik eingefuhrt. „Ge-stell heisst die Weise des Entbergens, die im Wesen der modernen Technik waltet und selber nichts Technisches ist" [1]. Mit dieser ungewohnlichen Bedeutung des Wortes betont Heidegger den Gedanken, dass die Technik nicht nur instrumentalistisch und anthropologisch, sondern auch ontologisch interpretiert werden kann.

Was ist die moderne Technik? Normalerweise definiert man Technik entweder als ein Mittel fur die bestimmten Zwecke oder als eine Art des menschlichen Tuns. Dabei versieht man die Tatsache, dass die Technik eine Weise des menschlichen Zuganges zum Seienden ist. Laut Heidegger zeigt sich im Wesen der modernen Technik eine besondere Weise des Entbergens des Seienden, und zwar das Entbergen des Wirklichen im Modus des Bestandes. Dies bedeutet zugleich, dass das, was uns sich im Modus des Bestandes gibt, nicht mehr als Gegenstand gegenubersteht. „Aber ein Verkehrsflugzeug, das auf der Startbahn steht, ist doch ein Gegenstand. Gewiss. Wir konnen die Maschine so vorstellen. Aber dann verbirgt sie sich in dem, was und wie sie ist. Entborgen steht sie auf der Rollbahn nur als Bestand, insofern sie bestellt ist, die Moglichkeit des Tarnsport sicherzustellen" [2], so Heidegger. Denjenigen Anspruch, der den Menschen dazu fuhrt, das Sichentbergende als Bestand zu stellen, nennt Heidegger das Ge-stell.

Das Problem besteht aber darin, dass ein solches Entbergen des Wirklichen zu den nichtkontrollierbaren Folgerungen fuhrt. Die moderne Technik fuhrt dazu, dass das Wirkliche uberall zum Bestand wird. Aber das Entbergen des Wirklichen als Bestandes ist nicht die einzige Moglichkeit des Entbergens des Wirklichen, der Unverborgenheit des Seienden. Heidegger weist auf das altgriechische Bedeutung des Wortes „techne" hin. In diesem Wort meldet sich die poetische Dimension des Technischen, die einen Ausweg aus der instrumentalistischen Verstandnis der modernen Technik zeigt. Heidegger glaubt, dass das wahrhafte Wesen der modernen Technik nicht durch die Wissenschaft, sondern durch die Kunst zuganglich werden kann. Es stellt sich die Frage, ob das Ge-stell das Wesen der Technik im XXI. Jahrhundert bleibt und wie ist es heute wissenschaftlich und kunstlerisch zu verstehen?

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THE PUTATIVE MECHANISM OF LIGAND-RECEPTOR BINDING OF TWO GAMMA-PYRIDONE DERIVATIVES

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The effect of two ?-pyridone derivatives – 5-hydroxy-2-hydroxymethyl-?-pyridone (AK1) and 5-hydroxy-1-methyl-?-pyridone-2-carboxylic acid (AK2) – on slow tetrodotoxin-resistant (TTX_r) sodium channels of sensory neurons was investigated by the whole-cell patch-clamp technique. The extracellular application of the agents (10^{-6} M) resulted in the decrease of the effective charge transfer (Z_{eff}) in the activation gating system of TTX_r channels. The values of Z_{eff} changed from the control value of 6.8 ± 0.4 (n = 22) to 4.7 ± 0.3 (n = 14) and 4.9 ± 0.4 (n = 18) for AK1 and AK2 correspondingly. The non-specific opioid receptor antagonist naltrexone totally blocked the observed effect.
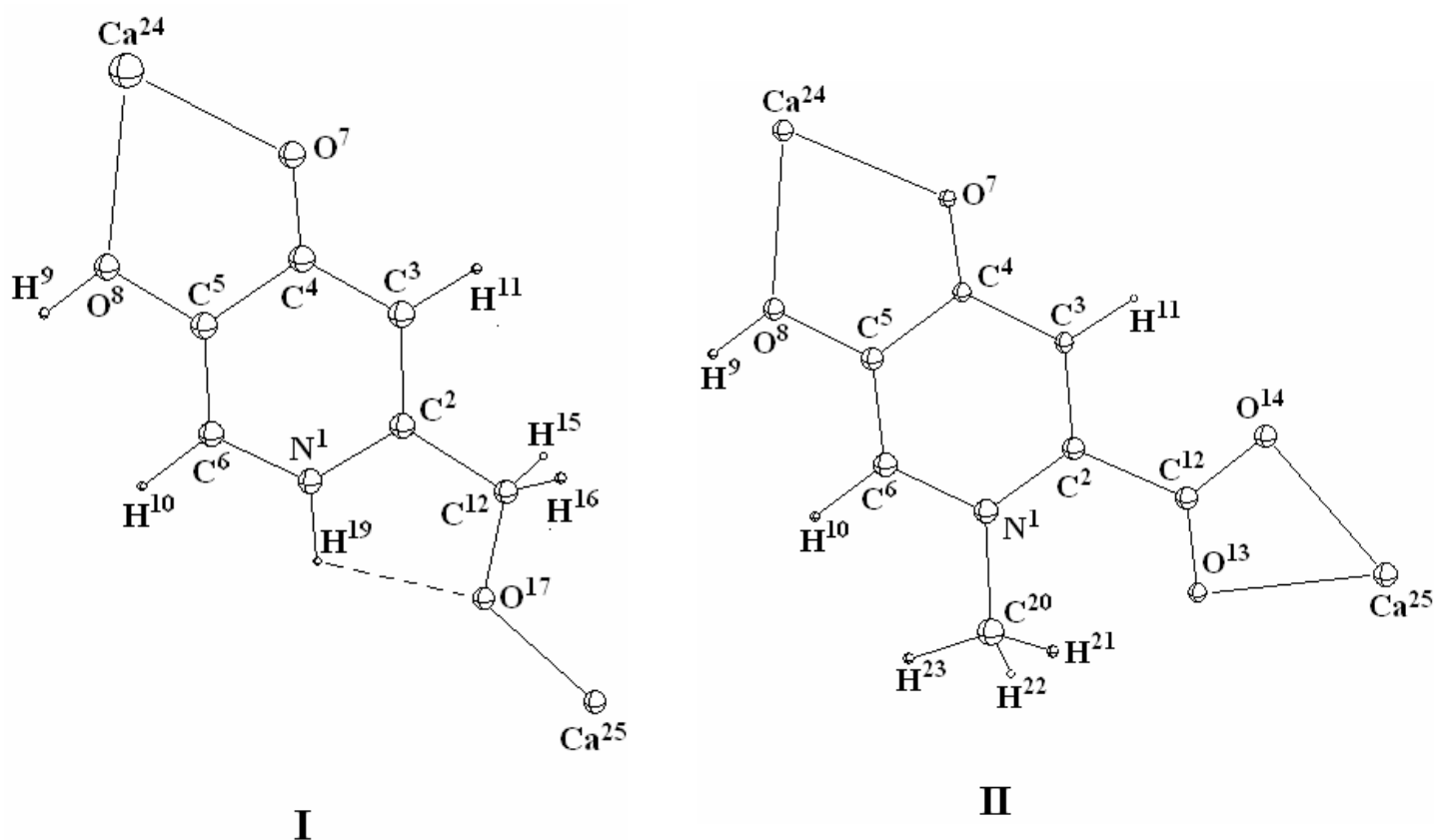
To help elucidate the putative mechanism of ligand-receptor binding of the agents, full 6-31G*/RHF geometry optimization of AK1 and AK2 in the forms of free acids, anions, Ca^{2+} chelates, Ca^{2+} salts, and Ca^{2+} salts of Ca^{2+} chelates was performed. The calculations were carried

out for the isolated molecules (dielectric constant ?=1) and in the solvated phase. The solvation effects were taken into consideration in the framework of PCM model with ?=10 and ?=78.3.

The spatial structures of the lowest energy isomers of AK1 and AK2 with two bound Ca^{2+} ions are presented in the picture. Our earlier studies on several ?-pyrone derivatives, which are closely related in structure and properties to ?-pyridones, made it possible to hypothesize that they bind to an unidentified opioid-like receptor in the form of the salt of Ca^{2+} chelate complex [1]. It was also shown that ?-pyrone molecules having the ability to modulate the activity of TTX_r channels should possess a carboxy group in position 2 and a hydroxy (or methoxy) group in position 5 of the six-membered ring. The modulating effect of AK2 is in accordance with this assumption, since this molecule meets the aforementioned structural criteria. Somewhat surprising is the observed modulating action of AK1, which possesses the hydroxymethyl substituent instead of the carboxy group in position 2 of the pyridone ring.

In the aqueous phase AK1 can bind only one Ca^{2+} with the involvement of the carbonyl and the hydroxy groups in positions 4 and 5 of the pyridone ring. However, the receptor binding pocket may be regarded as a heterogenous anisotropic low-dielectic milieu, which is substantially more polarizable than water and therefore capable of stabilizing the structures that cannot exist in the aqueous solution. Our calculations show that a strong N^1-H^{19}···O^{17} hydrogen bond present in AK1 makes the hydroxymethyl group in position 2 more acidic and facilitates the formation of Ca^{2+} salt with its participation. Consequently, it is possible that structure **I** would be stable in the receptor binding pocket. Moreover, the superposition of structures **I** and **II** shows that Ca^{2+} cations are located almost identically with regard to the pyridone ring in both molecules. Thus, the modulating activity of AK1 also may be accounted for on the basis of the ligand-receptor binding mechanism elaborated earlier for ?-pyrones [1]. Both AK1 and AK2 interact with the receptor by means of forming two ion-ionic bonds involving bound Ca^{2+} and negatively charged groups in the receptor binding pocket.

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I

II

The lowest energy isomers of AK1 (I) and AK2 (II) with two bound Ca^{2+} ions (N–-H···O hydrogen bond is shown as a dashed line).

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LIVING TISSUES FLUORIMETRY IN MEDICAL NANOBIOTECHNOLOGICAL STUDIES

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Luminescent analysis of bioobjects applies in medical-biological investigations widely enough. The most important achievements of quantum biophysics are based on it. Some scientists predicate that building of not nano-, but femtobiotechnology is constructed on facts obtaining in such studies.

In our laboratory problems of quantum biophysics are developed by means of exploration of biochemilumeniscence and fluorescence of living tissues. Biochemiluminescence is applied for study of dynamics of free radical processes particularly in immunocompetent cells. It was established that development of so-called «respiratory burst» in alveolar macrophages is provided by phosphoinositide intracellular signal system.

Vital fluorimetry methods are subdivided into two groups. Firstly, autofluorescence (without fluorescent dyes) is investigated. Secondly, secondary fluorescence (with fluorescent probes application) is explored too.

Autofluorescence is inherent for some biological molecules. For example, some of them are nicotinamide-adenine dinucleotide in reduced form (NADH) and flavoproteins in oxidized form. Both mentioned substances are key components of mitochondrial respiratory chain. It is possible to assay rate of electron transfer in electron transporting chain according to change in their fluorescence intensity. This method was applied in early diagnostics of neoplasms [1], separation of gunshot wound zones. It gives important information that determines treatment approach of these pathological processes.

It is also possible to study such processes investigating secondary fluorescence of bundle specially developed fluorescent probes. Nonthermal effects of nonionizing radiation were explored in our laboratory with chlortetracycline (fluorescent probe for Ca^{2+}) and thresholds were determined for some types of ionizing radiation.

Scientist interests have being engrossed to search of native fluorescent probes lately. They are mainly fluorescent proteins of tropical plants, animals, and algae. Their value is in opportunity of segregation of genes coding these proteins those can be embedded to the genome of investigated cell line or even whole animal that is very important for carrying chronic experiments out. If such proteins do not have affinity to required biological molecules then crosslink of genes coding these proteins is possible with genes of investigated biological molecules. In this case explored proteins with attached fluorescent probes begin to synthesize in cell.

Thus, fluorimetry based on recent achievements of genetic engineering is the most prospective destination of fluorescent methods development in medical nanobiotechnological studies.

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SOUTH-EASTERN ETHIOPIA: CHRISTIAN ENCLAVES AMONG MUSLIM OROMO (ON THE MATERIAL OF THE EXPEDITION OF PETER THE GREAT MUSEUM OF ANTHROPOLOGY AND ETHNOGRAPHY RUSSIAN AC. OF SCI. 22ND MARCH 2008 – 5TH APRIL 2008)

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The expedition was headed by the director of MAE (Kunstkamera), Ju. K. Chistov. The itinerary was coordinated with the itinerary of Russian poet Nikolaj Gumilev who visited Ethiopia (Abyssinia) in July-August 1913. N. Gumilev and his nephew N. Sverchkov were sent to this country on the instructions of the Museum with the purpose to collect ethnographical and entomological collections, photo material. The new expedition of 2008 had also the similar purposes. During of this expedition it's succeeded in receiving different ethnographical objects like items of material culture and photos. This demands interpretation and careful research study. The indicated paper is the first step toward such studies.

The starting point of the expedition became Addis Abeba – the capital of Ethiopia with a lot of churches built both by the tradition and in the new manner. The first cathedral of Ethiopia built in the manner usually associated with European design was the cathedral of Holy Trinity. It's a basilica. The other important place for today Addis Abeba is Bole Medhane Alem cathedral constructed in the similar architectural plan as Holy Trinity cathedral.

For the most part the expedition` itinerary passed through the south-eastern regions of Ethiopia main population of which is the Oromo people. We know that there are some tribal divisions among the Oromo. So called Qottu Oromo inhabits in the central highlands around the city of Harar. One of the largest branches of the Oromo is the Arsi Oromo inhabiting most of central and south-eastern Ethiopia. They constitute the main population of those regions where our way and the way of N. Gumilev passed. These names N. Gumilev mentioned in his writings.

Almost all the Oromo of Hararge and Oromiya region were converted to Islam. Despite early contacts with Islamized societies it's accepted (in the modern research tradition) that it was the imperial conquest (beginning at the end of the 19th) which accelerated the process of conversion. The Arsi area was in the forefront of the battle for the Oromo identity. Because of this at the end of the 19th cent. the Shoan military authorities introduced the large-scale mutilation of prisoners. The town called Anole located near the Qoqa Lake which we passed by our cars became the turning-point of systematic mutilation. In 1992 Anole was the pilgrimage place for thousands of Oromo that shows the importance of these events for the Oromo people. This explains generally negative relation of the local people to the Amharic language for that our expedition can witness (the region from Shashemene through such villages like Dodola, Adaba, Dinsho to Robe).

Today, along the road there are many new-built mosques of the same construction. But opposite of them often the orthodox churches are locating. These churches are also new-built. Most of them stylistically repeat the architecture of Bole Medhane Alem cathedral in Addis Abeba.

In fact we were very surprised to meet the Christian churches in the region of Muslim Oromo especially in Robe, the small town near the main Muslim holy places like Sheih Hussein and Sof Omar cave. Such churches with a territory for cemetery testify to the availability of the Christian community in the towns like Ziway, Robe, Awash, Dire Dawa founded at the end of the 19th cent.-first half of 20th cent. What's explanation of this fact? By now the Oromya kellel ("state") is inhabited not only by the Oromo but also by the Amhara, Gurage that is by the Christians. The Amhara arrived during and after the period of conquest at the end of the 19th cent. as soldiers and settlers. Throughout the 20th cent., particularly in the 1930s, for economic, political and demographic reasons the government encouraged many immigrants from the north to settle this land. As a result of this policy now we can see small islands of Christians, their churches and houses closely neighboring with Muslim Oromo huts.

Taking into account all these things it's very interesting how the local population (Oromo) coexistence with Christians. What kind of contacts there are at this time and what kind of perspectives could meet these communities in the future? This region - very useful for political and anthropological research studies - has also an importance for the study of transformation of the Christian tradition (church architecture, iconography, religious paintings, different church services and celebrations).

QUANTUM ELECTRODYNAMICS OF HEAVY IONS AND ATOMS

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Anintroductionto modernproblems ofquantum electrodynamics (QED) of highly charged ions is given. The results of recent theoretical calculations for the Lamb shift, the hyperfine splitting, and the bound-electron g-factor are compared with available experimental data. Special attention is focused on tests of QED at strong fields and on determination of fundamental constants. In particular, it is shown that the present status of theory and experiment on the $2p_{1/2}$ - 2s transition energy in Li-like uranium provides a test of QED at strong fields on a 0.2% level [1-2]. Measurements of the g-factor of H-and B-like lead accompanied by the related theoretical calculations can provide an independent determination of the fine structure constant [3].

Recent progress on evaluation of the QED corrections to the parity-nonconservation effect in neutral cesium is also considered. The complete gauge-invariant set of the one-loop QED corrections to the parity-nonconserving 6s-7s transition amplitude in 133 Cs was evaluated in Ref. [4] using a local version of the Dirac-Fock potential. The calculations were peformed in both length and velocity gauges for the absorbed photon. The QED correction was combined with other contributionstogetthetotal6s-7s PNC transition amplitude in 133 Cs and to derive the weak charge of ^{133}Cs employing the experimental data from Ref. [5]. It was found that the obtained weak charge Q_W deviates by 1.1σ from the prediction of the Standard Model.

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ELECTRONIC MONEY – NEXT STAGE OF PAYMENT SYSTEM EVALUATION

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Science and technology have greatly contributed to and influenced the direction of our social life. Computerisation in financial institutions is one of its most powerful contributions. This trend of so-called electronic banking started about 20 years ago. During the last 10 years private financial institutions, bank associations, central banks and governments of several countries together with international organisations, such as the Bank for International Settlements (BIS), have been engaged in using electronics for effecting settlement. Countermeasures have been developed for reducing and preventing certain risks. In most cases the objectives have been the improvement of efficiency and risk reduction in the financial sector. It's well-known that effecting accurate monetary credit and debt settlement (efficient payment system) is a keynote factor in securing a more stable and comfortable environment for society. Half a century ago nobody expected that monetary credit and debt settlement could be performed at such distances as quickly and accurately as it is done today.

The same should be true in our daily lives as far as payment instruments are concerned. Payment instruments for the general consumer have not witnessed significant changes. Traditional instruments such as cash, checks, credit cards and bank fund transfer are still being used. Among relatively new but already widely spread innovations it is worth to mention electronic fund transfer/point of sales (EFT/ POS), automated teller machine (ATM) networks, check truncation. As we enter the 21st century, science and technology are about to offer a new second stage settlement system - Electronic Money - (if we consider electronic banking as the first stage) using highly advanced electronic methods. The loss of the traditional paper form and acquiring electronic form is the obvious tendency in development of money today. If something better than "money" the traditional notes and coins, is to be used in the future, it will have to be electronic money or currency, supported by advanced electronic technology.

The new electronic payment systems can be roughly divided into 2 groups: one using smart cards (VisaCash, Mondex, GeldKarte) and the other using the Internet (CyberCash, DigiCash, Paypal). The classification of new settlement system is the fist step to analysis of the money evaluation process. Besides, it is important to study influence of electronic money to economy. Further consequences of electronic money (cash) from the view of economics (Monetary policy) should be researched. If electronic money is to be used, will it not increase social instability? How will it affect prices? As people come to use electronic money, will governments lose the power to maintain a well-ordered settlement system, or lose the power to determine the total amount of currency distributed and accurately control it? What will happen to payment privacy? As money is a basic element in social relationships, it is very important to answer these questions.

It might be possible by consideration of the existing projects of introduction and use of electronic money, their advantages and also the problems and dangers associated with their widespread usage.

The time will surely come when the physical currency in some countries will be inadequate to meet social demands: low costs, low risks, security, reliability. Even nowadays many countries pay abundantly high price for exploring traditional payment systems. The transaction-costs in Russia, for example, exceed 3% of Gross Domestic Product (GDP). In addition, we shouldn't forget about such essential features of a traditional payment system as money laundering, tax fraud, criminalization, environment and health damage etc. That's why many countries have been in active search and successful use of a variety innovative payment systems in their economies for a rather long time already. Russia, in this regard essentially lags behind western countries. Although today the Russian economy is in need of modernization of its payment system, it presents no urgency to change systems by means of modern and innovative medias. This is for a variety of reasons. But science and technology should continue to produce new applications, which will contribute to the improvement of our lives. When the necessity to change arises, the new science and technology referred to above will respond with fairness.

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SPIN-OPTRONICS: MANIPULATION OF THE POLARIZATION OF EMISSION AT NANO-SCALE

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Spin-optronics is a new emerging research area, which combines studies of spin and optical polarisation effects in solids with the ultimate goal of creating quantum optoelectronic devices [1]. This is an interdisciplinary research field at the crossroads of fundamental physics, optoelectronics, and nano-technology. Most of the recent developments in spin-optronics and prospects for future applications are based on the last decade's spectacular progress in nanotechnology. In spin-optronics, the information which is ultimately carried by the polarisation of photons, can be encoded in the confined spin state of carriers, manipulated on the nanoscale, and redelivered in the form of polarised photons. With respect to optics, spin-optronics has the advantage of being able to use well controlled carrier interactions occurring in nanostructures. With respect to 'spintronics', it has the advantage of strongly reducing the dramatic impact of carrier spin relaxation or decoherence, which has severely limited the achievement or the functionality of any working semiconductor-based spintronic devices.

In the present work we present recent results on theoretical description of spin and polarization dynamics in quantum microcavities- photonic structures designed to enhance the light-matter interaction. In strong coupling regime the normal modes of the system are cavity polaritons that are half-exciton, half-photon quasiparticles. When optically created, polaritons inherit the spin and dipole moment from the exciting light. However, from the very beginning of their life in a microcavity, polaritons start changing their spin state under effect of effective magnetic fields of different nature and scattering which makes pseudospin dynamics of exciton-polaritons rich and complex [2]. This can be used for the creation novel spinoptronic components such as quantum beam splitters, polarization filters and efficient sources of the entangled photon pairs [3]

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GLOBALIZATION AND SOCIETY: NEW PARADIGMS OF MUSEUMS' POLICY

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Museums unite society by the reflection of social life and offer of methods to understand the world which we live in, by intertwining standards of the past culture into living fabric of modern culture. Under new circumstances in the XXIth century museums became more active agents of public processes, their role grew as establishments of education and entertainment. Maintenance of cultural variety is a no less important task than creation of common cultural space. Historically young national communities enter the outer cultural space trying by preserve their achievements - both objects and technological legacy (in the form of "museum workshops", etc.). International Council of Museums (ICOM) in 2001 made decision about giving status of museum to wider circle of institutions.

Rapid changes in economic and social life alter the pattern of requirements of population. A presence and variety of museums becomes an important cultural and economic factor. Museums are integrated into a world economy, face intense competition not only with each other but also with a rapidly developing industry of entertainments. Globalization changed functions, policy and organizational structure of museum community. Control after efficiency of their activity increases. Marketing philosophy is introduced into museum management. In the last decade a closer co-operation of museums on local, national and international levels is practiced: development of museum network, plugging of remote and not popular museums in the popular routes. Large museums grow into certain similarity of multinational corporations, create subdivisions abroad.

The major tendencies of museums' policies in the epoch of globalization are:

- Museums deal with several main types of agents (visitors, state, sponsors, museum society, etc.).

- Informational, marketing, social and political technologies change the image of museum.

- Museums become the important explorers of multicultural society, acquainting people with other cultures and at the same time fixing their identity and place within the certain culture.

- The new paradigm of running a museum demands the new standards of management.

- The change of management style is initiated with the process of strategic planning.

- Museums go beyond their physical scopes, master virtual space, strengthen the global presence (virtual museums, Internet sale, CD, DVD, etc.).

- Large territorial units, converted into a single museum complex, move up actively; at the international market a new museum commodity appears - a country as a museum complex.

- The increase of volume and stake of temporal exhibitions promotes flexibility of marketing policy of museums.

- Strengthening of practical orientation of museum's activity is supported by introduction of mechanisms of state and public control, co-operation with sponsors.

- Introduction of interactive methods into practice of museum pedagogic.

- Carrying out of coordinated communication and competition policy.

- Advancement of complex museum services by introduction of museum passports.

- Development of the event marketing (packages of events).

- Flexible price policy, taking into account co-operation of different participants of exchange, related to the grant of museum services.

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SPACE-AND-TIME CURRENT SPECTROSCOPY OF WIDE-GAP SEMICONDUCTORS AND NANOSTRUCTURED MATERIALS

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The process of light interaction with condensed matter is an important problem of the modern solid state physics and quantum electronics. Holographic recording in wide-gap semiconductors and nanostructured materials is of particular interest from the scientific and practical point of view. Such a recording includes the stage of space charge formation, which is associated with the spatial redistribution of photoinduced carriers. A number of new methods studying the dynamics of space charge and photoconductivity in wide-gap semiconductors were proposed during recent years.

We report space-and-time current spectroscopy for characterization of wide-gap semiconductors (boron nitride) and nanostructured materials (porous glass filled with GaN nanoparticles, polypyrrole nanostructures within chrysotile asbestos). The approach is based on illumination of semiconductor material with an oscillating interference pattern formed of two light waves one of which is phase modulated with frequency ω. The non-steady-state photocurrent flowing through the short-circuited semiconductor is the measurable quantity in this technique. The alternating current is resulted from the periodic relative shifts of the photoconductivity and space charge electric field gratings arising in the crystal's volume under illumination. Dependencies of the signal amplitude versus temporal and spatial frequencies, light intensity, and temperature are studied for different illumination wavelengths. The conductivity of the material is measured, diffusion length of carriers is estimated.

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EFFECTS OF HARM REDUCTION MEASURES: HOW HAS DRUG USE IN PUBLIC CHANGED SINCE THE INTRODUCTION OF DRUG CONSUMPTION ROOMS?

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Drug use often takes place in public places, especially where "open drug scenes" do exist. This is often regarded as public nuisance. Drug consumption rooms offer the possibility for drug users to take drugs in a hygienic way under professional supervision (Thane 2002, Verthein et al. 2001). A number of studies on the effectiveness of drug consumption rooms show that they have a positive impact on the health status of the drug user as well as on service utilization in general (Zurhold et al. 2003). Drug-related emergencies as well as mortality have significantly declined since the introduction of drug consumption rooms (Walloch et al. 2007). Furthermore the acceptance in the neighbourhood is generally good, as drug use in public decreases and drug consumption rooms play an important role in reducing public disturbances in the vicinity of open drug scenes. In conclusion, the introduction of drug consumption rooms is an effective harm reduction measure to be included in a health policy dealing with substance abuse in the community.

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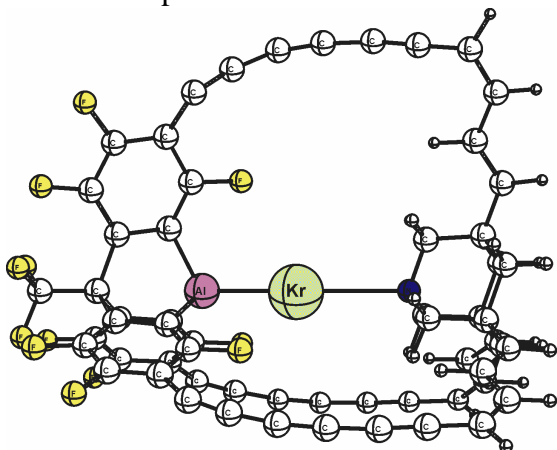
DONOR ACCEPTOR COMPLEXES OF NOBLE GASES

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Group 18 element compounds, generally called noble gases (Ng), exist in atmosphere as individual atoms. Due to completeness of the outer electronic shell, these atoms are not easily involved in chemical bonding. With the exception of xenon fluorides, all experimentally known compounds of noble gases are endothermic and easily dissociate, evolving Ng in their atomic form.

In the present report formation of the donor-acceptor (DA) complexes of noble gases with Lewis acids (LA) and bases (LB) of the general type LA←Ng←LB has been theoretically predicted. Such complexes feature 3-center four electron bond, formed by the lone pair of the noble gas, the lone pair of the Lewis base and vacant orbital of the Lewis acid. Bonding situation in such compounds will be discussed.

Use of the rigid cryptand-type ligand which features spatially separated pyramidalized Lewis acid and base centers (see Figure) allows to achieve exothermic complex formation with noble gases. These compounds are also the first examples featuring Al-Ng chemical bond. It is expected, that practical realization of the LA←Ng←LB concept may lead to the facile chemical extraction of the noble gases from air.

Reactivity of the rigid cryptand-type ligands for the hydrogen bond activation will be also discussed.

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SOLVING KEY EQUATION IN REED-SOLOMON CODE LIST DECODING

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(n,k,d) Reed-Solomon code is defined as the set of vectors $(f(x_1),...,f(x_n)), \deg f(x) < k, x_i \in GF(q)$. The problem of list decoding can be stated as finding all codewords of a Reed-Solomon code agreeing with a given vector $(y_1,...,y_n)$ in at least *t* positions. The Guruswami-Sudan algorithm [1] solves this problem by constructing an interpolation polynomial $Q(x,y) = \sum_{i=0}^{r} q_i(x) y^i$ having roots *(xᵢ,yᵢ)* of multiplicity *r*. Furthermore, the *(1,k-1)* weighted degree of this polynomial must not exceed some integer *l*, where *l,* ***r*** and *r* are some parameters dependent on *n,k* and ***t***. The solutions of list decoding problem can be found as *f(x): Q(x,f(x))=0.*

It was shown in [2] that such a polynomial can be found in a Groebner basis of ideal $<(y-T(x))^t \boldsymbol{f}^{r-t}(x), t=0..r>$, where $T(x_i) = y_i, i = 1..n$, and $\boldsymbol{f}(x) = \prod_{i=1}^{n}(x - x_i)$. Namely, one has to find polynomials $p_t(x)$, such that

$$q_i(x) = \left(\sum_{t=i}^{r} \binom{t}{i} (-T(x))^{t-i} \boldsymbol{f}^{r-t}(x) p_t(x) \right) + \left(\sum_{t=\max(i,r+1)}^{\min(r,r+i)} \binom{r}{r-t+i} (-T(x))^{t-i} p_t(x) \right), \deg q_i(x) \le l - (k-1)i \quad (1)$$

It was shown that in the case of r=ρ=1 and l=(n+k)/2-1 these polynomials can be found by means of extended Euclidean algorithm, similarly to the case of Gao decoding method [3]. In this paper we show that this approach can be extended to the case of list decoding by employing the second Buchberger criterion for elimination of S-pairs [4]. This represents a natural generalization of the classical decoding approach.

The described method can be used to reduce the complexity of list decoding and soft-decision decoding of Reed-Solomon codes.

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NICOTINIC AND OTHER CYS-LOOP RECEPTORS

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The talk is devoted mostly to nicotinic acetylcholine receptors. They belong to the family of ligand-gated ion channels and are built of five subunits, each containing a large extracellular domain. This domain contains a conserved disulfide (Cys-loop) present also in other receptors of the so-called Cys-loop family: glycine receptors, GABA A and 5HT3 serotonin receptors.These receptors have a very similar three-dimensional organization. The lecture covers the stucture of these receptor and the role of different toxins in elucidating the organization of their ligand-bindig sites -a step necessary for the design of novel drugs.

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REPROGRAMMING OF PROTEASOMES IN K562 CELLS UNDERGOING APOPTOSIS

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Apoptosis, or programmed cell death, is one of the major protective cellular processes providing the control over quality and quantity of cells in multicellular organism. Studies using the proteasome selective inhibitors have provided direct evidence for the ubiquitin–proteasome system functions in regulation of apoptosis. However, changes in the composition, phosphorylation or glycosylation of the subunits and regulation of the activities of proteasomes in proliferating cells undergoing apoptosis have not been studied so far.

The data of the present paper show for the first time that apoptosis inductors (doxorubicin or diethylmaleate) affect on regulation of subunit composition, enzymatic activities, and phosphorylation and glycosylation states of proteasomes in neoplastic (proerythroleukemic K562) cells. Thus, the specificity of proteasomal enzymatic (proteolytic and endoribonuclease) activities is changed in K562 cells undergoing apoptosis. Furthermore, apoptosis inductors treatment of K562 cells lead to modification of proteasomal subunits including catalytic subunits, associated with proteasomal enzymatic activities. Moreover, we showed the selective effect of dephosphorylation of proteasomal subunits on activities of observable particles. These findings confirm our hypothesis about so-called reprogramming of proteasomes population in undergoing apoptosis K562 cells which is manifested by changes of proteasomal composition, phosphorylation and glycosylation states and enzymatic activities during the process of programmed cell death.

It was previously shown that cells excreted proteasomes into the culture medium or extracellular space. The data of the present study testify to the specificity of proteasomes excreted by cells. The excreted proteasomes were found to retain their characteristic composition and enzymatic activities, although they differed from intracellular proteasomes in the subunits modifications and specificity of proteolytic activity and in characteristics of endoribonuclease activity. Furthermore, the activity of extracellular particles depended on the cell functional state (control and apoptotic cells). It should be emphasized that the character of changes in intracellular and excreted proteasomes activities were different, which suggests that the excretion

of the specific proteasome population from cells is part of a regulatory mechanism that control the intracellular activity of these particles.

We have also demonstrated for the first time that proteasomes quickly enter into K562 cells from culture medium, and then they are revealed both in cytoplasm and nuclei of cell-recipients. Moreover, internalized proteasomes influence on the expression of specific genes in K562 cells. Thus, we have demonstrated that exogenous proteasome (isolated from K562 cells treated with apoptotic inductors) significantly stimulate the affect of apoptosis inductors on the expression of genes-regulators of apoptosis. These data suppose the possible regulatory meaning of proteasomes internalized by cells and the participation of proteasomes in extracellular signaling pathways.

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THE IMPRECISE BAYESIAN MODELS OF SOFTWARE QUALITY

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In the last decades, various software reliability models have been developed based on testing or debugging processes, but no model can be trusted to be accurate at all times. This fact is due to the unrealistic assumptions in each model. Therefore, I try to develop a general software reliability model called the imprecise software reliability model, which could incorporate the available models. It should be noted that the growth reliability models are studied, i.e. they describe how observation of failures, and correcting the underlying faults - such as occurs in software development when the software is being tested and debugged - affect the reliability of software. The arbitrary software reliabiliry model depends on the vector a of parameters of probability distributions involved and on the vector b of parameters of the reliability growth.

A unique probability distribution characterizing the software reliability is replaced by a set of distributions M with some lower and upper bounds. It turns out that the maximum likelihood principle takes into account only points of bounded probability distributions. However, the main difficulty in using the imprecise reliability model is to define the lower and upper distributions of M.

In order to overcome this difficulty, the imprecise Bayesian inference is proposed. A critical feature of any Bayesian analysis is the choice of a prior or the choice of parameters of a prior probability distribution, especially, when we have no prior information about the parameters. In place of one reasonable prior, we use the class M of priors, which under some conditions is "not a class of reasonable priors, but a reasonable class of priors". Note that the set M depends on the set a of parameters. A number of imprecise Bayesian models can be chosen for produce the class M, including Walley's imprecise beta-binomial model, models of exponential distribution family [1].

The following scheme for constructing the software reliability model and for computing the cumulative probability distributions of time to failure after r periods of the software debugging is proposed. By constructing the imprecise Bayesian model and by its using, we get a set of probability distributions M with some bounds. The bounds for the set M do not depend on parameters b and are determined only by the parameter a. This implies that we have obtained the model only with parameters b. By having the lower and upper probability functions, the corresponding likelihood function maximized over $M(b)$ and over b. Hence, we find the parameters of the reliability growth b.

So, the parameters of the bounding probability distributions are computed by using imprecise Bayesian inference. The parameters of the reliability growth are computed by using the likelihood principle. Such the combination of Bayesian inference and the likelihood principle simplifies computations because we do not need to solve systems of non-linear equations for searching a lot of parameters of models in this case.

The proposed method can be also used in regression analysis.

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TRANSITION STATE THEORY IN MAGNETISM. APPLICATION TO THE HYDROGEN STORAGE PROBLEM

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The hydrogen storage in solid matrix is the vital issue of the hydrogen power engineering. To use hydrogen as energy carrier it is important to have material which is able to adsorb considerable amount of hydrogen and return it back without large energy lost. Small supported magnetic clusters are very attractive for this purpose because their electronic structure can be easily changed by external magnetic field and that opens the way for manipulation by adsorption-desorption process. Very small clusters consisting of just a few atoms are of special interest because they demonstrate very interesting behavior, which can be controlled by changing the external conditions. Such phenomena cannot be observed either for individual supported atoms due to the simplicity of the system or for large (on the atomic scale) objects like islands or monolayers due to statistical averaging.

Most of small magnetic clusters are characterized by non-collinear magnetic ordering and multiplicity of metastable states with close energies [1]. Adsorption of hydrogen near the cluster, variation of interatomic distances or introduction of the external magnetic field can change the ground state of the whole system. For investigation of stability of different states we developed the variant of transition state theory (TST) for magnetic degrees of freedom. TST is standard method for calculation of rate constants in chemical reactions and for study of the epitaxial

growth process [2]. However for evolution of magnetic systems with itinerant electrons such approach was applied for the first time.

As a model of a magnetic cluster we consider an iron trimer on metallic substrate. The shape of the trimer and the interatomic distances can be fixed by selecting the substrate material and the orientation of the substrate surface relative to the crystallographic axes. For certain trimer geometry both a ferromagnetic (FM) and an antiferromagnetic (AF) solution were found within the framework of model Hamiltonian approach for itinerant electrons. The minimum energy path (MEP) and the saddle point (SP) were determined to estimate the transition rate between these magnetic configurations using the TST.

Interaction of iron trimer with hydrogen has been investigated. It proves to be that hydrogen adsorption decreases the energy of d-electronic subsystem and even can switch the ground state from FM to AF. Therefore with hydrogen it is possible to manipulate by the magnetic structure. It was also shown that applying an external magnetic field returns the trimer ground state back to FM. Changing of magnetic ordering can be used for variation of bonding energy of hydrogen adsorption.

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HOLOGRAPHIC GRATING RELAXATION STUDIES FOR POLYMER SCIENCE AND OPTOINFORMATICS

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Initially being a technique for wavefronts transformation based on interference and diffraction, holography not only provides unique tools for making optical elements with otherwise inaccessible properties and ultradense information storage. Monitoring the properties of holograms (spatially periodical diffractive structures, volume gratings) induced in bulk material by exposure to an interference pattern gives an access to valuable information about molecular transformations, microscopic mobility and other phenomena that make grating modulation decay. The approach known as Holographic (grating) relaxation spectroscopy (HGRS), closely related with Forced Rayleigh scattering and Transient grating techniques, is especially suitable for the measurements of extremely low diffusion coefficients, such as those characteristic of polymer glasses: fine spatial scale predetermined by spatial period of interference fringes allows to detect effects caused by tiny diffusional displacements – down to a few nanometers.

Doping material with quinone species capable of forming chemical bonds with surrounding matter under exposure has made it possible to study diffusion of small molecular probe and (decades slower) different motions of photolabelled macromolecules. The figures below represent exemplary HGRS results that contain explicit information on several modes of polymer mobility (probe diffusion (A), local (B) and global (C) chain motion) at different

temperatures (Fig.1) and different stages of latex film formation (Fig.2), hardly obtainable by other techniques. In microscopically heterogeneous materials, diffusion coefficients and mean displacements in spatial domains of different types can be efficiently estimated by means of HGRS, even if the materials look transparent and the heterogeneity does not manifest itself via light scattering.
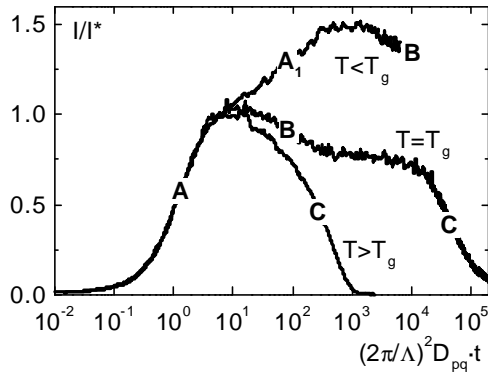
Fig.1. Postexposure grating relaxation in a styrene polymer at the glass transition temperature (T_g), above and below it (time scaled with probe diffusion rate).
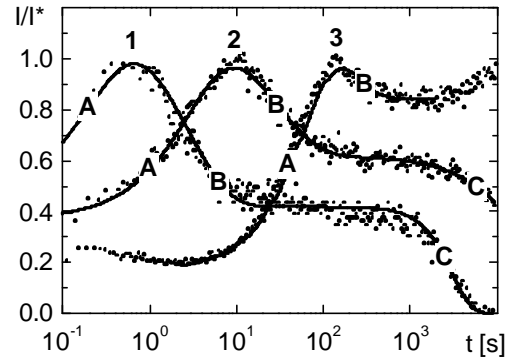
Fig.2. Grating relaxation affected by slowing down of molecular motions and decrease of their magnitude in the course of latex film formation (from wet to dry: 1-2-3).

Complementary to academic research, the peculiar nonmonotonous relaxation of photoinduced gratings originating from competition of fast and slow diffusion processes has become accepted as a mechanism for self-development of efficient and stable holograms recorded in thick quinone-doped polymer glasses. These holograms serve as reliable optical elements with subnanometer spectral selectivity, such as notch-filters, multiplexers, etc.

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ASYMPTOTIC THEORY OF THE RANDOM PERMUTATIONS AND ITS APPLICATIONS

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One of the main notions in mathematical combinatorics is the group S_n of $n!$ permutations of the n objects, say, the first natural numbers. The structure of the typical (random) permutations is very important question for various applications.
The following fact is a classical one: the number of the cycles

In the typical permutations from the group S_n asymptotically is equal to log n. What we can say about the joint distributions of the length of the cycles L_k, k=1,..n? The answer could be described using so called linking Markov chain. Consider the random sequences of the consequent ratios of the length of cycles:

$z_k = L_k/\{n-L_1-\ldots-L_{k-1}\}$, k=1,…n.

They generate the Markov chain with the asymptotic density of the transition probability:

dProb($z_1 |z_2$)/$dz_1 = z_2/z_1^2$ if $z_1>z_2/(1+z_2)$,

dProb(z_1 |z_2)/dz_1 = 0   otherwise
 and   for all k>1; Prob(z_{k-1} |z_k) =   Prob(z_1 |z_2).

Theorem

The density of the invariant measure for tha Markov chain satisfies to the functional equation:

$$ h(t)=t^{-2}\cdot\int_0^{\frac{t}{1-t}}h(u)\cdot udu..$$

This gives the complete information about joint distributions of the length of the cycles.
of the random permutations.

For example. 1.The lengths of the cycles of the random permutation decrease as the geometrical progression with denominator 1/e.
.2.For 0.99n! permutations of S-n the following is true: the summary length of the largest 11 cycles is greater or equal to the 0.99n , etc
.

Suprisingly the same answer we obtained for completely different problem.
Consider the decomposition of the natural number onto prime divisors
  n=p_1.p_2….p_k, p_1>=p_2>=….p_k
and consider the sequence z_1=log p_1/log n, z_2= log p_2/{log n –log p_1},…..
then asymptotic behavior of this sequence with respect to uniform distribution on the first natural numbers is the same as above for ransom permutations.
Consequently, we can conclude that the same properties have prime divisors
of the generic natural numbers.

The examples above illustrate the wide class of the problems of analysis, combinatorics, Geometry and algebra which called "limit shape problems" or "asymptotic algebraic analysis". The goal is to find asymptotic behavior of the objects which is not numbers or functions as in Classical analysis, but elements of the groups, configurations, geometrical structure and so on. The main question is in what terms we can describe our objects in order to express the asymptotic properties.
Here it is another example of the problems if this type with geometrical flavor.

Consider the set of all convex polygons in the unit square on the plane with the vertices on the lattice with lattice spacing equal to 1/n. What is the typical shape of such polygons with uniform distributions when n tends to infinity? The answer is given with nice convex curve inside unit square with the following equation (the square is |x|+|y|<1): $(1-x)^{1/2}+(1-y)^{1/2}=1$.

SIMULATION OF ELECTRON AND HOLE TUNNELING TRANSPORT THROUGH THE HIGH-*K* INSULATOR LAYERS AND DIELECTRIC STACKS IN MIS DEVICES

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Tunneling is a quantum-mechanical effect of nonzero probability for a particle to pass through a potential barrier whose maximum exceeds the full particle energy. This has certain analogy to the small-depth light penetration into the reflective media. Such an effect was discovered eight decades ago and in its earlier years enabled to explain some nuclear physics phenomena [1]. Now it plays an important role in diverse solid-state devices, where the tunnel barriers are formed by forbidden bands of semiconductor or dielectric layers and the acting

particles are electrons; holes may also tunnel but they are fictive objects and their transport can always be treated as a backward electron tunneling.

A very significant semiconductor-based tunnel system is the Metal-Insulator-Silicon (MIS) structure where the "insulator" is either an ultrathin dielectric layer or a stack including such layers. The application sphere of these structures involves field-effect transistors and memory elements. For many devices, it is desirable to reduce the tunneling current at a given value of an electric field in Si near the insulator interface. This may be achieved by employing dielectrics with high permittivity – this value is often denoted as k. Therefore, along with the traditional silicon dioxide ($k = 3.9$), MIS structures with alternative materials, particularly HfO_2, ZrO_2 (25), Al_2O_3 (9.3), Si_3N_4 (7.5) are intensively studied [2] and new high-k material are searched for. For example, we find a structure with CaF_2 deserving attention.

In our work, the simulator of MIS tunnel structures was elaborated [3]. Key physical points of this simulator are: a) quantization of carrier motion in an inversion or accumulation layer in Si is considered, polySi being treated as silicon; b) both conduction and valence band currents are simulated regarding for a discrete-level and a continuum fraction; c) energy and transverse momentum conservation is imposed; d) hot electron injection features are modeled. For transmission probability we use the well-known WKB formula. In our opinion essential is not the probability approach, but an adjustment of the effective electron (m_e) and hole (m_h) masses in the forbidden band – more exact, of the electron dispersion relations in the barriers. Beyond parabolic laws, the symmetric Franz-type relation has been examined. We found that e.g. for SiO_2 $m_e = 0.42m_0$, $m_h = 0.33m_0$ and Franz mass $m_F = 0.58m_0$; for Si_3N_4: $m_e = m_h = 0.5m_0$, $m_F = 0.6m_0$; for CaF_2: $m_e = 1.0m_0$, $m_F = 1.2m_0$. Both our own measurements and the literature data were attracted for verification. Franz model was preferable in case of tunneling close to the forbidden gap middle, i.e. for the valence band component.

Simulations of electric characteristics were performed for Al(Au,PolySi)/SiO_2(Si_3N_4, Al_2O_3,CaF_2)/Si structures as well as for polySi(Metal)/SiO_2(Al_2O_3)/Si_3N_4/SiO_2/Si memory cells. Further, some results were obtained for the effects relying on the fact that the tunneled electrons enter silicon energetically far above the Si conduction band edge. Such simulations helped by interpretation of light-emitting properties of Metal/SiO_2(Vacuum)/Si structures [4] and of the impact-ionization-related bistability of these devices.

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THE MEMBRANE TROPIC EFFECTS OF CARDIAC GLYCOSIDES

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There had been shown the effects of cardiac glycosides strophanthin-G, digoxin and corglycon in concentrations from 10^{-12} up to 10^{-6} M on sodium, calcium and potassium ionic currents in isolated neurones (*Lymnaea stagnalis*) using method of endocellular dialysis and fixing membranes potential. We observed convertible and slightly dose-dependent effects. In low concentrations ($10^{-12} – 10^{-11}$ Ì) all substances increased all ionic currents up to 5 %, in high concentrations there had been observed amplitude suppression. The most prominent suppression of ionic current (up 45 % above control) was detected under the influence of strophanthin on calcium currents, and (up to 26 % above control) was detected under the influence of digoxin on sodium currents in concentration – 10^{-6} M. The process of slow potassium currents inactivation

was accelerated by corglycon and strophanthin in concentration – 10^{-6} M. Digoxin caused shift of volt-amper maximum of ion current characteristics to the right on axis of potentials for 5–10 mV. Generally, strophanthin and digoxin, in comparison with corglycon, caused less activative and more supressive effect on membrane ion currents.

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ADDICTION AND ITS TREATMENT: MUCH PROGRESS. MORE TO LEARN

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Research on addiction treatment using randomized trials and placebo controls is relatively new. Much has been learned and many patients have been helped, but we need do more to better understand its causes and how it is best treated. This presentation will give a brief overview of what we have learned about addiction, its course, and treatments that can change its course, and a few areas that show promise for future treatment research.

Both ICD-10 and DSM-IV have definitions of addiction that are very similar and identify almost identical patients across different cultures. Studies have also shown abuse liability differs across substances. For example, about a third of persons who use amphetamines, cocaine, and heroin more than a few times become addicted, as compared to alcohol and marijuana where only about one in ten become addicted. Epidemiological studies have shown that addicted individuals can spontaneously remit, however treatment studies have shown that treatment-seeking patients have usually tried to stop and not succeeded. For these individuals, their addiction typically follows a chronic and relapsing course similar to that of persons with other chronic medical conditions such as asthma, diabetes and hypertension. This chronic relapsing course is associated with many medical and psychosocial problems. Injecting drug use, particularly heroin, is particularly harmful and associated with overdose death, criminal activity and a wide range of serious medical problems including hepatitis C and HIV.

We do not have a treatment that can cure addiction in the sense that antibiotics can cure pneumonia or surgery can cure appendicitis, however there are six types of interventions can alter its course for the better. These are: 1) therapeutic communities; 2) agonist maintenance for opioid (heroin) addiction; 3) naltrexone for opioid and alcohol addictions; 4) contingency management; 5) counseling and psychotherapy; 6) participation in self-help groups such as Alcoholics Anonymous and Narcotics Anonymous. Each of these interventions will be discussed briefly.

Areas for future research point to biological factors that result from addiction or predispose to its development. Among these are changes in neurotransmitters, hormones and receptors. Naltrexone studies for treatment of alcohol dependence will be used as an example. In the case of heroin and other opioid addictions, tremendous benefits will result if research can identify a compound that kills pain as well as morphine and other opioids but is not addicting.

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LASER-ASSISTED ABSOLUTE ASYMMETRIC SYNTHESIS FROM AN ISOTROPIC RACEMIC MIXTURE OF CHIRAL MOLECULES AT ROOM TEMPERATURES

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We analyzed the absolute asymmetric synthesis (AAS) of enantiomers from an isotropic racemic mixture of chiral molecules in gas phase, which employs the laser electrodipole interaction, and revealed a set of basic symmetry-based conditions on the parameters of field--molecule interaction. Using these conditions, we developed a novel scenario for the AAS (through selective photodestruction of the enantiomers of a given type) based on the joint action of the strong multicomponent femtosecond and picosecond laser pulses. Key mechanism of this scenario is the partly modified scheme of laser orientation-dependent selection of molecules proposed by us earlier [1,2]. Calculations made on example of chiral molecule SiHNaClF show rather high efficiency and stability of the proposed AAS scenario in respect to the parameters of the incident laser pulses and even feasibility of its realization at the room temperatures [3].

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ESTIMATES FOR THE RATE OF APPROXIMATION IN THE MULTIDIMENSIONAL INVARIANCE PRINCIPLE

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We shall consider the problem of constructing on a probability space a sequence of independent random vectors $X_1,..., X_n$ (with given distributions) and a corresponding sequence of independent Gaussian random vectors $Y_1,..., Y_n$ so that the quantity

$$?(X,Y)= \max_k \left| ?_{i=1}^k (X_i - Y_i) \right|$$

would be so small as possible with sufficiently large probability. The estimation of the rate of strong approximation in the invariance principle of probability theory may be reduced to this problem. We present the results published in [1–3].

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NUCLEOLAR PROTEINS AS TARGETS OF PHARMACEUTICAL DRUGS AND TOXIC ELEMENTS IN HUMAN CELLS IN VITRO

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The nucleolus is the largest nuclear structural domain that serves for ribosomal (rDNA) transcription, processing of newly synthesized pre-rRNA transcripts and for assembly of ribosomal particles (Hadjiolov, 1985). In addition, the data rapidly accumulating during the last years show that the nucleolus and its major proteins, beside ribosome biogenesis, are also involved in regulation of proliferation and apoptosis (Olson et al., 2004). Recent mass-spectroscopy data also argue in favor of "non-canonical" nucleolar functions, as far as the nucleolar proteome includes a vast number of proteins, which are not involved in ribosome biogenesis (Andersen et al., 2005). The most remarkable feature of the nucleolus that distinguishes it from many other cellular organelles is a high dynamics of the constituents, which can easily be revealed at the cellular level. Structural and functional alterations of nucleoli have

been described following cell exposure to ultraviolet irradiation (Zatsepina et al., 1989; Rubbi and Milner, 2003), treatment with heavy metal salts (Cervera et al., 1983; Jiang, Liu, 2000; Chen et al., 2002; Marcano et al., 2002; Xiao et al., 2002), by inhibitors of transcription and translation, as well as by chemical reagents, which are wildly used as anti-cancer drugs or pro-apoptotic agents. Based on the results obtained it becomes generally accepted that selection of nucleoli and key nucleolar proteins as targets for cancer cell injuries may open novel avenues for struggling neoplastic diseases. Noteworthy, the nucleolus reaction to cell exposure to various inducers of cell death is specific and can easily be revealed by immunocytochemical approaches with antibodies to abundant nucleolar proteins such as B23/nucleophosmin (a ribosome assembly factor), fibrillarin (a factor of early pre-rRNA processing) and to members of the RNA polymerase I transcription machinery. Each of these proteins specifically changes the characteristic localization following action of inhibitors of transcription, translation, intracellular kinases, or after oxidative stress. The most sensitive to stress induction are nucleoli of proliferating cells. Taken together, these data support the idea that immunocytochemical properties of the nucleolus can serve for elaboration of a novel – nucleolar – test-system for examination of mechanisms and efficacy of action of new anti-cancer drugs.

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INHIBITION OF CDK1 INDUCES PREMATURE ASSEMBLY OF NUCLEOLAR PRECURSORS IN METAPHASE OF MITOSIS

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It is well known that at the beginning of mitosis the nucleolus disassembles but then reassembles at the mitotic terminus. However, the mechanisms of these processes still remain unclear. An early step of the nucleolus reaasembly is formation of nucleolar precursors, called nucleolus derived foci (NDF), in the cytoplasm of anaphase or telophase cells. In the present

work, we show for the first time that selective inhibition of cyclin B-dependent kinase (CDK1) by roscovitine induces premature assembly of the NDF in mammalian cells at metaphase. Treatment of metaphase cells with roscovitine (75-150 µM, 15-30 min) induces formation of discrete structures in their cytoplasm that contain major proteins and rRNA of the mature nucleolus and anaphase NDF. Constituents of the induced NDF include B23/nucleophosmin (a major pre-ribosome assembly factor and a nucleolar phosphoprotein), C23/nucleolin (a multifunctional phosphoprotein that is involved in early and late stages of ribosome synthesis), fibrillarin (a major early pre-rRNA processing factor), Nop52 (is required for processing of the ITS2 spacer), as well as partially processed (immature) 46-45S pre-rRNA. The absence of rDNA and proteins bound to ribosomal genes, including RNA polymerase I and UBF, is also typical for induced NDF. Premature assembly of NDF at metaphase is reproducible in cells of various types thus indicating that mechanisms that regulate initial stages of the nucleolus reassembly occur with participation of CDK1 and are general in mammalian cells. Based on our and literature data, we suggest that inactivation of CDK1–cyclin B complex at the end of mitosis results in dephosphorylation of B23/nucleophosmin and C23/nucleolin and induces their interaction with pre-RNA molecules. As a consequence, formation of insoluble supramolecular complexes—nucleolus-derived foci – takes place. When assembled, NDF migrate forward reforming nuclei and then are targeted by newborn nucleoli. We also present evidences in favor of rRNA processing events which may occur within NDF and implication of the mitotic spindle mictotubules in NDF transport to the daughter nuclei.

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