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Life Sciences in the 21st Century: Looking into the Future

I Межфакультетская студенческая научно-практическая конференция

20–24 января 2018 г.

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20–24 января 2018 г. в МГУ состоялась I Межфакультетская студенческая научно-практическая конференция «Life Sciences in the 21st Century: Looking into the Future» (на английском языке), организованная кафедрой английского языка для естественных факультетов факультета иностранных языков и регионоведения МГУ имени М.В.Ломоносова совместно с биологическим факультетом и при активном участии еще пяти естественнонаучных факультетов университета – почвоведения, фундаментальной физико-химической инженерии, фундаментальной медицины, биотехнологического и химического. На конференции было сделано 137 научных докладов, охватывающих широкий спектр направлений исследований в биологии и смежных науках, начиная от классических зоологических и ботанических наблюдений до использующих самые современные методические подходы экспериментов. В сборник включены тезисы 6 пленарных докладов и 13 лучших секционных докладов, отобранных по результатам оценивания уровня владения академическим английским языком.

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FOREWORD

From 20 to 24 January 2018, the 1st annual student conference *Life Sciences in the 21st Century: Looking into the Future* was held at the Faculty of Biology of Lomonosov Moscow State University. The conference was organized and conducted by the Department of English for Sciences of the Faculty of Foreign Languages and Area Studies in collaboration with the Faculty of Biology and with active participation of a number of other MSU faculties, namely those of Soil Science, Fundamental Medicine, Biotechnology, Fundamental Physical and Chemical Engineering, and Chemistry.

The overwhelming majority of conference presenters and participants were Master's degree and PhD students of the Faculty of Biology whose Dean, academician Mikhail P. Kirpichnikov, in one of his interviews has once called the Faculty a "nature reserve", "the only place in the country and, possibly, in the whole world where the full range of the life sciences are explored, from a scientific understanding of Earth's system to most complicated problems of molecular biology" (http://www.ras.ru/news/shownews.aspx?id=3cb7c36f-8fbc-4a0c-b53e-d4be8c5af11e).

The conference organizers pursued a two-fold, scientific and pragmatic, goal. On the one hand, the forum was meant to provide young life science researchers with a much-needed opportunity to discuss the results of their work with the peers and seniors, to exchange views and ideas on key issues in focused subject areas and to enhance the existing interdisciplinary, interdepartmental and interfaculty research network in Moscow University. On the other hand, with English being the only working language of the event, its crucial pragmatic objective consisted in closely imitating the authentic format of professional communication at international scientific conferences, thus testing the adequacy of the students' operational knowledge of English as the global language of science and building their self-confidence.

The responsibility of achieving the first goal lay mainly with the students' supervisors and the departments where they specialized and conducted their research. Thus, the organizing and programme committees of the conference included professor Sergey A. Shoba, Dean of the Soil Science Faculty, corresponding member of the Russian Academy of Sciences; professor Alexander I. Kim, Deputy Dean, President of the Teaching and

Methodology Board of the Faculty of Biology; assistant professor Andrey V. Kitashov, Deputy Dean for International Cooperation of the Faculty of Biology; assistant professor Alexander A. Osmolovsky, Deputy Dean for Academic Affairs of the Faculty of Biology; assistant professor Nurshat M. Gaifullin, Deputy Dean for Research of the Faculty of Fundamental Medicine; assistant professor Ludmila D. Grigorieva, Deputy Dean for Academic Affairs of the Faculty of Fundamental Physical and Chemical Engineering; professor Sergey S. Karlov, Deputy Dean for Academic Affairs of the Faculty of Chemistry; assistant professor Olga V. Shpanchenko, Deputy Dean for Academic Affairs of the Faculty of Biotechnology.

To address the second goal, the Department of English for Sciences chaired by professor Lydia V. Polubichenko, devised a system of criteria that were consistently applied throughout the conference to assess the presenters' language and communication skills. The criteria, worked out by associate professor Lylia N. Shevyrdiaeva as an integral part of her innovative Master's degree *Course of Academic English for Biology Students*, incorporate the best international experience and expertise in the field and are fully adapted to the MSU standards and requirements. The scoring system is based on a 100-point grading scale for rating each student's academic achievement in speaking English (prepared presentation, asking and answering spontaneous questions), writing English (abstract, slides), public speaking and communication skills in the academic milieu.

The conference came as an important natural development in a series of actions taken by the Department to improve the standards of teaching English to science students. In particular, it was only made possible due to reformatting the Bachelor's degree final English language examination at the Faculty of Biology in 2014, when it was made to comply with the international standards of the B2-level certification examination and include the five traditional sections of reading, writing, speaking, listening, and use of English, all adapted to testing professional rather than general English. As a positive spillover effect, this decision brought about a number of momentous transformations in the process of teaching English to biology students at all the three – bachelor's, master's and doctor's – levels of higher education.

The conference organizing committee received 144 submissions, 137 presentations were made by students from the following six Moscow University faculties: Biology (99), Fundamental Physical and Chemical Engineering (12), Soil Science (10), Fundamental Medicine (9), Chemistry (4) and Biotechnology (3).

The plenary session encompassed six topics as diverse as European herbaceous vegetation, antioxidant enzymes activities, varicose veins,

reverse genetics, yeasts in tropical regions, and cancer immunotherapy.

- The work of the conference proceeded in the following sections:
- General biology
- Biochemistry and molecular biology
- Genetics, embryology, histology
- Bioengineering and biophysics
- Physiology and neurobiology
- Ecology

One unique feature of this conference was its strong academic community focus, the "we-are-all-one-big-academic-family" feeling. Indeed, the students appreciated that quite a few of their science and language teachers came to see them deliver their presentations, rooting for them. The teachers, for their part, were duly impressed and, on a number of occasions, pleasantly surprised with the students' mature performance and adequate command of English. In quite a few cases, the genuine interest of the audience led to free-ranging discussions of the issues raised by the speakers, which, having started in the conference room during a Q&A period, could easily spill over into the lobby. All in all, the conference made it perfectly clear to everyone involved that academic events of this kind, however hard to organize and conduct, are well worth it. They motivate students, promote a sense of belonging, give a feeling of achievement and job satisfaction, consolidate collective identity, and, in the long run, are, no doubt, mutually beneficial to both teachers and students alike.

Moreover, it is vitally important to Moscow University at large, as the national beacon of excellence in the sphere of education and science. To popularize Russian science in the international context, to spread information about the unique scientific schools of Moscow University and their outstanding achievements, regularly publishing in internationally accredited journals and participating in conferences worldwide, to organize powerful international scientific research teams in Russia, to attract to the alma mater students from abroad through personal contact and communication, – all these highly demanded functions that university teachers and researchers have to perform nowadays cannot be fulfilled unless they are well-versed in English, both spoken and written.

It is not for nothing that the conference title emphasized its focus on the future: in their presentations, the new generation of life scientists most convincingly demonstrated to their proud teachers and all those present their vast scientific potential. They proved to be creative and well-educated young professionals with up-to-date skills and interests, capable of doing

high-quality research and making serious contributions at the forefront of the life sciences. The papers covered the widest range of subjects from the classical problems in zoology and botany that never lose their interest and significance to the most recent topics emerging at the boundary of the traditionally biological and chemical, physical, geological and many other realms. From the plethora of these wide-ranging materials, however, the present volume only contains abstracts of 6 plenary and 13 sectional papers whose authors scored the most points for their English (from 90 to 100).

The apparent success of the conference brought about the unanimous decision to make it regular and hold annually, in the hope that every year the conference will attract more and more participants from different MSU science faculties, bringing together students and teachers doing research in life sciences and interested in learning and teaching English.

In conclusion, we would like to thank many people, students and professors, who have provided help, support and advice during the conference.

Alexander Kim
Lydia Polubichenko

CONFERENCE PROGRAMME

January 20

Plenary session 10.00–13.00	Afternoon session 14.00–18.00			
	Session 1. General biology		Session 2. Ecology	
	Subsession 1.1 Moderators: L.Shevyrdyaeva A.Izvolensky	Subsession 1.2 Moderators: L.Polubichenko N.Morgoun	Subsession 2.1 Moderators: O.Egorova A.Foursova	Subsession 2.2 Moderators: O.Kozlova A.Volkova
Conference opening address and welcome speech Lydia Polubichenko, Head of the Department of English for Sciences A.V.Kitashov, Deputy Dean of the Faculty of Biology				
Plenary presentations 1. Valentina Borodulina, Faculty of Biology European herbaceous vegetation: research limits, current state and potential threats 2. Ekaterina Gubernatorova, Faculty of Biology Proinflammatory cytokines in health and disease: reverse genetics 3. Elizaveta Krasavina, Faculty of Chemistry Analysis of elastin and glycosaminoglycans in primary varicose veins 4. Anna Morozova, Faculty of Soil Science Yeasts in tropical region 5. Vladislav Pavlov, Faculty of Fundamental Physical and Chemical Engineering Antioxidant enzyme activity in drug-resistant P388 mice leukemia cells 6. Artem Pilunov, Faculty of Biology Adoptive T cell transfer for cancer immunotherapy				
Room 126	Room 3A	Room 398	Room 292	Room 199

January 24

Morning session 10.00–14.00				Afternoon session 15.00–19.00		
Session 3. Biochemistry and molecular biology Session 4. Biophysics, bioengineering, biotechnology Session 5. Genetics, histology, embryology				Session 3. Biochemistry and molecular biology Session 4. Biophysics, bioengineering, biotechnology Session 6. Physiology and neurobiology		
Subsession 3.1 Biochemistry and molecular biology Moderators: L.Shevyrdyaeva O.Kozlova	Subsession 3.2 Biochemistry and molecular biology Moderators: L.Polubichenko T.Cherezova	Subsession 4.1 Biophysics, bioengineering, biotechnology Moderators: A.Foursova L.Frolova	Session 5. Genetics, histology, embryology Moderators: N.Morgoun A.Khakimova	Subsession 3.3 Biochemistry and molecular biology Moderators: L.Polubichenko A.Khakimova	Subsession 4.2 Biophysics, bioengineering, biotechnology Moderators: N.Morgoun A.Foursova	Session 6. Physiology and neurobiology Moderators: L.Shevyrdyaeva T.Cherezova
Room 126	Room 389	Room 199	Room 252	Room 398	Room 252	Room 343

January 20

Afternoon session 14.00–18.00; Subsession 1.1 General biology

Moderators: Lilia Shevyrdyaeva, Anna Izvolensky. Room 3A

	Name	Faculty, department	Title of paper in English	Title of paper in Russian
1	Дьякова Анна	Biology, Entomology	Study on morphology and fine structure of Megaphragma (Hymenoptera: Trichogrammatidae) brain	Изучение морфологии и ультраструктуры головного мозга Megaphragma (Hymenoptera: Trichogrammatidae)
2	Еникеев Радмир	Biology, Microbiology	New 1-hydroxy-2-thiopyridines active against mycobacteria	Изучение 1-гидрокси-2-тиопиридинов, активных в отношении микобактерии
3	Калинин Егор	Biology, Vertebrate zoology	Common Stonechat Saxicola torquatus sensu lato: complex analyses of variability in Palearctic	Черноголовый чекан Saxicola torquatus sensu lato: комплексный анализ изменчивости в Палеарктике
4	Немченко Людмила	Biology, Vertebrate zoology	Organization of bluethroat mating relations (Luscinia svecica) in sub-zone of dry steppes in Saratov region	Некоторые аспекты организации брачных отношений у варакушки (Luscinia svecica) в подзоне сухих степей Саратовского Заволжья
5	Нечаева Александра	Biology, Vertebrate zoology	Genetic diversity of the Chukotka-Kamchatka gyrfalcon (Falco rusticolus) population based on the nuclear microsatellite locus analysis	Генетическая изменчивость чукотско-камчатской популяции кречета(Falco rusticolus) на основании анализа ядерных микросателлитных локусов
6	Колтышева Дарья	Biology, Geobotany	Participation of mosses in alpine lichen heaths depending on soil nutrient and water availability	Изменение участия мхов альпийских лишайниковых пустошей при увеличении доступности почвенных ресурсов

7	Коренькова Анна	Biology, Vertebrate zoology	Comparative Analysis of Fox (Vulpes vulpes) and Wolf (Canis lupus) Pups' Play Behaviour at the Age of 4-11 Weeks	Сравнительный анализ игрового поведения у лисят Vulpes vulpes и волчат Canis lupus в возрасте от 4 до 11 недель
8	Никушин Олег	Biology, Plant physiology	The role of the cell wall in copper ions uptake by roots of Vicia narbonensis L.	Роль клеточной стенки в поглощении ионов меди корнями растений Вики нарбонской (Vicia narbonensis L.)
9	Никитин Михаил	Biology, Plant physiology	Accumulation and biological activity of protodioscin and deltoside isomers in cell suspension culture of Dioscorea deltoidea Wall.	Особенности накопления и биологическая активность изомеров протодиосцина и дельтозида в суспензионной культуре клеток диоскореи дельтовидной (Dioscorea deltoidea Wall.)
10	Ромашин Даниил	Biology, Plant physiology	Method comparison for long-term preservation of crude-oil utilizing microorganisms	Сравнение методов длительного хранения микроорганизмов, активных в отношении нефти
11	Федорчук Ольга	Biology, Anthropology	Ability to differentiate some signs of the human skull neurocranium	Дифференцирующие возможности некоторых признаков мозгового отдела черепа человека

January 20

Afternoon session 14.00–18.00; Subsession 1.2 General biology

Moderators: Lydia Polubichenko, Natalia Morgoun. Room 398

	Name	Faculty, department	Title of paper in English	Title of paper in Russian
1	Базаева Александра	Biology, Anthropology	The determination of the biological age of humans based on wrist bones: osseographic data	Определение биологического возраста по костям кисти: оссеографические данные
2	Бизин Михаил	Biology, Entomology	Acarocoenoses (Acari) of salt marshes in Russian Arctic: the taxonomical structure and spatial organization	Население клещей (Acari) приморских маршей российской Арктики: таксономическая структура и пространственная организация
3	Борисова Полина	Biology, Invertebrate zoology	Jaw structure in Lumbrineridae (Annelida) assessed by micro-computed tomography	Структура челюстного аппарата Lumbrineridae (Annelida) по данным компьютерной микротомографии
4	Воробьева Ольга	Biology, Invertebrate zoology	The Structure of Cnidosacs in Nudibranch Mollusc Aeolidia papillosa (Linnaeus, 1761) and Presumable Mechanism of Nematocysts Release	Строение книдосаков голожаберных моллюсков Aeolidia papillosa (Linnaeus, 1761) и возможный механизм выбрасывания клептокнид
5	Горелышева Дарья	Biology, Invertebrate zoology	Nematodes associated with foraminifera Reophax curtus in the White Sea	Нематоды, ассоциированные с фораминиферами Reophax curtus в Белом море

6	Железова Светлана	Biology, Geobotany	Functional traits of meadow plants on haymaking and conservation regimes in the Central Forest Reserve	Функциональные признаки луговых растений на заповедных и косимых лугах в Центрально-Лесном заповеднике
7	Изюмова Екатерина	Biology, Entomology	Using of the isotope analysis of the Coleoptera remains for reconstruction of the environmental conditions at time of their life in the Pleistocene-Holocene of North-East Russia	Применение изотопного анализа остатков Coleoptera для реконструкции условий их обитания в плейстоцене-голоцене северо-востока России
8	Киселица Марина	Biology, Mycology and algology	Endocytosis and it`s inhibitors in basidiomycetous fungus in Rhizoctonia solani	Эндоцитоз и его ингибиторы у базидиального гриба Rhizoctonia solani
9	Неклюдов Борис	Biology, Invertebrate zoology	A new phoronid species Phoronis savinkini sp. nov. from South China Sea	Новый вид форониды Phoronis savinkini sp.nov. из Южно-Китайского моря
10	Никишова Екатерина	Biology, Hydrobiology	Small flagellated protists of the White Sea plankton	Мелкие жгутиковые протисты планктона Белого моря
11	Размадзе Дарья	Biology, Evolution	Constructive features of the musculoskeletal system of the forelimb of the parrot on the example of Psittacus Erithacus.	Конструктивные особенности костно-мышечной системы летательного аппарата попугаев на примере Psittacus erithacus
12	Сенькова Анастасия	Biology, Mycology and algology	Contaminant mycobiota of mushroom farms of different specialization	Контаминантная микобиота грибоводческих хозяйств разной специализации

January 20

Afternoon session 14.00–18.00; Subsession 2.1 Ecology

Moderators: Olga Egorova, Alexandra Foursova. Room 292

	Name	Faculty, department	Ttitle of paper in English	Ttitle of paper in Russian
1	Ардисламов Назар	Soil science	Complex fertilization influence on yield and quality of sweet potato (Ipomoéa batátas)	Влияние комплексных удобрений на урожай и качество батата (Ipomoéa batátas)
2	Бондарева Елена	Soil science	The fungal biomass and composition of microscopic fungi in the White sea sediments of littoral zone.	Грибная биомасса и состав микроскопических грибов в грунтах литорали Белого моря
3	Борисенко Геннадий	Soil science	On the Effect of Salinity on Diazotrophic Activity and Microbial Composition of Phototrophic Communities in Bitter-1 Soda Lake (Kulunda Steppe, Russia)	О влиянии солености на диазотрофическую активность фототрофных сообществ озера Горчина-1 (Кулундинская степь, Алтайский край)
4	Бухтоярова Наталья	Biology, Mycology and algology	The results of long-term monitoring of the species diversity of myxomycetes in the Central Forest National Biosphere Reserve	Результаты многолетнего мониторинга видового разнообразия миксомицетов Центрального-Лесного Государственного Природного Биосферного заповедника
5	Венжик Александра	Soil science	Polyphasic analysis of intraspecific variation in yeasts Rhodotorula mucilaginosa	Полифазное изучение внутривидовой вариабельности дрожжей Rhodotorula mucilaginosa
6	Гаврилова Татьяна	Biology, Geobotany	Modelling of plant distribution in the Crimea (Apiaceae case study)	Моделирование распространения растений в Крыму (на примере семейства Apiaceae)

7	Глущенко Виктория	Soil science	On the investigation of the Bacterial Community Structure of Activated Sludge for Treatment Plants by Molecular Biological Methods	Об исследование структуры бактериального сообщества активного ила очистных сооружений молекулярно-биологическими методами
8	Захарченко Дарья	Biology, Geobotany	On the moss flora of the surroundings of Cape Zhelaniya (Severny (Northern) Island, Novaya Zemlya Archipelago)	Мхи мыса Желания (остров Северный, архипелаг Новая Земля)
9	Захарычева Алиса	Soil science	Microbiological characteristics of 2 novel genus-level taxa hydrolytic haloalkaliphilic actinobacteria from soda solonchaks.	Микробиологическая характеристика 2 новых родов гидролитических галоалкалофильных актинобактерий, выделенных из содовых солончаков
10	Казакова Анастасия	Soil science	The role of vegetation in the transformation of atmospheric and soil water during growth period at different stages of autogenous succession in coniferous-broadleaf forests (the case study of Bryansk region)	Роль растительности в трансформации состава атмосферных и почвенных вод в период вегетации на разных стадиях аутогенной сукцессии в хвойно-широколиственных лесах Брянской области
11	Карелина Екатерина	Biology, Mycology and algology	Powdery mildew fungi in urban conditions	Мучнисторосяные грибы в городских условиях
12	Кривова Зинаида	Biology, Mycology and algology	Complex characteristic of microalgae strains which inhabit on salt Lake Shira	Комплексная характеристика штаммов микроводорослей, изолированных из солёного озера Шира

January 20

Afternoon session 14.00–18.00; Subsession 2.2 Ecology

Moderators: Oxana Kozlova, Alexandra Volkova. Room 199

	Name	Faculty, department	Ttitle of paper in English	Ttitle of paper in Russian
1	Дмитриева Анастасия	Biology, Evolution	Study adaptation of Drosophila melanogaster (Diptera, Drosophilidae) to high NaCl medium	Изучение адаптации Drosophila melanogaster (Diptera, Drosophilidae) к среде с повышенным содержанием NACL
2	Комарова Валерия	Biology, Vertebrate zoology	Effects of social environment on the acoustic variables and occurrence of trumpet calls in the crested auklet's males (AETHIA CRISTATELLA)	Влияние социального окружения на акстические параметры и встречаемость триумфального крика самцов большой конюги (AETHIA CRISTATELLA)
3	Костерина Александра	Soil science	Lake Baikal. Two Steps from Disaster.	Озеро Байкал. Два шага до катастрофы.
4	Курапова Валерия	Soil science	Soil Monitoring and Radiation Control: Case Study of Torbeevo Solid Household Waste Landfill (Moscow Region)	Почвенный мониторинг и радиационный контроль вокруг полигона твердых коммунальных отходов «Торбеево» Московской области
5	Мерзеликин Александр	Biology, Hydrobiology	Application of the ADaM medium in toxicological investigations on the example of Ceriodaphnia affinis Lilljeborg	Применение искусственной среды ADaM для токсикологических исследований на примере Ceriodaphnia affinis Lilljeborg

6	Михайлова Мария	Biology, Vertebrate zoology	Interaction between Thrush Nightingale (Luscinia luscinia) and Common Nightingale (Luscinia megarhynchos) in the zones of secondary contact	Взаимоотношения восточного (Luscinia luscinia) и южного (Luscinia megarhynchos) соловьев в зонах вторичного контакта
7	Попова Марина	Soil science	Content and distribution of 137Cs in podzols and Vaccínium myrtíllus within the impact zone of the Kola nuclear power plant	Содержание и распределение 137Cs в подзолах и Чернике миртолистной в зоне влияния Кольской атомной электростанции
8	Пыркин Владислав	Soil science	Influence of forest fires on biological activity of soils	Влияние лесных пожаров на биологическую активность почв
9	Фролов Олег	Soil science	Influence of the passage through the intestine Aporrectodea caliginosa on the bacterial community.	Влияние пассажа через кишечник Aporrectodea caliginosa на бактериальное сообщество
10	Фронтова Алена	Biology, Geobotany	Phylogenetic signal of alpine plant functional traits in the North Caucasus	Филогенетический сигнал функциональных признаков альпийских растений Северного Кавказа
11	Чернышева Ангелина	Soil science	Microbial nitrogen fixation of the digestive tract of Tipulidae larvae of different ecological and trophic groups	Микробная азотфиксация пищеварительного тракта личинок типулид разных эколого-трофических групп
12	Gorshkova A.A., Fetisova E.S., Yakovleva E.U.	Biology, Evolution	Drosophila melanogaster adaptation to unfavourable food media: the results of an experimental evolution study	Адаптация Drosophila melanogaster к неблагоприятным кормовым субстратам: результаты эволюционного эксперимента

January 24

Morning session 10.00–14.00; Subsession 3.1 Biochemistry and molecular biology

Moderators: Lilia Shevyrdyaeva, Oxana Kozlova. Room 398

	Name	Faculty, department	Ttitle of paper in English	Ttitle of paper in Russian
1	Антипова Ольга	Chemistry	Barium cations are an effective tool for G-quadruplex DNA folding analysis	Катионы бария – эффективный инструмент анализа сборки G-квадруплексной ДНК
2	Баласанянц Самсон	Biology, Bioorganic chemistry	Fragments of the receptor for advanced glycation endproducts: prevention of memory loss and neuronal morphology impairment in animals with Alzheimer's-like neurodegeneration	Фрагменты рецептора конечных продуктов гликозилирования предотвращают потерю памяти и ухудшение морфологии нейронов у животных с нейродегенерацией альцгеймеровского типа
3	Гаджимурадова Надежда	Fundamental Physical and Chemical Engineering	Electrochemical activity of Escherichia coli extracts	Электрохимическая активность экстрактов бактерии кишечной палочки
4	Гиголаев Андрей	Biology, Bioorganic chemistry	New potassium channel blockers based on peptides from scorpion venom	Новые блокаторы калиевых каналов на основе пептидов из яда скорпионов
5	Григоров Артем	Biology, Bioorganic chemistry	Small non-coding RNA ncRv10243A as a modulator of oxidative stress response in Mycobacterium smegmatis	Малая некодирующая РНК ncRv10234A – модулятор окислительного стресса Mycobacterium smegmatis

6	Григорьев Андрей	Biology, Biochemistry	Transcriptional factor PREP1 in mesendodermal differentiation of mouse embryonic stem cells	Транскрипционный фактор PREP1 в мезэнтодермальной дифференцировке эмбриональных стволовых клеток мыши
7	Добролюбова Юлия	Biology, Immunology	Anti-Avastin Idiotypic Nanobodies	Анти-авастин идиотипические наноантитела
8	Зенков Роман	Biology, Virology	Stabilization of G-quadruplexes in promoter regions: simultaneous inhibition of expression of genes involved in carcinogenesis	Стабилизация G-квадруплексов в промоторных областях: одновременное подавление экспрессии генов, вовлеченных в процесс канцерогенеза
9	Иванников Роман	Biology, Virology	The competition between tick-borne encephalitis virus and Powassan virus during reproduction in the porcine embryo kidney cells	Конкуренция между вирусом клещевого энцефалита и вирусом Повассан при репродукции в культуре клеток почек эмбриона свиньи
10	Костюк Александр	Biology, Biochemistry	Genetically encoded fluorescent biosensor for hypochlorous acid detection	Генетически кодируемый флуоресцентный биосенсор для детекции хлорноватистой кислоты
11	Семин Ярослав	Biology, Immunology	Development of microbiota-specific IgA antibodies for the diagnostic and treatment of human diseases	Разработка специфичных к микробиоте ИгА антител для лечения и диагностирования болезней человека
12	Султанов Даниэль	Biology, Molecular biology	Unfolding of nucleosomes by PARP-1	Разворачивание нуклеосом фактором PARP-1

January 24

Morning session 10.00–14.00; Subsession 3.2 Biochemistry and molecular biology

Moderators: Lydia Polubichenko, Tatiana Cherezova. Room 389

	Name	Faculty, department	Ttitle of paper in English	Ttitle of paper in Russian
1	Антонова Наталия	Fundamental medicine	The development of novel antimicrobial agent to challenge bacterial resistance of Pseudomonas aeruginosa	Разработка нового антимикробного препарата для борьбы с резистентными бактериями Pseudomonas aeruginosa
2	Башарина Анна	Fundamental medicine	Estrogen receptor beta as a predictive marker in ovarian cancer patients treated with platinum and taxane-based chemotherapy	Экспрессия эстрогеновых рецепторов бета как предиктивный маркёр чувствительности к химиотерапии рака яичников.
3	Гузь Арсентий	Biology, Bioorganic chemistry	The synthesis of the antiviral compounds on the based on cytidine modified with bulky aromatic substituents	Синтез противовирусных соединений на основе цитидина с объемными ароматическими заместителями
4	Иваненко Александр	Biology, Biochemistry	Genetically encoded fluorescent biosensor for succinate detection	Генетически кодируемый флуоресцентный биосенсор для детекции сукцината
5	Ильин Иван	Fundamental medicine	Design of new inhibitors for target proteins of influenza virus by means of molecular modeling	Разработка новых ингибиторов для белков-мишеней вируса гриппа с помощью методов молекулярного моделирования
6	Капуста Дмитрий	Chemistry	Solvent effects in reactions of enzymatic catalysis	Сольватационные эффекты в реакциях ферментативного катализа

7	Петушкова Анастасия	Biology, Molecular biology	Rational design of recombinant papain-like cysteine protease: optimal domain structure and expression conditions for wheat-derived enzyme triticain-α	Рациональный дизайн рекомбинантной папаин-подобной цистеиновой протеиназы: оптимальная доменная организация и условия экспрессии фермента пшеницы тритикана-α
8	Козлова Анастасия	Biology, Molecular biology	Effect of Nhp6 protein on nucleosome transcription	Изучение роли белка Nhp6 в транскрипции нуклеосом
9	Ковшова Татьяна	Fundamental medicine	Approaches to Design Polymeric Nanoparticle-Based Drug Delivery Systems for Fluoroquinolones	Разработка подходов к созданию систем доставки фторхинолонов на основе полимерных наночастиц
10	Корсакова Екатерина	Fundamental medicine	Development of approaches to standardization and pharmacological study of the original non-nucleoside inhibitor of HIV-1 reverse transcriptase	Разработка подходов к стандартизации и фармакологическое изучение оригинального ненуклеозидного ингибитора обратной транскриптазы ВИЧ-1
11	Красовитов Кирилл	Biology, Biochemistry	Role of protein kinase Hog1 in manifestations of protein glycosylation defects in the secretory pathway inHansenula polymorpha	Роль протеинкиназы Hog1 в фенотипических проявлениях нарушений гликозилирования белков в секреторном пути у дрожжей Hansenula polymorpha
12	Кузнецова Екатерина	Fundamental medicine	Optimized protocol for decellularization of extracellular matrix produced by mesenchymal stromal cells	Оптимизация протокола децеллюлиризации внеклеточного матрикса, продуцируемого мезенхимными стромальными клетками
13	Кулакова Анна	Chemistry	Molecular modeling of hydrolysis in the active site of human carboxylesterase-1	Молекулярное моделирование реакции гидролиза в активном сайте карбоксилэстеразы-1 человека

January 24

Afternoon session 15.00–19.00; Subsession 3.3 Biochemistry and molecular biology

Moderators: Lydia Polubichenko, Albina Khakimova. Room 398

	Name	Faculty, department	Ttitle of paper in English	Ttitle of paper in Russian
1	Лопатухина Елена	Biology, Biochemistry	Developing novel approaches for generation of cells with knockout of genes of interest using CRISPR-Cas9 technique	Разработка новых подходов по созданию клеток с нокаутом интересующих генов с использованием технологии CRISPR-Cas9
2	Метелешко Юлия	Chemistry	Molecular modeling of mutants of fluorescent protein iLOV with modified spectral properties	Молекулярное моделирование мутантов флуоресцентного белка iLOV с модифицированными спектральными свойствами
3	Мотовилов Дмитрий	Biology, Bioorganic chemistry	A novel inhibitor of acetylcholine receptor derived from Gloydius saxatilis	Новый ингибитор ацетилхолинового рецептора полученный из Gloydius saxatilis
4	Павлова Анжела	Chemistry	DNA G-quadruplexes interaction with mismatch repair proteins	Взаимодействие G-квадруплексов в ДНК с белками из системы репарации «мисматчей»
5	Панова Анастасия	Biology, Biochemistry	In vivo visualization of biochemical processes in Danio rerio tissues using genetically encoded biosensors	In vivo визуализация биохимических процессов в тканях рыбы Danio rerio с помощью генетически кодируемых биосенсоров
6	Сагарадзе Георгий	Fundamental medicine	Development of combined biomaterial based on human mesenchymal stem/ stromal cell secreted products for spermatogenesis recovery	Разработка комбинированного биоматериала на основе продуктов секретирования мезенхимальных стволовых / стромальных клеток человека для восстановления сперматогенеза

7	Спектор Мириам	Biology, Biochemistry	HLA-typing by cDNA high-throughput sequencing	HLA-типирование с помощью массированного секвенирования кДНК
8	Смертина Елена	Fundamental medicine	A novel approach for delivery of tumor specific antigen coding RNA on the surface of oncolytic Vaccinia virus	Новый подход к доставке РНК, кодирующей опухолеспецифичный антиген, на поверхности онколитического вируса Vaccinia
9	Солодовников Александр	Biology, Molecular biology	The mechanisms of amenability of genes for the heterochromatin-mediated cis- and trans-inactivation	Механизмы чувствительности генов к гетерохроматиновому окружению при цис- и транс-инактивации
10	Фокичев Николай	Biology	Sarocladium strictum - as new producer of a complex trombolytic enzymes with plasminogen activator activity	Sarocladium strictum – новый перспективный продуцент комплекса тромболитических ферментов с активаторным к плазминогену действием
11	Чудецкий Иван	Biology, Bioorganic chemistry	α-Cobratoxin conjugated with fluorescent protein is a novel molecular tool for nicotinic acetylcholine receptor research	α-Кобратоксин соединенный с флуоресцентным белком – новейший молекулярный инструмент для изучения никотинового ацетилхолинового рецептора
12	Ширяев Дмитрий	Chemistry	High-throughput screening for both new translation and DNA` biosynthesis inhibitors and determination of their mode of action using double reporter system	Поиск новых ингибиторов трансляции и биосинтеза ДНК с определением механизма их действия с помощью двойной репортерной системы

January 24

Morning session 10.00–14.00; Subsession 4.1 Biophysics, bioengineering, biotechnology

Moderators: Alexandra Foursova, Liudmila Frolova. Room 199

	Name	Faculty, department	Ttitle of paper in English	Ttitle of paper in Russian
1	Андронов Михаил	Fundamental physical and chemical engineering	Synthesis and study of anionic complexes of fullerene C60 with cobalt(II) tetraphenylporphyrinate and cobalt(II) phtalocyanine	Синтез и исследование анионных комплексов фуллерена С60 с тетрафенилпорфиринатом кобальта(II) и фталоцианином кобальта(II)
2	Базылев Сергей	Biology, Bioengineering	Investigation of structure and functions of AT-chX genomic repeats in Drosophila melanogaster genome	Исследование структуры и функций геномных повторов AT-chX в геноме Drosophila melanogaster
3	Батов Михаил	Fundamental physical and chemical engineering	cis-Thioindigo (TI) – a new ligand with accessible radical anion and dianion states. Strong magnetic coupling in the {[TI-(μ2-O),(μ-O)]Cp*CrIII}2 dimers	цис-Тиоиндиго (TI) – новый лиганд с доступными анионом и дианионом. Сильные магнитные взаимодействия в димерах{[TI-(μ2-O),(μ-O)]Cp*CrIII}2
4	Бегрова Дарья	Biology, Bioengineering	Study of the complex Hof1-Bnr1 structure by electron microscopy	Изучение структуры комплекса Hof1-Bnr1 методом электронной микроскопии
5	Белова Евгения	Biotechnology	Оценка эффективности использования азота трансгенными растениями березы с геном глутаминсинтетазы	Effect of glutamine synthetase (GS) gene expression and nitrogen fertilization on the growth of transgenic birch plants (B. pubescens)
6	Вахрушева Анна	Biology, Bioengineering	Improvement of endoglucanase 2 chemical properties from Penicillum Verruculosum by site-directed mutagenesis	Улучшение химических свойств эндоглюканазы 2 из Penicillium Verruculosum методом направленного мутагенеза

7	Гиппиус Алексей	Fundamental physical and chemical engineering	Development of plasma-chemical team of synthesis of nanodispersed oxide of nickel and stabilized zirconium dioxide	Разработка плазмохимического метода синтеза нанокристаллических оксидов никеля и стабилизированного диоксида циркония
8	Жуков Олег	Biology, Biophysics	Model-based estimate of energy use by neocortical pyramidal neurons and interneurons	Модельная оценка энергетических затрат пирамидальных нейронов и интернейронов неокортекса
9	Зиборов Георгий	Fundamental physical and chemical engineering	Competition of band and hopping mechanisms of carrier transport in thin films of Ge:Mn with percolative magnetic ordering	Конкуренция зонного и прыжкового механизмов переноса носителей заряда в тонких пленках Ge:Mn с перколяционным магнитным упорядочением
10	Крапивин Владимир	Fundamental physical and chemical engineering	Structure–property relationships for oxidation potentials of stable nitroxyl radicals in solution	Влияние природы заместителя на потенциал окисления стабильных нитроксильных радикалов в растворе
11	Кузнецов Владислав	Fundamental physical and chemical engineering	Development of surface enchanted fluorescence (SEF) method for detection of molecular structure “dye-fullerene” with low quantum yield of fluorescence in biological systems	Разработка метода поверхностно усиленной флуоресценции молекулярных структур “краситель-фуллерен” с малым квантовым выходом флуоресценции в биологических системах

January 24

Afternoon session 15.00–19.00; Subsession 4.2 Biophysics, bioengineering, biotechnology

Moderators: Natalia Morgoun, Alexandra Foursova. Room 252

	Name	Faculty, department	Ttitle of paper in English	Ttitle of paper in Russian
1	Ким Юлия	Fundamental physical and chemical engineering	Development of the method of analysis 4,4`-bis-(tert-butyl-phenyl) amine anti-oxidant and its application	Разработка метода анализа антиоксиданта 4,4`-ди-трет-бутилдифениламина и его применение
2	Козловцева Дарья	Biology, Microbiology	The study of the influence of nutrient medium composition on the ability of Streptococcus pneumoniae to synthesize capsular polysaccharide	Изучение влияния состава питательной среды на способность Streptococcus pneumoniae синтезировать капсульный полисахарид
3	Меньших Ксения	Biotechnology	Modification via calcium phosphates as a way to increase the osteoinductivity of demineralized bone matrix	Модификация фосфатами кальция как способ повышения остеоиндуктивности костного матрикса
4	Михайлова Мария	Biology, Bioengineering	Function of a novel mammalian protein POLGX	Изучение функции нового белка млекопитающих POLGX
5	Моргунова Софья	Fundamental physical and chemical engineering	Photodynamic activity of water-soluble fullerene-chlorene nanostructuresin model system and their phototoxicity on HeLa cells	Фотодинамическая активность водорастворимых фуллерен-хлорин наноструктур в модельной системе и их фототоксичность на клетках HeLa
6	Овсянников Николай	Fundamental physical and chemical engineering	Heat resistance of Ti3Si1,25C2 MAX-phase coatings made by aerosol deposition method	Жаростойкость покрытий из MAX-фазы системыTi3Si1,25C2, полученных методом аэрозольного осаждения в вакууме

7	Родин Максим	Fundamental physical and chemical engineering	Synthesis and Properties of Polyurethane Elastomers Based On Beta-cyclodextrin Derivatives and Some Energetic Oligodiols	Синтез и свойства полиуретановых эластомеров на основе производных бета-циклодекстрина и некоторых энергетических олигодиолов
8	Скулкина Ксения	Biotechnology	Role of substituted salicilates in modulation of sal degradation gene activity	Роль замещенных салицилатов в модуляции активности генов их деградации
9	Слатинская Ольга	Biology, Biophysics	Effects of phosphate on photoactivity of the Orange Carotenoid Protein	Влияние фосфата на конформационные переходы в оранжевом каротиноидсодержащем белке
10	Федотов Алексей	Biotechnology	In vitro culture of Curio articulatus through regeneration from leaf and stem explants	Регенерация Curio articulatus из листовых и стеблевых эксплантов в культуре in vitro
11	Хомич Дарья	Biology, Biophysics	Interaction of polylysines with the surface of lipid membranes: The electrostatic and structural aspects	Взаимодействие полилизинов с поверхностью липидных мембран: электростатические и структурные аспекты
12	Шматко Артем	Fundamental physical and chemical engineering	Three-membered metallacycles of platinum revealed by mass-spectrometry	Трехчленные металлациклы платины, обнаруженные методом масс-спектрометрии

January 24

Morning session 10.00–14.00; Session 5. Genetics, histology, embryology

Moderators: Natalia Morgoun, Albina Khakimova. Room 252

	Name	Faculty, department	Ttitle of paper in English	Ttitle of paper in Russian
1	Басалова Наталья	Biology, Cell biology and histology	The human mesenchymal stromal cell secretome in tissue regeneration	Секретом мезенхимных стромальных клеток человека в регенерации тканей
2	Дутова Алиса	Biology, Genetics	Cloning of Rhodobacter sphaeroides reaction center genes in Photosistem II-deficient mutant of the cyan obacterium Synechocystis sp. PCC6803	Клонирование генов реакционного центра Rhodobacter sphaeroides в клетках мутанта цианобактерии Synechocystis sp. PCC6803, лишенного фотосистемы II
3	Дронов Илья	Biology, Cell biology and histology	Histophysiology of testicles after high-dose testosterone injections in C57Bl/6 mice	Гистофизиология семенников мышей C57BL/6 при введении высокой дозы тестостерона
4	Занина Анна	Fundamental physical and chemical engineering	Effect of hydroxamic acids on cytotoxicity of platinum complexes	Влияние гидроксамовых кислот на цитотоксичность платиновых комплексов
5	Зорникова Ксения	Biology, Cell biology and histology	The effect of cell-to-cell communication on multipotent mesenchymal stromal cells functional activity	Влияние межклеточной коммуникации на функциональную активность мультипотентных мезенхимальных стромальных клеток
6	Капитанова Ксения	Biology, Cell biology and histology	Detection of small subsets of CD4+ T-lymphocytes from peripheral blood of healthy donors and patients with atopic dermatitis using new method SmartFlare	Детекция малых субпопуляций CD4+ Т-лимфоцитов периферической крови здоровых доноров и пациентов с атопическим дерматитом с помощью нового метода SmartFlare

7	Конеева Цаган	Biology, Embryology	Dopaminergic system in the developing rat thymus	Дофаминергическая система в развивающемся тимусе крыс
8	Латыева Олеся	Biology, Embryology	Interaction of MSCs and myoblasts in the in vitro model of facioscapulohumeral muscular dystrophy	Изучение взаимодействия МСК и миобластов на in vitro модели миодистрофии Ландузи Дежерина
9	Лунькова Анна	Biology, Genetics	Molecular genetic analysis of the prevalence of bee viruses in the Western regions of the Russian Federation	Молекулярно-генетический анализ распространенности вирусов пчел на западной территории Российской Федерации
10	Мещерякова Полина	Biology, Genetics	Analysis of genome polymorphism of related isolates Trichormus variabilis	Анализ природы генетического полиморфизма близкородственных изолятов Trichormus variabilis
11	Миляева Полина	Biology, Genetics	Searching new genes involved in control of retroelements transposition in Drosophila melanogaster	Поиск новых генов, участвующих в контроле транспозиции ретроэлементов у Drosophila melanogaster
12	Паршина Елена	Biology, Embryology	The role of the cytoskeletal protein Zyxin in transcriptional regulation of the Pou5f3 genes during the early African clawed frog development	Роль цитоскелетного белка Zyxin в регуляции транскрипции генов Pou5f3 в ходе раннего развития эмбрионов шпорцевой лягушки
13	Потрясаева Наталья	Biology, Cell biology and histology	Viability of micronucleated tumor cells in vitro	Выживаемость опухолевых клеток с микроядрами in vitro
14	Ястребова Маргарита	Biology, Cell biology and histology	The role of transcription factor Snail in the resistance of breast cancer cells to hypoxia	Роль транскрипционного фактора Snail в устойчивости клеток рака молочной железы к гипоксии

January 24

Afternoon session 15.00–19.00; Session 6. Physiology and neurobiology

Moderators: Lilia Shevyrdyaeva, Tatiana Cherezova. Room 343

	Name	Faculty, department	Ttitle of paper in English	Ttitle of paper in Russian
1	Абрамов Евгений	Biology, Human and animal physiology	Effects of thrombin on function of rat astrocytes under ischemia	Особенности влияния тромбина на функции астроцитов крыс в условиях ишемии
2	Бармин Роман	Fundamental physical and chemical engineering	Study of photochemical and toxic properties of porphyrazines as promising photosensitizers for PDT	Изучение фотохимических и токсических свойств порфиразинов в применении к терапии онкологических заболеваний
3	Гринева Изабелла	Fundamental physical and chemical engineering	Molecular mechanisms of antitumor effect of the platinum(IV) complex with derivatives of isonicotinic acid as ligands	Молекулярные механизмы противоопухолевого действия комплекса платины(IV) с лигандами – производными изоникотиновой кислоты
4	Жараспаева (Полубедова) Софья	Fundamental medicine	Challenges of lipid-lowering therapy	Проблемы гиполипидемической терапии
5	Колотова Дарья	Biology, Human and animal physiology	The role of the caudate nucleus in absence epilepsy in WAG/Rij rats	Роль хвостатого ядра в абсансной эпилепсии у крыс линии WAG/Rij
6	Кондрашова Мария	Fundamental medicine	Review of the GMP headlines of EAEU countries	Анализ GMP практик стран ЕАЭС

7	Леонов Владислав	Biology, Human and animal physiology	Autoregulation of neurotransmitter release in mature and newly-formed mouse neuromuscular junctions involving α7-nAChRs	Механизмы ауторегуляции секреции медиатора в зрелых и новообразованных нервно-мышечных синапсах мыши с участием α7-нХР
8	Ободенская Ольга	Fundamental medicine	Pharmacokinetics and tissue distribution of ubiquinol for intravenous administration	Фармакокинетика и тканевое распределение убихинола для внутривенного введения
9	Папулина Мария	Fundamental medicine	A study of the efficacy of cisplatin in combination with digoxin in the ascites model of breast cancer	Изучение эффективности цисплатина при комбинированном применении с дигоксином на модели асцитного рака молочной железы
10	Пахомов Николай	Biology, Human and animal physiology	Negative inotropic effects of extracellular diadenosine tetraphosphate are mediated by protein kinase C and phosphodiesterases stimulation in the rat heart	Негативные инотропные эффекты внеклеточного диаденозин тетрафосфата в сердце крысы обусловлены действием протеинкиназы С и фосфодиэстеразами
11	Полищук Александра	Biology, Neurobiology	Selective slow-wave sleep suppression affects the glucose tolerance	Влияние селективной супрессии третьей стадии сна на толерантность к глюкозе
12	Разумовская Мария	Biology, Neurobiology	Effect of Noopept on nicotinic cholinoreceptors in command Helix neurons.	Влияние ноопепта на никотиновые холинорецепторы командных нейронов виноградной улитки
13	Ростовцева Александра	Fundamental medicine	Study of the ability of the plasmid encoding BDNF and uPA to restore the brain after hemorrhagic stroke	Изучение способности плазмиды, кодирующей BDNF и uPA, восстанавливать мозг после геморрагического инсульта
14	Швырева Елена	Biology, Human and animal physiology	The effect of modified fragments of obesitatin on body weight and other physiological characteristics	Влияние модифицированных фрагментов обестатина на массу тела и другие физиологические характеристики

EUROPEAN HERBACEOUS VEGETATION: RESEARCH LIMITS, CURRENT STATE AND POSSIBLE THREAT

ЕВРОПЕЙСКАЯ ТРАВЯНАЯ РАСТИТЕЛЬНОСТЬ: ПРОБЛЕМЫ ИЗУЧЕНИЯ, СОВРЕМЕННОЕ СОСТОЯНИЕ И ВОЗМОЖНЫЕ УГРОЗЫ

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Until nowadays geobotanists encounter a number of difficulties in their work with herbaceous vegetation despite the development of vegetation science. Traditionally, the term *herbaceous vegetation* is understood as formation dominated by herbs (non-woody vascular plants): meadows, steppes, marshes, ruderal and wetland communities. This paper focuses on European herbaceous vegetation because herbaceous communities on other continents are quite different, and formed and developed under the influence of other factors.

Difficulties in studies begin with the lack of unified terminology. Besides, herbaceous vegetation displays a variety of different types, and most often the border between them is not clear. Some of the problems are related to the organization of herbaceous ecosystems: their composition, structure, dynamic processes. A number of limitations are associated with attempts to classify existing herbaceous communities. Nevertheless, they are less classifiable than other vegetation types. The classification of European herbaceous communities is still poorly developed. Other limits are caused by the imperfection of methods and lack of uniform approaches to classification and research. So the main task now is to develop uniform methods to study the herbaceous vegetation which will take into account common features and specificity of these ecosystems.

Today many of the herbaceous communities are threatened by the change of land use towards intensification, abandonment and afforestation. This may lead to the disappearance of these ecosystems as objects of study. Under the changing conditions, the current state of herbaceous vegetation is still poorly studied. Considering this problem, we will focus on meadows, which are familiar to everyone in our region. They are an essential part of the cultural landscape of Europe and result from centuries or even millennia of low-intensity land use since the beginning of the Neolithic period. Mainland meadows of the forest zone are formed and maintained by human activities and were widespread in Europe at the turn

of the XX century. During the last century, due to changes in land use, its area shrank across Europe. This trend leads to a dramatic decrease in biodiversity and successional changes in these communities. Large areas of meadows become overgrown with shrub and woody vegetation. However these ecosystems do not fit the usual protection systems because they are maintained by anthropogenic influence. Therefore, meadows on the territories of reserves are also under threat.

Lack of unified approaches and research limitations together with current threats make herbaceous communities an important object of study in the modern changing world.

PROINFLAMMATORY CYTOKINES IN HEALTH AND DISEASE: REVERSE GENETICS

ОБРАТНАЯ ГЕНЕТИКА – ПОДХОД К ИЗУЧЕНИЮ ФУНКЦИЙ ПРОВОСПАЛИТЕЛЬНЫХ ЦИТОКИНОВ В НОРМЕ И ПАТОЛОГИИ

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Reverse genetics provides methodology to identify phenotypes associated with particular genetic sequence variations, ex. mutations or a complete gene inactivation. IL6, originally discovered as B cell stimulating factor 2, is a proinflammatory cytokine with pleiotropic functions ranging from hematopoietic regulation and tissue regeneration to chronic inflammation, autoimmunity and cancer development. Techniques of reverse genetics, such as conditional gene targeting, helped to establish the contributions of IL-6 to various disease states and its physiological functions in the healthy organism. Therapeutic inhibitors of IL-6 or its receptor are already used to treat a number of autoimmune diseases; however, the systemic inhibition inevitably results in neutralizing the protective functions of this cytokine. Using conditional gene targeting, we are dissecting distinct physiological functions of IL-6 produced by various cell types in the context of the live animal with the idea in mind that pathogenic features in a particular disease may be restricted to only some cellular sources.

Similar to other proinflammatory cytokines, IL-6 is elevated in asthma, a common inflammatory disease of the airway, and plays an active role in this disease. However, the exact molecular mechanism of IL-6 involvement in the pathogenesis of asthma remains largely unknown and the major cellular sources of pathogenic IL-6 have not been established. To address the role of IL-6 producing cells in allergic airway inflammation, we generated mice with tissue-restricted inactivation of IL-6 in myeloid (Mlys-Cre IL-$6^{fl/fl}$) and in dendritic (CD11c-Cre IL-$6^{fl/fl}$) cells and subjected them to intranasal administration of HDM (house dust mite) extract for 5 days per week with additional sensitization treatment for one week prior to the main course. We found that complete genetic inactivation of IL-6 or pharmacological inhibition using blocking antibody ameliorated the disease, with significant decrease in eosinophilia of the lungs. Interestingly, specific deletion of IL-6 in either macrophages or DCs reduced key indicators of allergic inflammation including lymphocyte infiltration, eosinophil and Th2 cell accumulation in the lungs, production of HDM-specific IgE and expression of asthma-associated inflammatory mediators. Taken together, our results indicate that IL-6 plays a pathogenic role in

HDM-induced asthma model and that lung macrophages and DCs are important sources of pathogenic IL-6, thus providing a rational basis for anti-IL-6 based therapies for patients with asthma.

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ANALYSIS OF ELASTIN AND GLYCOSAMINOGLYCANS IN PRIMARY VARICOSE VEINS

АНАЛИЗ СОДЕРЖАНИЯ ЭЛАСТИНА И ГЛИКОЗОАМИНГЛИКАНОВ В ВАРИКОЗНЫХ ВЕНАХ

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The primary cause of varicose veins is still unknown. Morphological studies showed alterations of collagen in the varicose vein walls. Venous insufficiency is a common medical condition afflicting 25% of women and 15% of men. Varicose veins present a significant clinical problem, but the aetiology and pathogenesis of primary varicose veins remain unclear. All of these techniques require knowledge of the chemical composition of varicose vein walls. The goal of our study is to determine the important components of this tissue – elastin and glycosaminoglycans (GAGs).

Varicose vein samples were collected from 11 patients with primary varicosity and undergoing stripping operations. Control samples with no clinical sign of varicose were removed to be used for graft procedures. The samples were heated at 85°C during 20 min. The denatured proteins are then highly susceptible to further extensive degradation by trypsin. Elastin is highly resistant to proteolysis. The supernatant containing the fragments derived from the digested proteins and GAG is removed. Aliquots of the digests were assayed spectrophotometrically for the glycosaminoglycan content with dimethylmethylene blue dye (pH=3) using chondroitin sulfate as a standard. The insoluble matrix left after trypsin digestion was elastin. Elastin was determined gravimetrically as the residue after denaturation and digestion by trypsin of intact tissue.

Elastin content was 18±0,5% and 12±2% of dry mass for control and varicose vein wall respectively. GAG content was 7±1 % and 10±3% of dry mass for control and varicose vein wall respectively.

The results of our study show that the wall of varicose veins has a higher GAG content compared with normal veins, whereas the elastin content is reduced only in the dilated segments of varicose veins. These findings tend to emphasize the important role of elastin in providing retractile force that opposes the development of dilation and tortuosity of the vein wall. Elastin content is significantly lower in varicose vein wall. We can assume that lower elastin is the primary changes that allow the development of varicosities, and that they are not a consequence of the broadening and stretching of the saphenous vein.

YEASTS IN TROPICAL REGION

ДРОЖЖЕВЫЕ ГРИБЫ В ТРОПИЧЕСКОМ РЕГИОНЕ

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The main aim of this study was to identify the specific taxonomic composition and structure of yeast communities in tropical ecosystems.

To achieve this goal, the following objectives were set:

– to investigate the taxonomic composition of yeasts in tropical regions;
– to trace the patterns of species allocation in three-dimensional succession row;
– to establish whether the species are confined to both the substrate and a certain part of the tropical region.

Sampling was conducted in Mexico's Yucatán and on the islands of Cuba, Jamaica and Sri-Lanka from December 2013 to July 2015. Leaves of some plant species, decaying plant remains and soil from upper horizons were sampled. Besides, a number of flowers and juicy fruits were analyzed.

For the registration of the yeast, we applied the plate method using GYPA. Different morphological types of colonies were isolated into a monospecific culture and were later studied under the microscope. The final identification was conducted according to the results of ribosomal DNA-analysis, particularly in D1/D2 region. The accumulated data were analyzed using Microsoft EXCEL and STATISTICA programs.

On the leaves, the average population turned out to be about 10,000 and about 100 of CFU per gram of substrate in the soil. Interestingly, an increase in population to 100,000 of CFU per gram in litterfall was observed. In all probability, plant litter in the tropics is functionally similar to forest litter in the middle latitudes, being an intermediate part of three-dimensional succession row, where cells from both soil and fallen leaves exist. This in turn leads to an increase in the amount of yeast that can be found there.

Generally, the tropical region is notable for its high taxonomic diversity. In the course of this study, eighty species of yeast were extracted; according to modern molecular phylogenetic criteria, twelve of them can be considered new. It should be noted that the number of species and genera from Mexican substrates is much bigger than in other tropical areas, though the number of samples was the same. It may well be associated with the continental location of the region in concern.

The data obtained in the course of this investigation may prove useful in a targeted search for natural strains. The latter may be of particular interest for microbiology.

The research conducted allows to draw the following conclusions:

1. The yeast population in substrates of three-dimensional succession row can be characterized as rich in species and genera.

2. Both eurytopic and endemic species are represented in tropical ecosystems.

3. The main unique feature of the taxonomic composition of tropical yeast communities is the prevalence of Ascomycota.

4. Remarkable differences have been identified in the taxonomic and spatial structure in different regions. It may well be the case of an island effect in relation to yeast communities.

ANTIOXIDANT ENZYME ACTIVITY IN DRUG-RESISTANT P388 MICE LEUKEMIA CELLS

ИЗУЧЕНИЕ АКТИВНОСТИ ФЕРМЕНТОВ АНТИОКСИДАНТНОЙ СИСТЕМЫ В КЛЕТКАХ ЛЕКАРСТВЕННО-УСТОЙЧИВЫХ ШТАММОВ ЛЕЙКОЗА Р388 МЫШЕЙ

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Development of drug resistance (DR) and multi-drug resistance (MDR) is one of the most serious problems of cancer therapy. DR induction mechanisms as well as ways of overcoming DR might be linked with changes in antioxidant system regulation (AOS). Studies of AOS functioning in cancer cells lead to comprehension of its role in antineoplastic drug resistance development mechanisms, which could be helpful in choosing the most efficient therapeutic regimens as well as provide insights on developing new drug products.

The study focuses on superoxide dismutase and catalase activity and measurement of glutathione levels in drug resistant P388 leukemia mice strains.

Enzyme activities were measured in a row of drug resistant P388 leukemia mice strains P388/Rub, P388/CP, P388/cPt resistant to rubomicine, cyclophosphamide, and cisplatin, respectively. P388/Rub has MDR genotype and fenotype. Superoxide dismutase activity was measured by the ability of the enzyme to inhibit photochemical reduction of nitroblue tetrazoleum. Catalase activity measurement method is based on spectrophotometry of the colored product of the reaction between Purpald dye and formaldehyde which is formed from methanol in the presence of hydrogen peroxide.

The principle of the method for determining the concentration of reduced glutathione is based on the ability of thiol groups of low molecular weight compounds to react with 5,5-dithio-bis (2-nitrobenzoic) acid (Elmann's reagent) to form a yellow-colored thionitrophenyl anion.

The study did not reveal any significant differences in the activity of superoxide dismutase and catalase enzymes in the cells of different DR strains of P388 leukemia. The injection of drugs that induce resistance in animals with DR strains did not cause significant changes in the antioxidant enzyme activity.

The therapeutic doxorubicin dose injected in animals with P388 / cPt strain induced a decrease in the catalase and superoxide dismutase activity compared to the control. A similar result was obtained for the P388 / Rub strain from the injection of therapeutic doses of cyclophosphamide.

It was found that strains resistant to cisplatin and cyclophosphamide differed significantly from the initial strain by the content of reduced glutathione. It was also shown that the concentration of reduced glutathione in P388 / CP strain cells is significantly reduced after a therapeutic drug (doxorubicin) is injected.

Compounds that developed strain resistance did not significantly affect AOS enzyme activity in these tumor cells. The use of therapeutic compounds on DR strains was accompanied by a decrease in the superoxide dismutase and catalase activity. The detected decrease in the antioxidant enzyme activity caused by antineoplastic drugs can lead tumor cells to a state of oxidative stress caused by the accumulation of reactive oxygen species.

The work was carried out in the Molecular biology laboratory of IPCP RAS under the supervision of A.A. Balakina.

ADOPTIVE T CELL TRANSFER FOR CANCER IMMUNOTHERAPY

АДОПТИВНЫЙ ПЕРЕНОС Т КЛЕТОК В ТЕРАПИИ РАКА

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Immunotherapy of cancer utilizes components of the immune system to kill malignant cells. It includes the use of monoclonal antibodies, checkpoint inhibitors, dendritic cell vaccines and adoptive transfer of T lymphocytes. The main advantage of immunotherapy over conventional methods of cancer treatment is its specificity achieved by targeted elimination of cancer cells. The effectiveness of immunotherapy is proven by the wide clinical application and immense share of therapeutic antibodies on the global market of pharmaceuticals. However, antibodies are not always suitable and effective. In such cases, design of new methods of immunotherapy promises better results.

Adoptive transfer is a method of immunotherapy that is based upon direct cytotoxicity of tumor-specific T cells. In the simplest approach, tumor-specific cytotoxic T cells are extracted from a patient with cancer, expanded using autologous dendritic cells pulsed with tumor lysate or synthetic antigenic peptides, stimulated with cytokines, and then transferred back to the patient. Effector T cells specifically recognize peptides presented in the context of major histocompatibility class I (MHC I) molecules, which allows them to recognize and eliminate cancer cells.

Further development of adoptive T cell transfer applies the genetic modification of T cells that are subsequently expanded and transferred to the recipient.

One possible modification is the introduction of chimeric antigen receptor (CAR). In CAR, the extracellular part of the T cell receptor (TCR) is substituted with an antibody, thus allowing recognition of antigens not presented in MHC I. Currently, anti-CD19 CAR-engineered T-cells already have been approved by FDA for treatment of certain types of leukemia. However, in cases of allogeneic hematopoietic stem cell transplantation (alloHSCT) such engineered T cells do not distinguish between healthy donor B lymphocytes and malignant recipient cells eliminating both.

Another way of modification is the introduction of exogenous T cell receptor thus redirecting specificity of modified cells. Our lab is developing methods of leukemia treatment based on alloHSCT combined with the adoptive T cell transfer. In that case, donor T cells are modified with TCR specific to minor histocompatibility antigens (MiHAs) derived from genetic differences between donor and recipient. Therefore, unlike CAR-modified T cells, MiHAg-specific T cells are capable of distinguishing between donor and recipient cells selectively eliminating only recipient cells. Although this kind of therapy is currently applicable only for a limited number of donor-recipient pairs, it promises to become an effective and safe method of leukemia treatment.

MICROBIAL NITROGEN FIXATION OF THE DIGESTIVE TRACT OF TIPULIDAE LARVAE OF DIFFERENT ECOLOGICAL AND TROPHIC GROUPS

МИКРОБНАЯ АЗОТФИКСАЦИЯ ПИЩЕВАРИТЕЛЬНОГО ТРАКТА ЛИЧИНОК ТИПУЛИД РАЗНЫХ ЭКОЛОГО-ТРОФИЧЕСКИХ ГРУПП

Angelina Chernyshova

Keywords: nitrogen fixation, microbial activity, cranefly larvae

In this paper intestinal symbionts capable of nitrogen fixation have been studied in the cranefly larvae of various ecological and trophic groups. Despite the fact that representatives of the Tipulidae family live on all continents, relatively few studies have been devoted to them.

Most of the cranefly life cycle takes place in the larval phase. Most tipulid larvae are phyto- and saprophagous. Since the number of tipulid larvae can reach 120 specimens/m^2, in some regions they are the main destructors of plant residues. Since the food of the larvae is poor in nitrogen, it is assumed that they compensate for the lack of dietary nitrogen through symbiotic nitrogen fixation.

This is a fundamental research in which the microbial nitrogen fixation activity in the cranefly larvae has been studied.

The saprophagous larvae *Tipula (Acutipula) maxima*, bryophagous larvae *Tipula (Savtshenkia) staegeri* and xylosaprophagous larvae *Tipula (Pterelachisus) irrorata* were selected as the study subjects. Methods of gas chromatography and isotope analysis were used.

High rates of nitrogenase activity were observed in living larvae of *T. maxima* – 3.75 nmol C_2H_4/h/g, which is comparable to the values of nitrogen fixation activity in the gastrointestinal tract of termites – 5.1 nmol C_2H_4/h/g. For the isotope analysis these larvae were kept in the atmosphere containing 3% of N^{15} gas. The content of label N^{15} in the body and in the intestine was determined after incubation. A significant accumulation of labeled nitrogen was found only in the contents and on the walls of the intestine, which is confirmed by the data obtained by gas chromatography. Nitrogenase activity in other larvae was slightly lower: in the gastrointestinal tract of *T.staegeri* – 0.39 nmol C_2H_4/h/g, in the intestinal tract of *T.irrorata* – 0.82 nmol C_2H_4/h/g, which is comparable to the data obtained after measurements in xylosaprophagous larvae of beetles *Dorcus rectus* – 1.25 nmol C_2H_4/h/g.

Thus, microbial nitrogen fixation of various orders has been observed in all the studied groups of larvae, which confirms our hypothesis of symbiotic nitrogen fixation.

ANTI-AVASTIN IDIOTYPIC NANOBODIES

АНТИ-АВАСТИН ИДИОТИПИЧЕСКИЕ НАНОАНТИТЕЛА

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Keywords: Anti-idiotype, nanobody, Avastin, VEGF

Increased expression of vascular endothelial growth factor (VEGF) could be observed in a wide spectrum of cancers. Avastin (humanized mouse monoclonal antibody) is used for tumor suppression by blocking VEGF. However, side effects have been reported, usually as a consequence of bolus-dose administration of the antibody. This restriction could probably be overcome with utilization of antibodies against idiotype.

According to the idiotypic theory, an antigen generates antibodies (Ab1) whose unique structure (idiotype) can induce the production of anti-idiotypic antibodies (Ab2). A subset of Ab2 is specific for the variable antigen-binding region of Ab1, and can function as an "internal image" of the target antigen by mimicking its three-dimensional structure.

In the 1990s, along with classical immunoglobulins, immunoglobulins of a non-canonical structure were found in the Camelidae family. Their single-domain antigen-binding fragments known as VHHs or nanobodies have received a progressively growing interest. Moreover, VHHs prefer to associate with concave-shaped epitopes and to recognise sites that are inaccessible or cryptic for conventional antibodies. Therefore, the aim of the present study was to prove the concept that it is possible to obtain VEGF mimicking anti-idiotypic nanobodies.

In this work, nanobodies were obtained by classical technology: immunization of the camel using Avastin, blood sampling, isolation of mononuclear cells, RNA isolation, cDNA synthesis, cloning into the phagemid vector pHEN4. As a result, a library of bacteriophages was obtained. Selection of the VHH was performed using phage display technology. 20 clones were selected and analyzed, which specifically recognized Avastin and did not recognize the constant regions of human and mouse IgG. These clones were grouped according to the identity of the restriction patterns using fingerprint restriction analysis. 10 unique clones were obtained and

sequenced. Preparation of recombinant structures for protein expression was executed by cloning the VHH nucleotide sequence into the expression vector pHEN6. Resulting constructs were checked by enzyme immunoassay: 6 clones demonstrated positive results. Production of nanobodies was performed in *E. coli*, 2 mg of each protein was obtained and purified.

The initial hypothesis was tested by immunization of mice using 6 different nanobodies. After immunization an increase of the titer of antibodies was observed against the original antibodies and to some extent against VEGF. Therefore, these nanobodies could function as an "internal image" of VEGF.

Thus, a new type of anti-idiotypic nanobodies has been obtained which opens wide perspectives for further utilization.

SAROCLADIUM STRICTUM AS A NEW PRODUCER OF COMPLEX TROMBOLYTIC ENZYMES WITH PLASMINOGEN ACTIVATOR ACTIVITY

SAROCLADIUM STRICTUM – НОВЫЙ ПЕРСПЕКТИВНЫЙ ПРОДУЦЕНТ КОМПЛЕКСА ТРОМБОЛИТИЧЕСКИХ ФЕРМЕНТОВ С АКТИВАТОРНЫМ К ПЛАЗМИНОГЕНУ ДЕЙСТВИЕМ

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Keywords: blood disorders, thrombotherapy, plasminogen activators, micromicetes, diagnosticum

In the twenty-first century cardiovascular diseases and their complications have become increasingly spread all over the world mostly affecting rich and developed countries. According to WHO, they take more than 26 million lives a year. In this regard, modern medicine is increasingly in need of new plasminogen activator drugs which are actively used in the treatment of various blood disorders. Such preparations perform the lysis of blood clots by activating the patient's own system of thrombolysis and dramatically reduce the range of conventional medical treatment complications: bleeding and rethrombosis. However, the majority of such drugs have significant shortcomings, therefore, the development of new safe compounds is an extremely urgent task.

A very promising candidate is the complex of thrombolytic enzymes strictoliase produced by the micromycete *Sarocladium strictum*. The fungi were grown on the previously selected medium in submerged culture on the orbital thermostated shaker. The preparation was obtained by acetone

precipitation of the proteins in the liquid culture with the ratio of 1:2 after 6 days of producer culturing, followed by drying. When strictoliase was applied to fibrin plates, according to the Astrup-Müllerz method, plasminogen activator activity and fibrinolytic activity were revealed. For the further study of the proteinase properties, isoelectrofocusing was performed. As a result, four fractions were identified which demonstrated high activity against the studied chromogenic peptide substrates that were similar to the proteins of the hemostasis system.

Experiments on animals with intravenous and external application of strictoliase demonstrated the lack of allergenic properties, low toxicity, anti-inflammatory action and high thrombolytic activity against stabilized clots. The proteinases of the fractions I, II and III have narrow substrate specificity with pronounced urokinase activity, and proteinase of the fraction IV manifests wide substrate specificity that is responsible for the combined effect of strictoliase. Apparently, it is the urokinase activity that triggers the activator to plasminogen action of strictoliase, due to which it may be possible to use it for the treatment of thrombophlebitis and phlebothrombosis. The use of the purified proteinases of strictoliase separately can make this drug more specialized, which can allow using the preparation as a thrombolytic agent or as a diagnosticum for the concentration of plasminogen in blood.

TRANSCRIPTIONAL FACTOR PREP1 IN MESENDODERMAL DIFFERENTIATION OF MOUSE EMBRYONIC STEM CELLS

ТРАНСКРИПЦИОННЫЙ ФАКТОР PREP1 В МЕЗЭНТОДЕРМАЛЬНОЙ ДИФФЕРЕНЦИРОВКЕ ЭМБРИОНАЛЬНЫХ СТВОЛОВЫХ КЛЕТОК МЫШИ

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Keywords: PREP1, PBX1, mESC, differentiation, signalling, development

This research is dedicated to understanding the mechanisms underlying stem cell differentiation affected by PREP1 transcription factor.

PBX1 and PREP1 are members of TALE homeobox family of transcription factors and functionally complete each other (Blasi et al.). Primarily these factors stimulate epithelial-mesenchymal transition and thus perform a crucial function during early embryonic development. Fernandez-Diaz et al. demonstrated that absence of PREP1 results in defective formation of all germ layers and causes death of embryos during

gastrulation in mice. In addition, experimental data suggest that PREP1 and PBX1 perform the function of adipogenesis key regulators affecting differently early and terminal stages of this process (Maroni et al.). Moreover Risolino et al. have shown that PREP1 is an anti-oncogene. PREP1 deficient mice are more likely to develop tumors such as lymphoma and leukemia. Based on these facts we hypothesize that PREP1 and PBX1 acting together or independently may stimulate transition of stem cells from pluripotent to multipotent state and maintain multipotency.

In our research, an *in vitro* model of mesendodermal differentiation based on mouse embryonic stem cells (mESC) was proposed. This model reflects the early stages of embryonic development by spontaneous differentiation and formation of embryoid bodies which resemble an early embryo. Using RNA-silencing *prep1* knocked-out mESC line was introduced. Subsequently we observed that in the absence of PREP1 its functional partner PBX1 proteolytically degrades. Thus, an additional line with a restored expression of PBX1 was also developed. We compared the gene expression of pluripotency and mesodermal differentiation markers in these lines with wild-type mESC. Furthermore, using western blot approach we estimated protein expression of Wnt, Erk and SMAD signal pathway components that are involved in regulation of cell differentiation.

As a result at the early stages of differentiation in *prep1* knocked-out lines the expression of mesendodermal and definitive mesoderm markers is suppressed whereas the pluripotency markers expression is higher in comparison with wild-type. Moreover restored PBX1 expression has not affected expression patterns of mesendodermal and pluripotency markers in PREP1 deficient lines. Analyzing expression of signaling pathway components it has also been established that during the early stages of differentiation Wnt, Erk and SMAD pathways are activated in knocked-out lines. Consequently, the experimental data suggest that the effects may be related to failures in differentiation in PREP1 deficient mESC.

Integrating the results together we have demonstrated that PREP1 is directly involved in and stimulates mesendodermal differentiation of mESC.

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GENETICALLY ENCODED FLUORESCENT BIOSENSOR FOR HYPOCHLOROUS ACID DETECTION

ГЕНЕТИЧЕСКИ КОДИРУЕМЫЙ ФЛУОРЕСЦЕНТНЫЙ БИОСЕНСОР ДЛЯ ДЕТЕКЦИИ ХЛОРНОВАТИСТОЙ КИСЛОТЫ

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Keywords: genetically encoded fluorescent biosensor, redox biosensor, reactive chlorine species, hypochlorous acid, real-time imaging

Small chemically unstable inorganic compounds like reactive oxygen and nitrogen species have attracted increased attention in recent years as their contribution to cellular signaling and disease progression has been experimentally shown [1]. However, few researchers have addressed the issue of hypochlorous acid (HOCl) production and action in living organisms, therefore, our knowledge of its role in normal and pathological conditions remains very limited.

HOCl is a powerful oxidizing agent that in mammals is mostly produced by neutrophils in the course of myeloperoxidase (MPO) reaction [2]. Its derivatives can damage molecular structure of a cell due to their ability to oxidize protein cysteines and to form chloramines [3]. Myeloperoxidase reaction contributes significantly to immune response as MPO-deficient mice demonstrate increased susceptibility to a range of bacterial and fungal infections [4]. Moreover, non-infectious diseases – mainly cardiovascular and neurodegenerative diseases – are accompanied by accumulation of reactive chlorine species (RCS) [5]. To date, studies on HOCl role in normal and pathological conditions are hampered due to the lack of appropriate tools while traditional analytical approaches are not applicable to molecules with such short lifespan.

Recent evidence suggests that prokaryotic transcription repressor NemR is capable of RCS sensing due to reversible formation of a sulfenamide bond between Cys106 and Lys175 residues [6]. Spatial rearrangement of these residues leads to conformational changes in a flexible loop located in the regulatory domain of NemR. In the present study we set an objective to develop a genetically encoded fluorescent indicator for RCS *in vivo* detection in the real-time mode.

Twelve chimeras were designed by introducing cpYFP into the residue 97–105 region of NemR Cys106 only. We suggested that conformational changes that occur in this region under HOCl treatment would be transmitted to the beta-barrel of fluorescent protein reversibly affecting chromophore microenvironment. Resulting perturbations in phenolate-phenolic equilibrium could be detected as shifts in spectral properties of the protein by traditional optical equipment.

All chimeras were tested for HOCl sensitivity and the best one ($NemR^{1-102}$-SAG-cpYFP-GT-$NemR^{105-199}$) was chosen for further studies aimed to establish biochemical properties of the probe in more detail. Those included temperature dependence, acid dissociation constant, dynamic range of the response and specificity towards a set of reactive compounds.

We expect that additional optimization of the probe by mutagenesis techniques will pave the way for utilizing it as a powerful tool for research on inflammatory models in cell cultures and living organisms.

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DEVELOPING NOVEL APPROACHES FOR GENERATING CELLS WITH KNOCKOUT OF SPECIFIED GENES OF INTEREST USING CRISPR-CAS9 TECHNIQUE

РАЗРАБОТКА НОВЫХ ПОДХОДОВ ПО СОЗДАНИЮ КЛЕТОК С НОКАУТОМ ИНТЕРЕСУЮЩИХ ГЕНОВ С ИСПОЛЬЗОВАНИЕМ ТЕХНОЛОГИИ CRISPR-CAS9

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Keywords: CRISPR-Cas9, knockouts, epitope tags

Development of efficient and reliable ways to make precise, targeted changes to the genome of living cells is in the focus of attention of biomedical researchers. Recently, a new tool based on a bacterial CRISPR-Cas9 system from ***Streptococcus pyogenes*** **has generated considerable excitement.** The functions of CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) and CRISPR-associated (Cas) genes are essential in adaptive immunity in select bacteria and archaea enabling the organisms to respond to and eliminate invading genetic material. Three types of CRISPR mechanisms have been identified, of which particular attention is paid to type II. In the case of type II invading DNA is cut into small fragments and incorporated into a CRISPR locus amidst a series of short repeats (around 20 bps). The loci are transcribed, and transcripts are then processed to generate small RNAs (crRNA – CRISPR RNA), which are used to guide effector endonucleases that target invading DNA based on sequence complementarity.

Based on type II CRISPR system a simplified two-component gene editing system was developed which includes Cas9-endonuclease that can cut the two strands of DNA at a specific location in the genome and a guide RNA (gRNA) – a single synthetic RNA that consists of a small piece of pre-designed RNA sequence (about 20 bases long) and a piece of RNA scaffold. gRNA forms a complex with Cas9 and 'guides' the nuclease to the right part of the genome so the enzyme makes a cut across both strands of the DNA. The simplicity of the two-component **CRISPR-Cas9** system makes this technology attractive to the geneticists and medical researchers to precisely edit parts of the genome by removing, adding or altering sections of the DNA sequence.

Our research is concerned with the problem of generation of cells with knockout genes of interest including genes encoding intracellular proteins. The current interest in the problem lies in the low efficiency of 'gene editing' and the difficulties related with the isolation of cells with knockouts. So, the aim of our project is to develop conceptually new approach for knockout selection to circumvent the indicated shortcomings. The concept relies on a rationally designed new short expression construct that will knockout endogenous gene expression and enable efficient expression of an epitope tag on cell surface used as a marker for high-efficient selection knockouts via fluorescence-activated cell sorting (FACS).

MODIFICATION VIA CALCIUM PHOSPHATES AS A WAY TO INCREASE OSTEOINDUCTIVITY OF BONE MATRIX

МОДИФИКАЦИЯ ФОСФАТАМИ КАЛЬЦИЯ КАК СПОСОБ ПОВЫШЕНИЯ ОСТЕОИНДУКТИВНОСТИ КОСТНОГО МАТРИКСА

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Keywords: bone tissue engineering, bone augmentation, materials for medicine, remineralization of bone matrices

In order to obtain successful clinical results, biomaterials used in bone tissue engineering (BTE) must possess a number of properties including biocompatibility, osteoinductivity and osteoconductivity. Additionally, these materials must demonstrate appropriate mechanical features to endure possible stresses at the site of implantation. Present natural and synthetic materials used as bone grafts frequently lack necessary mechanical properties. The goal of this research is to mineralize decalcified collagenous matrix, thereby increasing its mechanical stability.

Demineralized bone matrix (DBM) is one of the few materials of biological origin suitable for use in allo- and xenotransplantation in BTE. Currently, there are studies demonstrating both the high potential of DBM and the need to increase its osteogenic and mechanical properties. For this purpose DBM was saturated with calcium phosphates through incubating matrices in solutions of amorphous calcium phosphates (ACPs) and nanosized hydroxyapatite (nHAp) under conditions of constant pH and temperature. nHAp is often used as an effective osteoplastic material because of its physicochemical properties which are very similar to HAp of native bone tissue. ACPs, in turn, are necessary precursors for natural mineralization process. Two groups of samples were incubated in solutions of calcium-phosphate compounds with the addition of albumin: several studies show its potential in enhancing bone regeneration.

Samples were subjected to saturation in solutions for 12 and 48 hours. One part was implanted heterotopically in male rats (Wistar) and the other part was submitted to histological and calcium content analyses. The dependence of the concentration of adsorbed calcium on time was shown. The dynamics of concentration growth was approximately the same for all four groups. On the contrary, histological analysis performed before implantation showed no dependence on time. Alizarin Red staining demonstrated equal amounts of calcium phosphates adsorbed along the periphery of trabeculae. Thus, although the data on calcium concentration demonstrate a good sorption ability of the matrix, histological analysis does not provide the desired result: trabeculae are lined with deposits not to the fullest extent.

It is beyond argument that these results are of an intermediate nature. Final conclusions can be drawn after performing a full histological analysis of samples implanted for 6 and 13 weeks, as well as an in vitro analysis of the ability of the material to induce osteoblastic differentiation.

IN VIVO VISUALIZATION OF BIOCHEMICAL PROCESSES IN *DANIO RERIO* TISSUES USING GENETICALLY ENCODED BIOSENSORS

IN VIVO ВИЗУАЛИЗАЦИЯ БИОХИМИЧЕСКИХ ПРОЦЕССОВ В ТКАНЯХ РЫБЫ DANIO RERIO С ПОМОЩЬЮ ГЕНЕТИЧЕСКИ КОДИРУЕМЫХ БИОСЕНСОРОВ

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Keywords: redox indicators, *Danio rerio* (zebrafish), *in vivo* imaging

Redox reactions are involved in regulation of many essential biological processes. Deviations in redox homeostasis may result in the development of various pathological conditions. For a long time monitoring of intracellular redox changes has been limited in living systems due to the lack of suitable methods. At present, redox biology has received a boost due to the development of genetically encoded fluorescent indicators.

Genetically encoded probes based on GFP-like fluorescent proteins provide new opportunities for biomedical research enabling real time imaging of various redox parameters with temporal and spatial resolution. Another advantage of genetically encoded sensors is their suitability for use in systems of any complexity: from cells to whole organisms. A wide variety of these probes

is available to date: indicators for detection of hydrogen peroxide (H_2O_2), redox state of intracellular glutathione, NAD and NADP and other compounds.

In our study we visualized redox changes with genetically encoded indicators in tissues of *Danio rerio* (zebrafish) induced by chemical and physiological stimuli. Tol2 transposon system was used to obtain transgenic zebrafish. Presently 10 F_0 and 1 F_1 transgenic lines of *Danio rerio* expressing genetically encoded probes in the whole body, heart or brain are available.

In this research new sensors have been tested for the first time in tissues of *Danio rerio*. It was established that SoNar, the indicator for NAD^+/NADH ratio, and FusionRed-NeonOxE, the H_2O-$_2$sensing probe, showed desirable response upon chemical stimulation.

FusionRed-NeonOxE was further tested in the physiological model of inflammation. It is known that inflammation caused by small injury is accompanied by H_2O_2 production. H_2O_2 accumulation is a signal for immune cells activation. FusionRed-NeonOxE has been successfully used to detect increase of H_2O_2 concentration after injury of 5-day old zebrafish larvae.

To investigate the influence of hypoxia on the redox balance in tissues of *Danio rerio* a special hypoxic chamber was designed and assembled in our laboratory. Using this hypoxic chamber, we expect to detect real time alterations induced by oxygen deficiency.

In vivo visualization of intracellular redox changes with genetically encoded indicators is a powerful approach that should significantly improve our understanding of the role of redox signaling in both physiological and pathological conditions.

DNA G-QUADRUPLEXES INTERACTION WITH MISMATCH REPAIR PROTEINS

ВЗАИМОДЕЙСТВИЕ G-КВАДРУПЛЕКСОВ В ДНК С БЕЛКАМИ ИЗ СИСТЕМЫ РЕПАРАЦИИ «МИСМАТЧЕЙ»

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Keywords: G-quadruplex, mismatch repair, gel mobility shift assay, footprinting

Guanine quadruplexes in DNA (hereafter G4) are four-stranded non-canonical forms of DNA. Being present in genomes of living organisms, G4 were shown to perform important regulatory functions. However, they contribute to genome instability as well.

A number of proteins are endowed with the ability of interaction with G4. As discovered previously, mismatch repair (MMR) protein MutS from *E. coli* and *H. sapiens* is capable of specific and efficient tetramolecular G4 binding. MMR system corrects the mistakes of DNA polymerase and therefore serves to genome stability. MutS is the protein responsible for misincorporated nucleotides recognition and recruitment of MutL protein which introduces single-strand cut alone or by the engagement of MutH protein in some γ-proteobacteria including *E. coli*. There is no available data on MutL and MutH interaction with G4, additional information is required to comprehend the authentic role and mechanism of interaction between MutS and G4.

Therefore, in order to investigate G4 influence on the initial steps of MMR we suggested DNA model system that included the motif of parallel intramolecular G4 flanked with duplex regions carrying MutH recognition site and GT-mismatch in some cases. DNA with $(GT)_n$-loop of exactly the same size as G4 motif flanked with corresponding duplex sequences was used as a control. The presence of G4 structure in the conditions employed in further experiments was proved by dimethylsulphate-footprinting. Applying gel mobility shift assay we investigated the binding of MutS from *E. coli* and *Rhodobacter sphaeroides* to fluorophore-labeled G4 DNA constructions in conditions providing different MutS conformations. The determined affinity of both MutS proteins hereby changed in the row G4 DNA > DNA with GT-mismatch, DNA with $(GT)_n$-loop > canonical DNA duplex if ADP were present as binding cofactor, yet the difference in affinity between G4 and other DNA molecules greatly increased upon ATP or ATPγS addition. The proposed DNA constructions were thereafter subjected to hydrolysis induced by *R. sphaeroides* MutL (rsMutL) possessing the endonuclease function or *E. coli* MutH. The hydrolysis efficiency was demonstrated not to be dependent on G4 presence in DNA duplex in case of MutH. However in case of rsMutL the shift between yields of non-specific hydrolysis products was observed for G4 DNA compared to canonical DNA duplex. Hence, in this work for the first time the potential influence of intramolecular G4 DNA on MMR functioning was demonstrated.

RATIONAL DESIGN OF RECOMBINANT PAPAIN-LIKE CYSTEINE PROTEASE: OPTIMAL DOMAIN STRUCTURE AND EXPRESSION CONDITIONS FOR WHEAT-DERIVED ENZYME TRITICAIN-A

РАЦИОНАЛЬНЫЙ ДИЗАЙН РЕКОМБИНАНТНОЙ ПАПАИН-ПОДОБНОЙ ЦИСТЕИНОВОЙ ПРОТЕИНАЗЫ: ОПТИМАЛЬНАЯ ДОМЕННАЯ ОРГАНИЗАЦИЯ И УСЛОВИЯ ЭКСПРЕССИИ ФЕРМЕНТА ПШЕНИЦЫ ТРИТИКАНА-A

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Keywords: recombinant protein, papain-like cysteine protease, protein folding, proteolytic cleavage, autocatalytic activation, celiac disease

The paper investigates the optimal domain structure and expression conditions for wheat-derived enzyme Triticain-α.

It is a well-known fact that recombinant proteases of exogenous origins are broadly used for therapeutic applications. In particular, they were suggested for treatment of celiac disease (CD) as a promising alternative to strict gluten-free diet. The authors of more recent studies have revealed that Triticain-α exhibits glutenase activity in vitro at acidic pH levels at human body temperature. These data point to the great potential of Triticain-α as a basic compound for the development of pharmaceuticals effective in CD treatment. In the present study, we have focused on the rational design of the optimal domain architecture of Triticain-α and selection of the expression system to develop potentially scalable protocol for cheap and efficient production of active recombinant enzyme.

Expression vectors encoding Triticain-α variants were obtained on commercially available plasmids. Molecular cloning was performed according to the standard protocols. The expression in bacteria was induced by the addition of isopropyl thio-β-D-thiogalactopyranoside, in yeast – by buffered methanol-complex medium. Protein content was analyzed by sodium dodecyl sulphate polyacrylamide gel electrophoresis. Soluble Triticain-α variants were purified from cellular extracts on a column with Ni-nitrilotriacetic acid sepharose. The activity of Triticain-α variants was examined in the presence of the peptide substrate acetyl-(Pro-Leu-Val-Gln)-7-amino-4-methylcoumarin by monitoring fluorescence of the released AMC as a function of time.

In the course of our work, we assessed expression of full-length Triticain-α, catalytic domain of Triticain-α, two-domain Triticain-α constructs, co-expression of catalytic domain of Triticain-α with folding chaperones in *Escherichia coli,*

expression of Triticain-α constructs in yeast. Then we selected bacterial strain for expression of Triticain-α constructs in soluble form. All variants of Triticain-α were isolated and purified, and their activities were measured.

It was found that minimal structure of the enzyme required for its folding in vivo contains its prodomain covalently attached to the catalytic domain; N-terminal position of the affinity six-histidine tag in Triticain-α is more preferable than its C-terminal position; expression of the Triticain-α as soluble protein results in the generation of more catalytically active protease than in the case of its refolding after expression in inclusion bodies.

We suggest that these findings are helpful to obtain Triticain-α preparations for scientific purposes or medical applications such as the production of pharmaceuticals for the treatment of celiac disease.

A NOVEL APPROACH TO DELIVERY OF TUMOR-SPECIFIC ANTIGEN-CODING RNA ON THE SURFACE OF ONCOLYTIC *VACCINIA VIRUS*

НОВЫЙ ПОДХОД К ДОСТАВКЕ РНК, КОДИРУЮЩЕЙ ОПУХОЛЕСПЕЦИФИЧНЫЙ АНТИГЕН, НА ПОВЕРХНОСТИ ОНКОЛИТИЧЕСКОГО ВИРУСА VACCINIA

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Keywords: oncolytic viruses, melanoma, antigen presenting cells

Increasing evidence of a notable role of dendritic cells in inducing anti-tumor immunity has led to intensive search for cancer immunotherapies capable of promoting the antigen-presenting machinery by dendritic cells. Dendritic cells (DCs) represent a heterogeneous population of professional antigen-presenting cells. Once activated, DCs can uptake, process and present different types of antigens, including tumor-specific antigens, hence mediating anti-tumor immune response. Due to immunosuppressive microenvironment inside the tumor the functionality of DCs is impaired. To overcome this obstacle and to force DCs to function as antigen-presenting cells oncolytic virus-based immunotherapy has been employed.

Oncolytic viruses are attenuated viruses that have lost their ability to replicate and spread in normal cells but can cause lysis of cancer cells. Nevertheless the mere presence of viruses inside the human body activates innate immune response, limiting the success rate of viral vectors. Thus, therapeutic success is a balance between innate immunity that eliminates the virus and viral capability to induce anti-tumor immune response. This fact led to the idea of coating

oncolytic viral particles with tumor-specific antigens providing immediate stimulus for DCs once they are infected to process it and present on their MHC molecules, thus activating cytotoxic CD8+ T-cells mediating response. A number of approaches of coating viral particles with peptides that represent processed tumor surface antigens have been demonstrated. In this study we coated oncolytic *Vaccinia virus* particles with RNA molecules coding tumor specific antigen allowing the DCs to translate and process it.

Complexes of oncolytic *Vaccinia virus* and mRNA coding ovalbumin were obtained. Mice bearing melanoma model tumor were treated intratumorally. Five groups were created: treated with the complexes of *Vaccinia virus*, lipofectamine and ovalbumin mRNA or EGFP RNA, groups treated with aforementioned RNA molecules with lipofectamine only and the mock group. Tumors were measured every other day. All the animals were sacrificed on day 26 and the following organs were isolated: spleen, tumor and tumor lymph nodes. The percentage of activated T-cells was measured using flow cytometry.

The results demonstrate that there is a significant decline in tumor growth in all the treated groups compared to the mock group but no explicit difference between the groups. Nevertheless survival analysis clearly indicates higher survival rate among the groups treated with complexes containing *Vaccinia virus* in comparison to those treated with RNA molecules only.

STABILIZATION OF G-QUADRUPLEXES IN PROMOTER REGIONS: SIMULTANEOUS INHIBITION OF EXPRESSION OF GENES INVOLVED IN CARCINOGENESIS

СТАБИЛИЗАЦИЯ G-КВАДРУПЛЕКСОВ В ПРОМОТОРНЫХ ОБЛАСТЯХ: ОДНОВРЕМЕННОЕ ПОДАВЛЕНИЕ ЭКСПРЕССИИ ГЕНОВ, ВОВЛЕЧЕННЫХ В ПРОЦЕСС КАНЦЕРОГЕНЕЗА

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Keywords: G-quadruplex, G4 DNA, C-JUN, RELA, ELK3, G-quadruplexligands, oncogenes

Epigenetic mechanisms of oncogene expression regulation are the focus of growing attention in modern molecular oncology. Non-canonical DNA-forms – G-quadruplexes (G4) – are among the key elements of these control systems. Oncogene promoters are significantly enriched with

G4-forming sequences (G4-motifs). Certain chemical substances are able to stabilize G4-structures and, thus, reduce the transcription of oncogenes. Despite the obvious practical benefits of this approach, the discovery of new G4-motifs is a rather slow process. It is explained by the fact that in most cases the genome-wide search for such sequences is not associated with experimental examination of their effect on gene expression. This study aims to identify new potential quadruplex sequences and to prove their role as the targets of antitumour drugs based on G4-ligands.

The genome-wide search for G4-motifs in promoter areas was performed by means of bioinformatic analysis of human genome databases (Human Genome GRCh39/hg39). G-quadruplex formation in the revealed sequences and topology of the structures were examined using circular dichroism (CD) spectra of synthetic oligonucleotides. Three approved G4-ligands were chosen for stabilization of G4-structures: TmPyP4, BRACO-19 and *pyridostatin*. Ligand affinity was measured in G-quadruplex fluorescent intercalator displacement (G4-FID) experiment. The effects of ligands on the expression level of oncogenes were estimated using q-PCR in two cell lines of human breast cancer (MCF-7, HBL-100) and one non-tumorigenic epithelial cell line (MCF10A). Concentrations of the compounds for treatment of the cell lines were calculated in cytotoxicity test (MTT).

The genome-wide search has revealed 50 oncogenes comprising G4-motifs in promoter regions. Three genes with five G4-motifs from this list have been selected for subsequent stages of research (*C-JUN, RELA* and *ELK3*). The evidence from CD experiment has confirmed G-quadruplex formation. Topology has been determined for the sequences in two different buffer solutions. G4-FID experiment has proved affinity of the ligands. TmPyP4 and pyridostatin show the highest and the lowest affinity levels, respectively. Cytotoxic activity of the compounds in three cell lines has been measured and correlation has been detected between affinity and cytotoxicity of the agents. Two ligands (BRACO-19 and *pyridostatin*) demonstrate selectivity – a stronger effect for cancer cell lines compared with non-tumorigenic cells. The compounds cause reduction of transcription level in a dose-dependent manner and inhibitory activity correlates with their affinity.

This study provides important evidence that the revealed G4-motifs can be considered as potential targets in anticancer therapy. Nevertheless, further research including experiments on transfected cell models is needed to confirm the discovered effects.

MODEL-BASED ESTIMATE OF ENERGY USE BY NEOCORTICAL PYRAMIDAL NEURONS AND INTERNEURONS

МОДЕЛЬНАЯ ОЦЕНКА ЭНЕРГЕТИЧЕСКИХ ЗАТРАТ ПИРАМИДАЛЬНЫХ НЕЙРОНОВ И ИНТЕРНЕЙРОНОВ НЕОКОРТЕКСА

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Keywords: neuron models, energy consumption, neuroenergetics

Mammalian brain is known to consume much metabolic energy compared to other organs [1]. Approximately half of that energy consumption is accounted for by information processing activity of neurons.

Energy consumption by individual neurons can be predicted within the methodology of computational neuroscience [1, 2]. Such approach has already been successfully employed to analyse a wide range of subcellular processes. However, only few investigations have been undertaken using models that incorporate detailed morphology though it is responsible for particular features of neuronal activity.

This report presents preliminary results of a study aimed to implement energy calculation method in morphologically detailed models. Models of two large neocortical neuron subgroups, namely pyramidal neurons and interneurons, were used in the study.

The models taken from Blue Brain project database were run in NEURON software. Energy consumption was calculated with original Python programming language code based on the method suggested by Moujahid and D'Anjou [3]. Neurons were analysed under two different conditions: spontaneously spiking state mimicking the natural activity of a neuron and current pulse stimulated state that is routinely applied in experiments.

The results suggest that a single interneuron uses on average 4.9*109 adenosine triphosphate molecules per second (ATP/s) which is nearly three times more than that of a pyramidal neuron (1.7*109 ATP/s) which is consistent with observed mitochondria numbers and experimentally measured energy use in neocortex [4,5]. Accurate rescaling showed that pyramidal neurons account for 57% of total energy consumption in neocortex while interneurons are responsible for 15% which is partly explained by the low density of the latter. It was further demonstrated that the distribution of energy consumption between cellular compartments (soma, dendrites, axon) in the two neuron types is different. In pyramidal neurons almost 72% of eenergy use is attributed to dendrites and the rest

originates mostly from the axon while interneurons allot most of their energy expenditure to their axons. It was also found that pyramidal neurons and interneurons exibit distinct dependences of their energy consumption on the frequency of synaptic activation which has yet to be analysed.

The study demonstrates adequate estimates of energy use by cortical neurons and the potential of multicompartmental models to expand current knowledge of neuroenergetics. It also provides direct assessment of energy consumption by cortical interneurons that are crucial for appropriate brain function.

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