

Московский государственный университет имени М.В. Ломоносова

Факультет иностранных языков и регионоведения

Биологический факультет

II Межфакультетская студенческая научно-практическая конференция «Life Sciences in the 21st Century: Looking into the Future»

22-23 января 2019 г.

МАТЕРИАЛЫ

II Межфакультетская студенческая научно-практическая конференция

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

МГУ, 22-23 января 2019 г.

УДК 57:58:59:61:63

ББК 28

ISBN

Рекомендовано к опубликованию решением Ученого и Учебно-методического советов биологического факультета Московского государственного университета имени М.В. Ломоносова

Редакционная коллегия: д.ф.н., профессор Полубиченко Л.В., к.ф.н., доцент Шевырдяева Л.Н., старший преподаватель Фурсова А.А.

22-23 января 2019 г. в МГУ состоялась II 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 120 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.

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Foreword

On 22 - 23 January 2019, the 2nd annual student conference *Life Sciences in the 21st Century: Looking into the Future* took place at the Faculty of Biology of Lomonosov Moscow State University. The conference was organized and conducted by the Department of English for Natural 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.

As at the 1st conference in 2018, 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 forum provided 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. With English being the only working language of the conference, 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 conference brought together about 180 participants. The organizing committee received 129 submissions, 120 presentations were made by students from the following 6 Moscow University faculties: Biology, Fundamental Physical and Chemical Engineering, Soil Science, Fundamental Medicine, Chemistry and Biotechnology. The plenary session encompassed 7 topics as diverse as plant species distribution and carpenter ant nest's microbiological characteristics, pacemaking of the mammalian heart and cavernous fibrosis, genetics, vaccination and biochemistry.

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

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. From the plethora of wide-ranging conference materials, however, the present volume only contains abstracts of 7 plenary and 15 sectional papers whose authors scored the most points for their English (from 91 to 100).

The work of the conference was covered in the newspaper *Moscow University*, 2019, №2 (February), p. 4.

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

Professor Lydia Polubichenko

Dr. habil. in Philology

Head of the Department of English for Natural Sciences

Faculty of Foreign Languages and Area Studies

2019 Student Conference Life Sciences in the 21st Century: Looking into the Future

Programme

January 22

Morning session 10.00-14.00 Session 1. General biology Session 2. Biochemistry and molecular biology Session 6. Ecology				Plenary session 15.00-19.00 Conference opening address and welcome speech Lydia Polubichenko, Head of the Department of English for Sciences, Professor of the Faculty of Foreign Languages and Area Studies		
Subsession 1.1 General biology L.Polubichenko L.Frolova	Subsession 1.2 General biology A.Foursova S.Agadzhanian	Subsession 1.3 General biology, 6 Ecology N.Morgoun T.Cherezova	Subsession 2.1 Biochemistry and molecular biology L.Shevyrdyaeva N.Glinskaya	Subsession 2.2 Biochemistry and molecular biology O.Kozlova V.Ignatenko	Subsession 2.3 Biochemistry and molecular biology O.Egorova A.Ziyatdinova	Plenary presentations 1. Gavrilova Tatiana, Faculty of Biology Modelling of plant species distribution: an overview of current approaches 2. Ivanova Alexandra, Faculty of Biology Development of normal and pathophysiological

						<p>pacemaking of the mammalian heart</p> <p>3. Skulkina Kseniya, Faculty of Biotechnology</p> <p>Search for transcription factors presumably influencing the induction of the naphthalene and salicylate destruction genes in <i>Pseudomonas</i></p> <p>4. Volok Viktor, Faculty of Biology</p> <p>Experimental assessment of protectivity of specific inactivated vaccines against neuroinvasion of virulent tick-borne encephalitis virus</p> <p>5. Zaytsev Andrey, Faculty of Soil science</p>
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						<p>Hydrolytic potential of actinomycetes associated with carpenter ants <i>Camponotus vagus</i> and other nest's microbiological characteristics.</p> <p>6. Zhukov Sergei, Faculty of Fundamental Physical and Chemical Engineering</p> <p>DFT study of metallocene catalyst system activation as influenced by its components' structure</p> <p>7. Zhumataev Marat, Faculty of Medicine</p> <p>Prevention of cavernous fibrosis in patients after nerve-sparing radical prostatectomy</p>
Room 389	Room 3A	Room 398	Room 462	Room 498д	Room 464	Room M1

January 23

Morning session 10.00-14.00			
Session 3. Biophysics, bioengineering, biotechnology			
Session 4. Physiology and neurobiology			
Session 5. Genetics, histology, embryology			
Subsession 3.1 Biophysics, bioengineering, biotechnology L.Shevyrdyaeva S.Agadzhanian	Subsession 3.2 Biophysics, bioengineering, biotechnology N.Morgoun T.Cherezova V.Ignatenko	Session 4 Physiology and neurobiology N.Glinskaya A.Khakimova L.Frolova	Session 5 Genetics, histology, embryology O.Kozlova A.Foursova A.Ziyatdinova
Room 398	Room 389	Room 464	Room 498д

January 22

Morning session 10.00-14.00

Subsession 1.1 General biology

Moderators: L.Polubichenko, L.Frolova

Room 389

	Name	Name	Faculty, department	Title of paper in English	Title of paper in Russian

1	Головлев Александр	Alexander Golovlev	Biology, Vertebrate zoology	Migratory behavior of the froglets of the common frog (<i>Rana temporaria</i> L. 1758)	Миграционное поведение сеголеток травяной лягушки (<i>Rana temporaria</i> L. 1758)
2	Дубровская Анна	Anna Dubrovskaya	Biology, Vertebrate zoology	Stream frogs of the genus <i>Odorrana</i> : phylogeny, taxonomy and biogeography	Ручьевые лягушки рода <i>Odorrana</i> : филогения, таксономия и биогеография
3	Зарипов Павел	Pavel Zaripov	Biology, Ichthyology	Effect of surfagon on rheoreaction and state of gonads of Brown trout <i>Salmo trutta</i> (Linn.)	Реореакция кумжи <i>Salmo trutta</i> (Linn.) и состояние её половых желез под воздействием сурфагона
4	Крупницкая Нелля	Nellya Krupitskaya	Biology, Invertebrate zoology	A new species of predatory flagellates from the family Colpodellidae (Alveolata: Chrompodellida): laboratory cultivation, morphology, ultrastructure, and molecular phylogeny	Новый вид хищных жгутиконосцев семейства Colpodellidae (Alveolata: Chrompodellida): лабораторное культивирование, морфология, ультраструктура и молекулярная филогения
5	Купаева Дарья	Daria Kupaeva	Biology, Vertebrate zoology	Folding morphogenesis during anchoring disc formation of <i>Dynamena pumila</i> stolon	Морфогенез складки во время формирования прикрепительного диска столона <i>Dynamena pumila</i>
6	Мельник Николай	Nikolai Melnik	Biology, Ichthyology	The first evidence of sympatric divergence in riverine conditions of high latitudes – Stone charr and Dolly Varden form the Kamchatka River basin	Первый пример симпатрического видообразования в реках высоких широт — Каменный голец и Речной голец из бассейна Реки Камчатки

7	Прозоров Данила	Danila Prozorov	Biology, Ichthyology	Features of rheoreaction of juvenile cyprinidae in autumn migration period	Особенности реореакции у молоди карповых рыб в период осенней миграции
8	Самохвалова Анастасия	Anastasiia Samokhvalova	Biology, Vertebrate zoology	The structure and variability of Moscow dialect in urban and suburban population of the Thrush Nightingale	Структура и изменчивость вокального диалекта московской популяции восточного соловья (<i>Luscinia luscinia</i>)
9	Филенко Владислав	Vladislav Filenko	Biology, Ichthyology	The structure of populations and morphological features of the Dolly warden <i>Salvelinus malma</i> (Valbaum) from the rivers of Bering Island.	Структура популяций и морфологические особенности Мальмы <i>Salvelinus malma</i> (Valbaum) рек острова Беринга.
10	Шарова Мария	Maria Sharova	Biology, Ichthyology	Effect of thiourea on behavior of Climbing perch <i>Anabas testudineus</i> in water flow	Влияние тиомочевины на поведение анабаса <i>Anabas testudineus</i> в потоке воды

January 22

Morning session 10.00-14.00

Subsession 1.2 General biology

Moderators: A.Foursova, S.Agadzhanyan

Room 3A

	Name	Name	Faculty, department	Title of paper in English	Title of paper in Russian
1	АНТОНОВ ЕВГЕНИЙ	Evgeny Antonov	Biology, Mycology and algology	Revision of the <i>Talaromyces</i> collection by molecular-genetic methods.	Ревизия коллекции рода <i>Talaromyces</i> молекулярно-генетическими методами.

2	Бортников Федор	Fedor Bortnikov	Biology, Mycology and algology	Myxomycetes of the Kedrovaya Pad State Nature Biosphere Reserve	Миксомицеты государственного природного биосферного заповедника «Кедровая Падь»
3	Володяшкин Роман	Roman Volodyashkin	Biology, Microbiology	Description of novel alkaliphilic betaine-decomposing strains	Описание новых алкалофильных бетаин-разлагающих штаммов
4	Голубева Александра	Aleksandra Golubeva	Biology, Mycology and algology	Fatty acid profile of <i>Parietochloris</i> sp. under different culturing conditions	Профиль жирных кислот <i>Parietochloris</i> sp. при разных условиях культивирования
5	Дбар Сария	Sariya Dbar	Biology, Microbiology	Probiotic strains of <i>Lactococcus lactis</i> ssp. <i>lactis</i> and their ability to synthesize neurotransmitters.	Пробиотические штаммы <i>Lactococcus lactis</i> ssp. <i>lactis</i> и их способность к синтезу нейромедиаторов.
6	Емельянова Ольга	Olga Emelianova	Biology, Evolutionary biology	Bat quadrupedalism and its place in locomotor adaptations of flying mammals	Четвероногое передвижение рукокрылых и его место в комплексе локомоторных адаптаций группы
7	Журавлева Елена	Elena Zhuravleva	Biology, Microbiology	Isolation and characterization of a new species of a new genus of syntrophic bacteria <i>Thermocaenobacter saccharolyticus</i> .	Выделение и описание нового вида нового рода синтрофной бактерии <i>Thermocaenobacter saccharolyticus</i> .
8	Иксанова Асия	Asiya Iksanova	Biology, Microbiology	Serum antimicrobial peptides: effect towards the fungal and bacterial infectious agents	Антимикробные пептиды сыворотки крови: действие на возбудителей грибковых и бактериальных инфекций

9	Медведева Анастасия	Anastasia Medvedeva	Biology, Plant physiology	Role of cytokinin receptors in regulation of <i>Arabidopsis thaliana</i> response to high light stress	Роль рецепторов цитокининов в регуляции ответа <i>Arabidopsis thaliana</i> на световой стресс
10	Неудахина Мария	Mariia Neudakhina	Biology, Mycology and algology	Desmids of small-size bog and nearby water-logged land in the vicinity of Lobnya (Moscow region)	Десмидиевые водоросли малого болота и близлежащих водоемов в окрестностях города Лобня (Московская область).
11	Храмов Дмитрий	Dmitry Khramov	Biology, Plant physiology	Expression of P-type ATPase genes of marine green microalgae <i>Dunaliella maritima</i> under hyperosmotic salt shock.	Экспрессия генов АТФаз Р-типа морской зеленой микроводоросли <i>Dunaliella maritima</i> в условиях гиперосмотического солевого шока.

January 22

Morning session 10.00-14.00

Subsession 1.3, 6 General biology, Ecology

Moderators: N.Morgoun, T.Cherezova

Room 398

	Name	Name	Faculty, department	Title of paper in English	Title of paper in Russian
1	Васильева Александра	Aleksandra Vasileva	Biology, Anthropology	Associations of functional morphology and some psychological	Ассоциации морфофункциональных

				characteristics of people with genetic variation in dopamine and serotonin systems	особенностей и некоторых психологических характеристик личности с вариабельностью генов дофаминовой и серотониновой систем
2	Дудорова Анастасия	Anastasia Dudorova	Biology, Vertebrate zoology	The relationships between adult males and infants in the group of the Nile fruit bats (<i>Rousettus aegyptiacus</i> , Geoffroy, 1810)	Взаимоотношения между взрослыми самцами и детенышами в группах нильских крыланов (<i>Rousettus aegyptiacus</i> , Geoffroy, 1810)
3	Комиссаров Никита	Nikita Komissarov	Biology, Mycology and algology	Ecological and physiological characteristics of micromycetes derived from the White Sea sediments	Эколого-физиологическая характеристика микромицетов из донных грунтов Белого моря
4	Коржавина Оксана	Oksana Korzhavina	Biology, Evolutionary biology	A review of reef-dwelling microscopic copepod crustaceans associated with corals, echinoderms and sponges of the Caribbean Sea	Обзор микроскопических веслоногих ракообразных, обитающих на кораллах, иглокожих и губках коралловых рифов Карибского моря
5	Крючкова Маргарита	Margarita Kriuchkova	Soil science, Soil biology	How do the fungal communities from desert soils react to the impact of high energy electrons (HEE) irradiation?	Как грибные сообщества пустынных почв реагируют на облучение высокоэнергетичными электронами?
6	Морозова Анна	Anna Morozova	Soil Science	Internal cavities of the fruit bodies of some macromycetes as a possible habitat of yeasts.	Внутренние полости плодовых тел некоторых макромицетов как возможное местообитание дрожжевых грибов

7	Пашкина Виктория	Viktoria Pashkina	Biology, Geobotany	Spatial structure of flora within agricultural landscapes: a case study of Samoylovsky district, Saratov region.	Пространственная структура флоры с условиях агроландшафтов (на примере Самойловского района Саратовской области).
8	Семенова Арина	Arina Semenova	Soil science	CORRELATION BETWEEN ECOLOGICAL PARAMETERS OF PLANT COMMUNITIES ON PAYARINSARI ISLAND AND THEIR POSSITION IN THE RELIEF	ВЗАИМОСВЯЗЬ ЭКОЛОГИЧЕСКИХ ПАРАМЕТРОВ РАСТИТЕЛЬНЫХ СООБЩЕСТВ ОСТРОВА ПАЯРИНСАРИ С ПОЛОЖЕНИЕМ В РЕЛЬЕФЕ
9	Смирнова Екатерина	Ekaterina Smirnova	Biology, Hydrobiology	Simulation of a spatially distributed predator-prey system with periodic predator migrations	Моделирование пространственно-распределенной системы «хищник-жертва» с периодическими миграциями хищника
10	Смирнова Нина	Nina Smirnova	Biology, Entomology	The study of the natural focus of tick-borne encephalitis virus in the territory of Moscow	Исследование очага вируса клещевого энцефалита на территории города Москвы
11	Шкурко Анна	Anna Shkurko	Biology, Higher plants	Paleoreconstruction of the Kindo Peninsula vegetation in the Holocene by pollen analysis	Реконструкция растительности полуострова Киндо в голоцене методом спорово-пыльцевого анализа

January 22

Morning session 10.00-14.00

Subsession 2.1 Biochemistry and molecular biology

Moderators: L.Shevyrdyaeva, N.Glinskaya

Room 462

	Name	Name	Faculty, department	Title of paper in English	Title of paper in Russian
1	Албакова Зарема	Zarema Albakova	Biology, Immunology	The effect of Ouabain on NLRP3 inflammasome activation	Эффект Уабаина на активацию NLRP3 инфламмосомы
2	Баркова Дарья	Daria Barkova	Biology, Bioorganic chemistry	Selection of a DNA-aptamer to glutamic acid	Получение и характеристика ДНК-аптамера к глутаминовой кислоте
3	Вакуленко Юлия	Yulia Vakulenko	Biology, Virology	Evolution of VP1 gene in non-polio enteroviruses	Эволюция гена VP1 у неполиомиелитных энтеровирусов
4	Гарифулина Александра	Aleksandra Garifulina	Biology, Bioorganic chemistry	Nicotine analogs, azemiopsin polypeptide and amyloid- β peptide isoforms as ligands of nicotinic acetylcholine receptors	Исследование свойств аналогов никотина, полипептида аземиопсина и изоформ бета-амилоидного пептида в качестве лигандов никотиновых ацетилхолиновых рецепторов
5	Гольцова Александра	Aleksandra Goltsova	Biology, Virology	CRISPR/Cas9-mediated CCR5 delta 32 mutation in human cells	Моделирование CCR 5 delta 32 мутации в клетках человека при помощи системы редактирования генома CRISPR/Cas9
6	Короткова Дарья	Daria Korotkova	Biology, Bioorganic chemistry	Gene c-Answer, lost in vertebrate evolution, controls brain development and regeneration in <i>Xenopus laevis</i>	Утраченный в ходе эволюции позвоночных ген c-Answer регулирует развитие мозга и регенерацию у <i>Xenopus laevis</i>

7	Лубова Ксения	Kseniya Lubova	Biology, Bioorganic chemistry	Site-directed mutagenesis of the TRPV1 reveals amino acid residues crucial for receptor gating	Сайт-направленный мутагенез остатков TRPV1, значимых для управления рецептором
8	Манухова Татьяна	Tatyana Manukhova	Biology, Virology	Structure and properties of Alternanthera mosaic virus virions and virus-like particles	Структура и свойства вирионов и вирусоподобных частиц вируса мозаики альтернантеры
9	Полуконова Анна	Anna Polukonova	Biology, Virology	Expression analysis of potential stroma-specific markers in mouse allograft tumor models	Анализ экспрессии потенциальных строма-специфичных маркеров в аллогraftных моделях опухолей мыши
1010	Федорина Анастасия	Anastasiya Fedorina	Biology, Bioorganic chemistry	HSP70 lowers the local level of IL-4, affects neutrophil/eosinophil balance and prevents allergic airway inflammation	БТШ70 снижает уровень ИЛ-4, влияет на нейтрофил-эозинофильный баланс и предотвращает аллергическое воспаление дыхательных путей

January 22

Morning session 10.00-14.00

Subsession 2.2 Biochemistry and molecular biology

Moderators: O.Kozlova, V.Ignatenko

Room 498д

	Name	Name	Faculty, department	Title of paper in English	Title of paper in Russian
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1	Баженова Дарья	Daria Bazhenova	Fundamental Medicine	Use of contrast-enhanced spectral mammography for differential diagnosis tumor for breast	Возможности двухэнергетической контрастной спектральной маммографии в дифференциальной диагностике образований молочной железы
2	Бязрова Мария	Maria Byazrova	Biology, Immunology	In vitro B lymphocyte stimulation – a new era in monoclonal antibody generation?	In vitro стимуляция В-лимфоцитов – новая эра в создании моноклональных антител?
3	Головачев Ярослав	Iaroslav Golovachev	Biology, Biochemistry	Analysis of the influence of reaction conditions on the branched-chain amino acid transaminase enzymatic activity	Анализ влияния условий реакционной среды на ферментативную активность трансаминазы разветвлённых аминокислот
4	Долгова Снежана	Snezhana Dolgova	Fundamental Medicine, Neurology	Idiopathic generalized epilepsy: evaluation of the effectiveness of treatment (prospective clinical and electrophysiological study)	Идиопатическая генерализованная эпилепсия: оценка эффективности лечения (проспективное клинико-электрофизиологическое исследование)
5	Курашенко Александр	Alex Kurashenko	Biology, Molecular biology	DNA topology research	Исследование топологии ДНК
6	Намаканова Ольга	Olga Namakanova	Biology, Immunology	Effects of pharmacological inhibition of TNF and IL-6 in murine model of asthma	Эффекты фармакологической блокировки TNF и IL-6 в мышинной модели астмы

7	Соколинская Елена	Elena Sokolinskaya	Biology, Molecular biology	The insect gustatory receptors as an instrument for manipulation of ion currents in mammalian cells	Вкусовые рецепторы насекомых как инструмент управления ионными токами в клетках млекопитающих
8	Уварова Аксинья	Aksinya Uvarova	Biology, Molecular biology	RNA-mediated chromosomal translocations	РНК-опосредованные хромосомные транслокации
9	Ушакова Екатерина	Ekaterina Ushakova	Biology, Immunology	Combination immunotherapy of TLR3 and TLR4 agonists improve survival in the model of metastatic 4T1 breast cancer.	Комбинированная иммунотерапия агонистами TLR3 и TLR4 рецепторов увеличивает продолжительность жизни у мышей в модели метастатического рака молочной железы
10	Шитиков Савелий	Savely Sheetikov	Biology, Immunology	Unraveling the minor histocompatibility antigen immunogenicity through naïve CD8 T cell frequencies estimation.	Оценка иммуногенности минорных антигенов гистосовместимости путем определения частот наивных CD8 Т-клеток

January 22

Morning session 10.00-14.00

Subsession 2.3 Biochemistry and molecular biology

Moderators: O.Egorova, A. Ziyatdinova

Room 464

	Name	Name	Faculty, department	Title of paper in English	Title of paper in Russian
1	Антипина Анастасия	Anastasia Antipina	Fundamental Medicine, Pharmaceutical Chemistry, Pharmacognosy	Development of methods of extraction, standardization and pharmacological study of the substance of polyphenols derived from Ginkgo biloba leaves	Разработка методов выделения, стандартизации и фармакологическое изучение субстанции полифенолов, полученной из гинкго двулопастного (Ginkgo biloba) листьев
2	Басалова Наталия	Nataliya Basalova	Fundamental Medicine, Biochemistry PhD Program	The evaluation of the role of mesenchymal stromal cells secretome in restoration of spermatogonial stem cell niche	Оценка роли секретома мезенхимальных стромальных клеток в восстановлении ниши сперматогониальных стволовых клеток
3	Богомякова Маргарита	Margarita Bogomiakova	Biology, Immunology	Derivation and characterization of induced pluripotent stem cells lines with inactivation of the beta-2-microglobulin gene by CRISPR/Cas9 genome editing	Получение и характеристика линий индуцированных плюрипотентных клеток с инактивацией гена бета-2-микроглобулина методом геномного редактирования CRISPR/Cas9
4	Заболотский Артур	Artur Zabolotsky	Biology, Bioorganic chemistry	Production of alpha-fetoprotein receptor binding peptide in acid labile tandem repeats	Получение пептида связывающего рецептор альфа-фетопротеина в виде кислото-лабильных тандемных повторов.

5	Зорникова Ксения	Ksenia Zornikova	Biology, Immunology	Cell-to-cell communication of mesenchymal stromal cells: effects and importance	Прямое межклеточное взаимодействие мезенхимальных стромальных клеток: эффекты и важность
6	Полищук Александра	Aleksandra Polishchuk	Biology, Institute of Higher Nervous Activity and Neurophysiology	Selective slow-wave sleep suppression affects glucose tolerance and melatonin secretion	Влияние селективной супрессии третьей стадии сна на толерантность к глюкозе и секрецию мелатонина
7	Стрелецкая Алена	Alena Streletskaia	Fundamental Medicine, Biochemistry and Molecular Medicine	Regulation of functional activity and splicing of MCL-1 to combat tumor resistance to apoptotic cell death	Регуляция функциональной активности и сплайсинга Mcl-1 для снижения резистентности опухолевых клеток к апоптозу
8	Четвериков Николай	Nikolai Chetverikov	Biology, Cell biology and histology	Neurocytotoxicity thymoquinone in cerebellar granule neurons culture	Нейроцитотоксичность тимохинона в культурах зернистых нейронов мозжечка
9	Яременко Степан	Stepan Yaremenko	Fundamental Medicine	Comparison of the dual energy computed tomography (DECT) with PET-CT for tissue characterization in lung cancer.	Сопоставление данных двухэнергетической компьютерной томографии с данными позитронно-эмиссионной компьютерной томографии при раке легкого

January 23

Morning session 10.00-14.00

Subsession 3.1 Biophysics, bioengineering, biotechnology

Moderators: L.Shevyrdyaeva, S.Agadzhanian

Room 398

	Name	Name	Faculty, department	Title of paper in English	Title of paper in Russian
1	Белова Анна	Anna Belova	Fundamental Physical and Chemical Engineering	Synthesis of porphyrazines and their metal complexes	Синтез порфиразинов и их металлокомплексов
2	Гринченко Варвара	Varvara Grinchenko	Biology, Bioengineering	Functions of electrospun isotropic collagen structures	
3	Дозморов Сергей	Sergey Dozmorov	Fundamental Physical and Chemical Engineering	Synthesis, spectral and photochemical properties of 1,10- bis[(2-styrylquinolin-8-yl)-oxy]- decane	Синтез, спектральные и фотохимические свойства 1,10- бис[(2-стирилхинолин-8-ил)- окси]-декана
4	Замалутдинов Алексей	Aleksey Zamalutdinov	Biotechnology	Co-expression of mammalian steroidogenesis proteins in Methylobacterium extorquens.	Ко-экспрессия белков стероидогенеза млекопитающих в клетках Methylobacterium extorquens
5	Замалутдинова Софья	Sofia Zamalutdinova	Biotechnology	New psychrophilic strain from permafrost of West Spitsbergen Island: identification and detection of	Идентификация новых психрофильных штаммов из вечной мерзлоты о. Западный Шпицберген и определение их

				their ability to transform sterols and cholic acids.	способности к трансформации стероидов и холевых кислот.
6	Зарубин Михаил	Mikhail Zarubin		Plasmonic nanoprobe for multimodal optical microscopy on live cells	Плазмонные нанозонды для мультимодальной оптической микроскопии в живых клетках
7	Котов Александр	Alexander Kotov	Biology, Bioengineering	Searching for the CLAMP protein domains responsible for its interaction with the MLE using yeast two-hybrid system.	Поиск доменов белка CLAMP, ответственных за его взаимодействие с белком MLE, используя двугибридный дрожжевой анализ.
8	Очнева Александра	Aleksandra Ochneva	Biotechnology	Hemostatic-active proteolytic enzymes produced by <i>Aspergillus sclerotiorum</i>	Протеолитические ферменты <i>Aspergillus sclerotiorum</i> , активные в отношении белков системы гемостаза
9	Пересадына Арина	Arina Peresadina	Biotechnology	Activation of modified swine procaspase-3 by S273R protease of ASFV in mammalian cells	Активация модифицированной прокаспазы-3 свиньи протеазой S273R вируса АЧС в клетках млекопитающих
10	Слатинская Ольга	Olga Slatinskaya	Biology, Biophysics	Study of the state of photosynthetic pigments of hybrid maize seeds exposed to ultraviolet radiation	Исследование состояния фотосинтетических пигментов при воздействии ультрафиолета
11	Третьяков Богдан	Bogdan Tretyakov	Fundamental Physical and Chemical Engineering	Investigation of stabilization of the tetranitrosyl iron complex with thiosulfate ligands by albumin and hemoglobin	Исследование стабилизации тетранитрозильного комплекса железа с тиосульфатными лигандами альбумином и гемоглобином

12	Узун Мария	Maria Uzun	Biology, Biotechnology	Revealing of new taxonomic groups using novel approaches of magnetotactic bacteria investigation	Выявление новых таксономических групп с использованием новых подходов исследования магнитотактических бактерий
13	Шеблаева Анна	Anna Sheblaeva	MSEC MSU	Evaluation of the limit angles of inclination of the implant in the jaw bone using 3D modeling.	Оценка предельных углов наклона имплантата в кости с использованием 3D моделирования.
14	Шемшур Татьяна	Tatiana Shemshur	Fundamental Physical and Chemical Engineering	Cathode materials for solid state batteries based on polyiodide based	Катодные материалы для твердотельных батарей на основе полийодидов
15	Щёлоков Дмитрий	Dmitry Shchelokov	Biology, Bioengineering	Physiologically based pharmacokinetic modeling of anti-PD-1 therapeutic antibodies	Физиологически обоснованное моделирование фармакокинетики терапевтических антител к рецептору PD-1

January 23

Morning session 10.00-14.00

Subsession 3.2 Biophysics, bioengineering, biotechnology

Moderators: N.Morgoun, T.Cherezova, V.Ignatenko

Room 389

	Name	Name	Faculty, department	Title of paper in English	Title of paper in Russian
1	Вевиорский Александр	Alexander Veviorskiy	Biology, Bioengineering	Small molecules DNA intercalation capability model applied to potential DNA repair inducers	Исследование ДНК-интеркалирующей способности низкомолекулярных соединений для поиска потенциальных индукторов репарации ДНК
2	Грибкова Анна	Anna Gribkova	Biology, Bioengineering	Construction and analysis of an interactome between nucleosomes and chromatin proteins	Построение и анализ интерактома нуклеосом и белков хроматина
3	Долгих Екатерина	Ekaterina Dolgikh	Fundamental Physical and Chemical Engineering	The self-organization of water-soluble derivatives of fullerene from pulsed field gradient NMR	Самоорганизация водорастворимых производных фуллерена по данным ЯМР с импульсным градиентом магнитного поля
4	Дубинина Татьяна	Tatiana Dubinina	Fundamental Physical and Chemical Engineering	Passivation of zinc oxide and tin oxide electron transport layers by [6,6]-phenyl-C61-butyric acid for highly efficient perovskite solar cells	Пассивация электрон-транспортного слоя оксида цинка и оксида олова [6,6]-фенил-С61-масляной кислотой для получения высокоэффективных перовскитных солнечных батарей
5	Захарова Екатерина	Zakharova E.V	Biotechnology	In silico modeling of human peroxiredoxin VI complexes with thiolic ligands reducers	In silico моделирование комплексов тиоловых восстановителей с белком пероксиредоксином VI человека

6	Калинин Данил	Danil Kalinin	Biotechnology	Obtaining recombinant light chain of human enteropeptidase (L-HEP) as part of a hybrid construct	Получение рекомбинантный легкой цепи энтеропептидазы человека (L-HEP) в составе гибридной конструкции
7	Ким Дебора	Deborah Kim	Biology, Microbiology	Cell wall glycopolymers of some representatives of the genus Clavibacter	Гликополимеры клеточных стенок некоторых представителей рода Clavibacter
8	Козлов Роман	Roman Kozlov	Fundamental Physical and Chemical Engineering	Polyamidoacids as a promising materials for Li-organic accumulators	Полиамидокислоты как перспективные материалы для Литий-органических аккумуляторов
9	Кривова Виктория	Victoria Krivova	Fundamental Physical and Chemical Engineering	Polymer membranes: stabilization of gas transport properties	Стабилизация газотранспортных свойств полимерных мембран
10	Курбанов Ринат	Rinat Kurbanov	Fundamental Physical and Chemical Engineering	Synthesis of transition metals clusters based on cobalt and ruthenium with a paramagnetic cation.	Синтез кластеров переходных металлов на основе кобальта и рутения с парамагнитным катионом.
11	Лапанькова Анастасия	Anastasia Lapankova	Chemistry faculty	Synthesis of the rod-shaped magnetic nanoparticles of magnetite modified by dopamine	Синтез стержневидных магнитных наночастиц магнетита, модифицированных дофамином
12	Петленко Антонина	Antonina Petlenko	Biotechnology	Devitalization of bovine jugular veins using supercritical CO ₂	Девитализация яремных вен быка с помощью scCO ₂

13	Хомякова Ирина	Irina Khomyakova	Biotechnology	A Passive Immunization Approach Against S.aureus Associated Infections	Подход к пассивной иммунизации против инфекций, ассоциированных с S.aureus
14	Царегородцева Дарья	Daria Tsaregorodtseva	Biotechnology	Application of biopolymers for post-operative adhesion prevention	Применение биополимеров для предупреждения формирования пост-операционных спаек

January 23

Morning session 10.00-14.00

Session 4 Physiology and neurobiology

Moderators: N.Glinskaya, A.Khakimova, L.Frolova

Room 464

	Name	Name	Faculty, department	Title of paper in English	Title of paper in Russian
1	Акутин Иван	Ivan Akutin	Biology, Human and animal physiology	Mechanism of acetylcholine quantal size increase caused by activation of PAR1 receptors in mouse motor synapses	Механизм увеличения размера кванта ацетилхолина при активации PAR1 рецепторов в моторных синапсах мыши
2	Бойко Любовь	Lyubov Boyko	Biology, High nerves activity	Visual-motor integration at sight-reading music by professional pianists: eye movement and working memory	Зрительно-моторная интеграция у профессиональных пианистов во время чтения с листа: движения глаз и рабочая память

3	Голяко Иван	Ivan Goliako	Biology, Human and animal physiology	Diabetes mellitus and hyperglycemia change the effects of thrombin and activated protein C on the proinflammatory secretion of mast cells	Участие тромбина и активированного протеина С в регуляции функций тучных клеток при диабете и гипергликемии у крыс
4	Груздев Глеб	Gruzdev G.A.	Biology, Human and animal physiology	Effects of selective serotonin reuptake inhibitor fluvoxamine prenatal administration on anxiety and cognitive function of rat offspring	Влияние пренатального введения флувоксамина на способность к обучению и уровень тревожности потомства белых крыс
5	Зигмантович Александра	Alexandra Zigmantovich	Biology, Neurobiology	Wavelet-synchronization research of event-related potentials to naturalistic music stimuli in patients with brain injury in vegetative state and mutism	Исследование вейвлет-синхронности вызванных ответов мозга на натуралистические музыкальные стимулы у пациентов с черепно-мозговой травмой в вегетативном состоянии и мутизме
6	Морареску София	Sofia Moraresku	Biology, High nerves activity	Brain reactive changes during movements in traumatic brain injury patients (fMRI and EEG studies)	Реактивные перестройки мозга во время двигательных нагрузок у пациентов с черепно-мозговой травмой (фМРТ и ЭЭГ исследования)
7	Подшивалова Елизавета	Elizaveta Podshivalova	Biology, Human and animal physiology	PROTECTIVE PROPERTIES OF THE MITOCHONDRIA-TARGETED ANTIOXIDANT SKQ1 IN MOUSE MODEL OF MK801-INDUCED ACUTE NEURODEGENERATION	ИЗУЧЕНИЕ ПРОТЕКТОРНЫХ СВОЙСТВ МИТОХОНДРИАЛЬНО-НАПРАВЛЕННОГО АНТИОКСИДАНТА SKQ1 ПРИ НЕЙРОДЕГЕНЕРАТИВНЫХ ПОВРЕЖДЕНИЯХ, ВЫЗВАННЫХ

					ОСТРЫМ ВВЕДЕНИЕМ МК801, У МЫШЕЙ
8	Полковникова Мария	Polkovnikova M.V.	Biology, Human and animal physiology	Effects of alcohol consumption during pregnancy on dopamine-related gene expression and behavior in F2 rats	Нарушения поведения и экспрессии генов дофаминовой системы мозга у потомства второго поколения от самок крыс, алкоголизованных во время беременности
9	Селезнева Александра	Alexandra Selezneva	Biology, Human and animal physiology	Effect of chronic neonatal injection of AVP(6-9) and its analogue Ac-D-SPRG on social behavior of rats	Влияние хронического неонатального введения АВП(6-9) и его аналога Ac-D-SPRG на социальное поведение крыс
10	Семина Анна	Anna Semina	Biology, Human and animal physiology	Effects of short-term compression of dorsal nerve root in spinal cord on median nerve function in rats	Влияние кратковременной компрессии заднего корешка спинного мозга на функциональное состояние срединного нерва у крыс
11	Стаханова Анна	Anna Stakhanova	Biology, Human and animals physiology	Delayed effects of chronic neonatal injection of arginine-vasopressin (6-9) analogue, Ac-D-MPRG, on training and degree of depression in rats of different age groups.	Отставленные эффекты хронического неонатального введения аналога АВП (6-9) Ac-D-MPRG на обучение и степень депрессивности белых крыс разных возрастных групп.
12	Стурова Анна	Anna Sturova	Biology, Human and animal physiology	Parkinson's disease modelling in vitro to test potential neuroprotectors	Моделирование болезни Паркинсона in vitro для тестирования потенциальных нейропротекторов

13	Трошев Дмитрий	Dmitry Troshev	Biology, Neurobiology	Association between context and unconditioned stimulus and subsequent retrieval of this memory involves retrosplenial but not hippocampal c-fos expression in mice	Активация экспрессии c-fos в ретроспленальной коре, но не гиппокампе, сопровождает формирование ассоциации между обстановкой и безусловным стимулом и ее последующее извлечение у мышей
14	Федотова Анна	Anna Fedotova	Biology, High nerves activity	Effects of COMT Val158Met polymorphism on auditory information processing in healthy subjects and schizophrenia patients	Влияние полиморфизма Val158Met гена катехол-О-метилтрансферазы (КОМТ) на обработку слуховой информации в норме и при шизофрении

January 23

Morning session 10.00-14.00

Session 5 Genetics, histology, embryology

Moderators: O.Kozlova, A.Foursova, A. Ziyatdinova

Room 498д

	Name	Name	Faculty, department	Title of paper in English	Title of paper in Russian
1	Алемасцева Екатерина	Ekaterina Alemastseva	Biology, Genetics	Assessment of gene kdin-1 role in learning and memory in <i>Caenorhabditis elegans</i>	Исследование роли гена kdin-1 в процессах обучения и памяти у <i>Caenorhabditis elegans</i>

2	Анисимова Дарья	Daria Anisimova	Biology, Genetics	Pros and cons of mass selection of varieties of leading crops	Плюсы и минусы создания большого количества сортов ведущих сельскохозяйственных культур
3	Галиакберова Аделя	Adelia Galiakberova	Biology, Embryology	In vitro modeling of neurogenesis using Human Induced Pluripotent Stem Cells	Моделирование нейрогенеза in vitro при помощи индуцированных плюрипотентных стволовых клеток человека
4	Ганеева Ирина	Irina Ganeeva	Biology, Cell biology and histology	Analysis of the age-related changes in the myocardium of different chambers in Japanese quails	Анализ возрастных изменений миокарда разных отделов сердца японского перепела
5	Доронина Татьяна	Tatiana Doronina	Biology, Cell biology and histology	Life and Death of Antipodal Cells of Wheat Embryo Sac	Жизнь и смерть антиподальных клеток зародышевого мешка пшеницы
6	Емец Елизавета	Yelyzaveta Yemets	Biology, Genetics	Obtaining and analysis of mutants of cyanobacterium <i>Anabaena variabilis</i> ATCC29413 tolerant to high temperature in heterotrophic cultivation conditions	Получение и анализ мутантов цианобактерии <i>Anabaena variabilis</i> ATCC29413, толерантных к повышенной температуре в гетеротрофных условиях культивирования
7	Западинская Ксения	Kseniia Zapadinskaia	Biology, Genetics	The role of electron transport chain components' coding genes in regulation of electron transport through photosystem I in cyanobacteria <i>Synechocystis</i> sp. PCC6803	Роль генов, кодирующих компоненты дыхательной электрон-транспортной цепи, в регуляции транспорта электронов через фотосистему I у

					цианобактерии <i>Synechocystis</i> sp. PCC6803
8	Иванова Анна	Anna Ivanova	Biology, Embryology	A research of development potential in early mosaic human em-bryos on the in vitro implantation model	Исследование потенциалов к развитию ранних мозаичных эмбрионов человека на модели имплантации in vitro
9	Лаврушкина Светлана	Svetlana Lavrushkina	Biology, Cell biology and histology	The role of nuclear lamina organization in the regulation of cell motility	Роль организации ядерной ламины в регуляции клеточной подвижности
10	Матвеева Диана	Diana Matveeva	Biology, Cell biology and histology	The characteristics of fibrillar extracellular matrix of multipotent mesenchymal stromal cells in vitro	Характеристика фибриллярных компонентов внеклеточного матрикса мультипотентных мезенхимальных стромальных клеток in vitro
11	Рябинин Андрей	Andrei Riabinin	Biology, Cell biology and histology	Differentiation of human pluripotent cells into epidermal and dermal lineages for skin equivalent's engineering	Дифференцировка плюрипотентных клеток человека в эпидермальном и дермальном направлениях в рамках получения кожных эквивалентов
12	Таран Александра	Aleksandra Taran	Biology, Cell biology and histology	Cellular bases of pathogenesis of the Huntington's disease	Клеточные основы патогенеза болезни Гентингтона
13	Турищева Екатерина	Ekaterina Turishcheva	Biology, Cell biology and histology	THE INFLUENCE OF PHYTOHORMONES ON THE BIOSYNTHETIC SYSTEM OF	ВЛИЯНИЕ ФИТОГОРМОНОВ НА СЕКРЕТОРНО-СИНТЕТИЧЕСКУЮ СИСТЕМУ НОРМАЛЬНЫХ И

				NORMAL AND TUMOR HUMAN FIBROBLASTS	ОПУХОЛЕВЫХ ФИБРОБЛАСТОВ ЧЕЛОВЕКА
14	Череева Виктория	Victoria Cheredeeva	Biology, Genetics	Investigation of the expression of the Gagr gene, a genomic homolog of the gag gene in the Drosophila melanogaster, in response to stressful effects	Исследование экспрессии гена Gagr, геномного гомолога гена gag у Drosophila melanogaster, в ответ на стресс
15	Чернявский Даниил	Daniil Chernyavsky	Biology, Cell biology and histology	The role of mild uncoupling of oxidative phosphorylation in the regulation of the barrier function of the endothelium.	Роль слабого разобщения окислительного фосфорилирования в регуляции барьерной функции эндотелия
16	Шевцова Анна	Anna Shevtsova	Biology, Genetics	MOLECULAR-GENETIC ANALYSIS OF THE PREVALENCE OF VIRUSES OF BEES IN THE WESTERN TERRITORY OF THE RUSSIAN FEDERATION	МОЛЕКУЛЯРНО-ГЕНЕТИЧЕСКИЙ АНАЛИЗ РАСПРОСТРАНЕННОСТИ ВИРУСОВ ПЧЕЛ НА ЗАПАДНОЙ ТЕРРИТОРИИ РОССИЙСКОЙ ФЕДЕРАЦИИ

Plenary presentations

Modelling plant species distribution: an overview of current approaches

Моделирование распространения видов растений: обзор существующих подходов

Tatiana Gavrilova

Faculty of Biology, Department of Ecology and Plant Geography

Keywords: *plant geography, plant species distribution modelling, presence-absence data, presence-only data*

Plant species distribution modelling allows to establish correlations between sampling sites and environmental factors and to analyze them. These models are highly useful to gain ecological insights and to predict species occurrence across landscapes. Therefore, plant species distribution modelling remains a considerable challenge for modern plant geography.

The major approaches to modelling plant species distribution differ in the type of data they require. When the data on plant species occurrence are collected systematically, for instance, in formal biological surveys, a set of sites are studied and the presence, absence and abundance of species at each site are recorded. The data of this type are usually referred to as "presence-absence data". However, for most regions systematic biological survey data tend to be sparse and limited in coverage. Plant species occurrence data are generally represented by presence-only records in herbaria and museum databases. The desire to maximize the utility of such resources has resulted in a range of different methods for modelling plant species distribution based on presence-only data.

To model plant species distribution two types of data are required: the geographical coordinates of species records and the environmental data. Current sampling techniques include obtaining the coordinates via GPS navigator during the field work. Thus, if a herbarium specimen was collected in the late 20th or in the 21st century, the coordinates are labelled on it. In contrast, older specimens lack the coordinates. To determine the exact coordinates of the sites where the specimens were collected topographic maps and Internet resources such as Wikimapia or Google maps were used.

The environmental data for modelling represent the distribution of variables across a particular area. The calculation of these variables is based on climatic parameters such as temperature and precipitation or remote sensing data. Thus, the environmental data are independent of the data on species records.

Different approaches and software may be utilized to combine the two types of data and to obtain models of plant species distribution. These approaches have been successfully applied in various projects both on regional and global scale.

Development of normal and pathophysiological pacemaking of the mammalian heart

Развитие пейсмекера сердца млекопитающих в норме и патологии

Alexandra Ivanova

Faculty of Biology, Department of Human and Animal Physiology

Keywords: heart electrophysiology, pacemaker, development, myocardium of thoracic veins, atrial fibrillation

The development of a normal heart pacemaker during embryonic and early postnatal ontogenesis is a fundamentally important point which determines functioning of the heart throughout the subsequent life. Developmental abnormalities of the pacemaker lead to the disturbances in the heart rhythm and a number of cardiovascular diseases.

In early embryogenesis the heart tube does not possess a single pacemaker and all cardiomyocytes of primary myocardium are able to produce spontaneous action potentials. The so-called «pacemaker phenotype» of primary cardiomyocytes is determined by high expression of ion channels that provide spontaneous depolarization and low expression of potassium channels that provide hyperpolarization of the cell membrane. During further stages of the development the major part of primary myocardium loses the pacemaker properties and transforms into the working myocardium which can be characterized by hyperpolarized resting membrane potential and inability to spontaneous depolarization. Only a small part of cardiomyocytes remains spontaneously active, localizes in a small region – sinoatrial node (SAN) that becomes the main heart pacemaker.

Interestingly, the inheritors of primary myocardium can be found beyond the heart. In mammals, cardiac tissue extends in thoracic veins which include caval and pulmonary veins. It is known that thoracic vein myocardium develops from the same precursor cells that have pacemaker properties. But in contrast to the SAN cells, under normal development thoracic vein cardiomyocytes must acquire working myocardium characteristics and are not expected to be spontaneously active.

However, under pathological conditions cardiomyocytes of caval and pulmonary veins are able to manifest their own automaticity and form the ectopic region of electrical excitation. The ectopic firing originated can initiate and maintain arrhythmias, in particular, atrial fibrillation (AF). In our experiments we investigate different factors that can trigger the spontaneous vein activity such as adrenergic stimulation. In addition, we aim to uncover the electrophysiological mechanisms of the transformations in caval vein myocardium at early stages of ontogenesis. According to our observations, the influence of sympathetic nerves and the redistribution of adrenergic receptors can play a role in this process.

Nowadays, in clinical practice the most common way to eliminate AF is the separation of vein myocardial tissue from the heart through the use of risky surgical procedures. The investigation of heart pacemaker development can contribute to the recognition of arrhythmia mechanisms and elaboration of new non-invasive, safe and effective therapy of cardiovascular diseases.

Search for transcription factors presumably influencing the induction of the naphthalene and salicylate destruction genes in *Pseudomonas*

Поиск транскрипционных факторов, предположительно оказывающих влияние на индукцию генов деструкции нафталина и салицилата у микроорганизмов рода *Pseudomonas*

Kseniya Skulkina

Faculty of Biotechnology

The intensification of the oil and petroleum industry results in increased waste generation. The ability of some microorganisms to use oil as an only or primary carbon source is well known and can be used for bioremediation of contaminated areas.

Biological preparations containing living cells of individual strains or bacterial consortia are used as the instrument for purification from oil or petroleum products. The main disadvantage of the currently existing preparations is their homogeneity: the presence of one or two species of microorganisms requires a narrow range of optimal environmental conditions.

The efficiency of biological preparations can be half-reduced while transferring experiments from laboratory to field conditions. It can be caused by a variety of factors. In order to solve the problem of biological preparation transfer to real ecological conditions it is necessary to understand exactly which factors can affect the intensity of the polyaromatic hydrocarbons (PAH) and their derivative destruction. Nowadays, there is not enough information about interactions between petroleum conversion processes and global metabolic processes at a regulatory level.

The aim of the project is to find out the impact of various global regulators and regulatory proteins of two-component systems on specific mechanisms regulating the expression of salicylate destruction genes. Salicylate is the key metabolite and an inducer of the transformation process of the most common PAH for the *Pseudomonas putida* species.

Using the Virtual Footprint tool the comparison of the regulatory regions of a dozen of operons which encode the naphthalene and salicylate conversion enzymes has been made. As a result repeating binding sites for global regulators and regulatory proteins of two-component systems have been found, including proteins responsible for the DNA condensation (IHF, H-NS, Fis), quorum-sensing (Ppur), surviving in conditions of oxygen (OxyR), nitrogen (NtrC, NasT), iron (Fur, PvdS) and amino acid (ArgR, Lrp) starvation. To measure the expression activity of the genes we selected the housekeeping genes (*16S*, *rpoD*, *rpoC*, *proC*) and the “controlled” genes (*gnlA*, *rpoN*, *rpoS*, *ppsD*, *PP1183*, *kat*, *aphC*, *arcA*, *ldh*, *lapA*) which are needed to confirm that culturing conditions really create nutrient component deficiency.

For experiment various databases (NCBI, UniProt, KEGG) and tools (SnapGene viewer) were used to annotate the target strain selected genes by sequence similarity. To check the specific annealing and confirm the results primer sequences for qPCR have been created (PRIMER-BLAST, BlastX).

The research was supported by RFBR (project No.18-29-05071)

Experimental assessment of protectivity of specific inactivated vaccines against neuroinvasion of virulent tick-borne encephalitis virus

Экспериментальная оценка эффективности специфических инактивированных вакцин для защиты от проникновения вирулентного вируса клещевого энцефалита в ЦНС

Viktor Volok

Faculty of Biology, Department of Virology

The tick-borne encephalitis virus (TBEV) is a major cause of acute neurological infections in Northern Eurasia with manifestations ranging from a mild flu-like disease to severe meningitis and encephalitis. Cases of persistent TBEV infection have also been documented. Four inactivated vaccines against TBEV have been in use for several decades and have proven their efficacy, but rare cases of breakthrough infections have been described. As has been shown by detection of antibodies to non-structural proteins, vaccination against TBEV prevents the disease, but may not prevent the replication of the virus. Since the viral replication is a prerequisite for neuroinvasion and consequent viral persistence in CNS, the aim of this study was to attempt to detect the TBEV in the brain of immunized mice after infection with virulent TBEV strains. A series of experiments was conducted to assess the influence of different factors on the efficacy of vaccination.

During the experiments inbred and outbred mice of different sex and age were immunized twice using commercially available vaccines against TBE. Two weeks later, all animals were infected with different strains and doses of the virus and monitored for disease progression and death. Samples of the brain tissue were collected and studied for the presence of TBEV RNA using RT-qPCR. Passages in cell culture and brains of suckling mice were used in an attempt to isolate the infectious virus.

Vaccination successfully protected inbred BALB/c mice from the disease after inoculation with a high dose (1600 LD₅₀) of the TBEV strain Vasilchenko. More heterogeneous outbred ICR mice showed lower susceptibility to 85 LD₅₀ of this strain than inbred mice, but were less protected by the vaccine. Then, three different vaccines were tested against three subtypes of the virus and demonstrated variable levels of protection. Viral RNA was detected in the brains of all survived non-immunized mice and in 38% and 26% of samples from immunized mice with and without clinical symptoms, respectively. Thus, the vaccination provided a significant level of protection against neuroinvasion ($p < 0.01$), but the virus was detected in the CNS of some healthy immunized animals. We were not able to isolate the infectious virus from any sample.

The obtained results support the overall efficacy of inactivated vaccines against an array of strains of TBEV and show that vaccination confers significant protection against neuroinvasion, but may not always prevent the virus from entering the CNS even in the absence of clinical symptoms.

The hydrolytic potential of actinomycetes associated with carpenter ants *Camponotus vagus* and other nest's microbiological characteristics.

Гидролитический потенциал актиномицетов, ассоциированных с муравьями-древоточцами *Camponotus vagus*, и другие микробиологические характеристики гнезда.

Andrey Zaytsev

Soil Science Faculty

Keywords: *Actinomycetes*, *Camponotus vagus* ants, *cellulose decomposition*

Actinomycetes are widely known as a reliable and productive source of different enzymes, including hydrolases. Thus, many cellulolytic strains of *Streptomyces* genera were isolated from composts, soils and sedimentary materials. Such interest to the new hydrolytic microorganisms lies in the perspective of their usage in biotechnology and industry.

It is well known that the enzyme hydrolysis of diverse polymers has many advantages over the most popular acid hydrolysis. Moreover, microorganisms' hydrolytic complex study in different ecosystems has an ecological aspect. It is especially true for soils because the soil is a niche for the decomposition of various polymers, such as cellulose and chitin. Assays on such hydrolytic complex might reveal its role in the global carbon and nitrogen cycle.

The aim of the present study was to compare microbiological activity and the actinomycete cellulolytic complex of *Camponotus vagus* ant nest as a unique ecological niche with the background soil. As an object of our study, we took the samples of nest material, situated in the Ryazan region, and the samples of background soil presented by pine sands.

The microbiological activity was evaluated by means of enzyme activity, total bacteria count, level of nitrogen fixation, denitrification and carbon dioxide emission. Isolation of cellulolytic actinomycetes was processed by seeding the diluted material from enrichment media, containing cellulose, on solid media, represented by either cellulose agar or Getchinson media with filter paper. The screening of cellulolytic activity was determined on a solid medium, containing a soluble cellulose analogue – carboxymethylcellulose (CMC) with further Petri dishes dyeing with Congo-red solution. The dye has the ability to bind with cellulose, coloring the media. However, it does not interact with glucose, cellulose monomer. The dye having been washed out, the size of colorless zones permitted to estimate the cellulolytic activity of isolates strains.

It was determined that the examined microbial community parameters (nitrogen fixation, denitrification, etc.) in the ant nest material are noticeably higher than the ones in the background soil. It was especially explicit for carbon dioxide emission values. Actinomycete communities, associated with ants and with background soils were also compared to decompose cellulose, using the CR method. Our work revealed that among actinomycetes, isolated from the nest, a higher

number of cellulolytic actinomycetes was observed, compared to those from soil strains. Such results may lead to the conclusion that ant nests' microflora possesses a higher cellulolytic ability, alongside with total microbiological activity and bacteria abundance.

DFT study of metallocene catalyst system activation as influenced by its components' structure

DFT-исследование влияния структуры компонентов металлоценовой каталитической системы на энергетику образования каталитически активных комплексов

Sergei Zhukov

Faculty of Fundamental Physical and Chemical Engineering

Homogeneous metallocene catalyst systems are widely used for various alkene polymerisation processes. Ethylene-propylene rubber production is among them. The traditional technology for the manufacture of this material is based on ecologically hazardous catalyst systems and hence is being gradually phased out by metallocene-based one. Spectacular progress has been made in the molecular design of the first principal component of such systems, that being precatalyst, containing a group 4 transition-metal center (M) coordinated to two ligands (L, L*) and two alkyl groups (R, R*): LL*MRR*. However, the second component, a metylalumoxane cocatalyst, remained largely unaltered, causing multiple drawbacks associated with its high practical cost and ambiguity of its chemical nature. Recently, alkylaluminium aryloxides were proposed as viable alternatives for the role of metallocene cocatalysts system. Well-defined chemical structures of such species call for theoretical investigation on their interaction with precatalysts.

The crucial step of the interaction is established to be ion-pair formation (cocatalyst assumes negative charge) followed by ion-pair separation with precatalyst M-R bond cleavage. Thus the process will be discussed in terms of ion-pair formation and separation energies. A number of alkylaluminium aryloxides were considered as cocatalysts for $\text{rac-Et(2-MeInd)}_2\text{ZrMe}_2$. Ion-pair separation energies were found to increase in the row $(2,6\text{-}^t\text{Bu}, 4\text{-NO}_2)\text{Ar-O-Al}^i\text{Bu}_2 < [(2,6\text{-}^t\text{Bu})\text{Ar-O}]_2\text{-Al}^i\text{Bu} < (2,6\text{-}^t\text{Bu})\text{Ar-O-Al}^i\text{Bu}_2 < (2,6\text{-}^t\text{Bu})\text{Ar-O-Al}^n\text{Oct}_2 < (2\text{-}^t\text{Bu}, 6\text{-Me})\text{Ar-O-Al}^i\text{Bu}_2 < (2,6\text{-Ph})\text{Ar-O-Al}^i\text{Bu}_2$. The ability of a cocatalyst to form catalytically active species should decrease according to that row. For a single cocatalyst, $(2,6\text{-}^t\text{Bu})\text{ArO-Al}^i\text{Bu}_2$, different metallocene precatalysts were considered and ion-pair separation energies were found to increase in the row $\text{rac-EtInd}_2\text{TiMe}_2 \sim \text{rac-Et(2-MeInd)}_2\text{ZrMe}_2 < \text{rac-Me}_2\text{Si(2-MeInd)}_2\text{ZrMe}_2 < \text{rac-EtInd}_2\text{ZrMe}_2 < \text{rac-EtInd}_2\text{HfMe}_2 < \text{Ph}_2\text{CCpFluHfMe}_2$. The ion-pair separation energies are in the range of 60-75 kcal/mol in toluene (100-115 in the gas phase), but are significantly lowered to ~ 45 kcal/mol in the presence of alkene, that is in line with known estimations of only 8% of a catalyst to form active species.

Having compared the calculated energies with the known ethylene and propylene polymerization activities of the systems of interest, no direct correlations were observed. Nevertheless, it is the systems with high ion-pair separation energies that demonstrated the lowest activities, so qualitative estimations take place.

Prevention of cavernous fibrosis in patients after nerve-sparing radical prostatectomy

Профилактика кавернозного фиброза у пациентов, перенесших радикальную нерво-сберегающую простатэктомию

Marat Zhumataev

Faculty of Fundamental Medicine, Department of Urology and Andrology

Keywords: *cavernous fibrosis, erectile dysfunction, prostate cancer, radical prostatectomy*

Prostate cancer is the most common noncutaneous cancer in men in the United States. Currently, most cases of prostate cancer are identified by screening in asymptomatic men. The vast majority of cases is diagnosed by oncomarker PSA estimated in patient's blood. Elevation of PSA level in blood above 4,0 ng/ml allows to suspect prostate cancer. Biopsy establishes the diagnosis of prostate cancer. After the diagnosis is verified by prostate biopsy, other diagnostic modalities such as MRI and bone scintigraphy are applied to identify the spreading of prostate tumour inside or outside organ (T), involvement of lymphatic nodes (N) and presence or absence of metastasis (M). Based on radiological findings prostate cancer is staged as localized, locally advanced and metastatic.

Treatment option of prostate cancer depends on the stage of this disease. Radical prostatectomy is the gold standard of operative treatment of localized prostate cancer. Removal of prostate within tumour tissue provides the oncological outcome of treatment. Damage of nerves and vessels leads to disorder of vascular supply and innervation of penis. Consequently, the patients after radical prostatectomy suffer from the erectile dysfunction dramatically decreasing their quality of life.

Currently the development of laparoscopic and robot-assisted techniques allows to save the prostatic nerves and vessels. Although the manipulations in prostatic area during nerve-sparing radical prostatectomy affect the nerves innervating penis. Erectile dysfunction in some cases occurs even in the patients after nerve-sparing technique due to fibrosis of cavernous tissue. Clinical research of cavernous tissue of operated patients has demonstrated the decreased level of smooth muscle cells and endotheliocytes, as well as the accumulation of collagen and activation of fibroblasts in the cavernous bodies. Prevention of cavernous fibrosis presents an important purpose to save sufficient quality of life in this group of patients.

There are several oral and injectable medications prescribed to treat erectile dysfunction in these cases. Moreover, shock wave therapy and autoplasm are reported as potential approaches to prevent fibrosis of penile tissue. The main goal of our research at Department of Urology and Andrology, MSU is to develop an optimal clinically proven algorithm of cavernous fibrosis prevention in patients after nerve-sparing radical prostatectomy. Comparison of groups treated by different methods will be based on the information derived from questionnaires, analysis of cavernous tissue density and blood velocity in

penile arteries measured by elastography and Doppler echography. Optimal dosage, regimen and combination of treatment options are expected as the main results of the present investigation.

Sectional presentations

Evolution of VP1 gene in non-polio enteroviruses

Эволюция гена VP1 у неполиомиелитных энтеровирусов

Yulia Vakulenko

Faculty of Biology, Department of Virology

Keywords: *Evolution, virus, capsid, emerging infections*

Enteroviruses are amongst the most rapidly changing viruses. The poliovirus is known to accumulate 1% of substitutions in VP1 per year. Enteroviruses are also an important source of emerging infections. We did a parallel analysis of 30 EV types to study common trends and variation in the evolution of VP1. All enterovirus types represented by at least 50 partial VP1 sequences (3' terminal 300 nt) were analyzed by the Bayesian phylogenetic approach using BEAST software.

The inferred nucleotide substitution rates in non-polio enteroviruses were on average 0.9% per year and varied between 0.6-1.2% in most of the types. The rate estimates for the type were reproducible and almost not affected by the sample bias. In all types, the age of the most recent common ancestor of the type was between 55-200 years. This age was significantly affected by the presence of a prototype strain in a sample. Without the prototype strain, common ancestors of the types appeared up to 40 years younger. Moreover, the topology of phylogenetic trees suggested that the global populations of VP1 region sequences of roughly half of the most common types underwent global population bottlenecks. This resulted in very recent common ancestor ages of contemporary isolates and extinction of most lineages that hypothetically existed in the mid-20th century. On the other hand, diversification of the known types was inferred to have occurred within the last 500 years. The analysis of 2657 complete VP1 sequences of 33 types indicated that the type criterion based upon 75% nucleotide sequence identity remains generally valid, despite a high substitution rate and the exponential growth of the number of sequenced isolates.

VP1 genes of the Enterovirus type exist as global populations that undergo global expansion-extinction cycles. At the same time, none of the types that existed in the 1950s was extinct to date. Therefore there must be long-term reservoirs of enterovirus genes. Generally, poor surveillance and common detection of rare genetic variants of VP1 in Africa suggest that rare enterovirus variants can be preserved on this continent. Reports of known and novel enterovirus types in non-human primates call for further studies of this potential reservoir of enterovirus genes. The stability of types despite the rapid accumulation of substitutions supports a hypothesis of types as fitness peaks, where viruses drift around, but cannot normally jump to another fitness peak because of unacceptable fitness penalty for going off the current state.

Description of novel alkaliphilic betaine-decomposing strains
Описание новых алкалофильных бетаин-разлагающих штаммов

Roman Volodyashkin

Faculty of Biology, Department of Microbiology

Keywords: *betaine, soda lakes, alkaliphilic organisms*

Betaine is one of the most common cellular osmoprotectors on Earth. Its accumulation inside the cell allows microorganisms to survive in environments with high salinity. Despite the wide distribution of betaine in soda lakes, little is known about the pathways of its degradation in these ecosystems, as well as about the bacteria carrying out this process. This work aims at the isolation and characterization of betaine-decomposing strains from soda lakes located in Altai region.

Sampling for the isolation of microorganisms was carried out in Tanatory lake system. A medium with betaine as the sole carbon source was utilized to isolate the bacteria of interest. The inoculation of selected water samples in this medium was performed, followed by the isolation of pure cultures using Pasteur method. To establish the taxonomic position of the isolated strains, the 16s rRNA gene analysis and the total DNA hybridization method were applied. The determination of cell morphology was conducted via light and electron microscopy. Assessment of microbial growth under different conditions was based on optical density; if such approach was not appropriate, growth was evaluated by the concentration of metabolic products measured by gas chromatography. The metabolic products of betaine were separated using cation-exchange high-performance liquid chromatography.

As a result of the isolation, two strains capable of utilizing betaine were obtained. Analysis of the 16s rRNA genes and DNA-DNA hybridization data indicate that the microorganisms represent the same species and form a new genus belonging to the family *Halanaerobiaceae*. The cells of both strains are rod-shaped, motile and manifest peritrichous flagellation. The maximum growth of bacteria was observed under the following conditions: 37 °C, pH 8.6; salinity 10 % NaCl. Unlike the closest relatives, the cultures are not strict anaerobes and grow at oxygen concentrations of up to 3% in the gas phase. Microorganisms ferment simple sugars and polysaccharides, as well as amino acids along with betaine. Products of betaine metabolism have been identified as acetate and trimethylamine. The activity of extracellular proteases is insignificant; therefore, the studied strains are likely to live in association with proteolytic microorganisms.

The formation of trimethylamine, which is the major substrate for methanogenesis in soda lakes, confirms the important role of the studied organisms in natural ecosystems; however, more detailed investigations are required to establish their relationships with other members of the microbial community.

Diabetes mellitus and hyperglycemia change the effects of thrombin and activated protein C on the proinflammatory secretion of mast cells

Участие тромбина и активированного протеина С в регуляции функций тучных клеток при диабете и гипергликемии у крыс

Ivan Goliako

Faculty of Biology, Department of Human and Animals Physiology Department

Keywords: *Protease-activated receptors, mast cells, hyperglycemia, diabetes, thrombin, activated protein C*

In this study, we focus on the influences of diabetes and inflammation on the effects of thrombin (Th) and activated protein C (APC) on mast cell secretion. According to World Health Organization, over 422 million people have diabetes. This disease has many complications such as retinopathy, nephropathy, diabetic foot ulcers, etc [1]. Mast cells (MC) are important participants of the inflammatory response accompanied with these complications. Serine proteases of hemostasis have been shown to be able to regulate the activity of mast cells via the protease-activated receptors (PAR) [2]. However, it is not clear what role Th and APC play in the regulation of mast cell functions at diabetes, therefore the aim of this work is to study the influence of diabetes on the Th- and APC-regulated secretion of MC at inflammation.

The experiments were performed *in vivo*, on the mast cells obtained from male Wistar rats (250-300g), and *in vitro*, on a rat basophilic cell line (RBL-2H3). Models of diabetes and inflammation were induced by an injection into rats' peritoneal cavity of streptozotocin (60 mg/kg) and 4% thioglycolate, respectively. A week after diabetes induction MC were obtained. To induce the analogues models *in vitro*, the cell line was incubated in high-glucose medium (25 mM) or in the presence of calcium-ionophore (50 nM). Histamine and β -hexosaminidase levels were measured and considered as an indicator of mast cell activation.

In the present study we found that low concentrations of Th (50 nM) and APC (10 nM) led to a decrease in the diabetes-inflammation-induced secretion of the mast cells, while a high concentration of Th (100 nM) stimulated secretion of diabetic rats' mast cells at inflammation. The inflammation alone did not affect actions of proteases. These results were confirmed by experiments on cell cultures where a high glucose level promoted pro- and anti-inflammatory actions of Th and APC, respectively. Proteases did not change their effects at the calcium-ionophore-induced cell activation.

The results obtained indicate the unidirectional action of high glucose concentration and diabetes on the effects of APC. The mechanism by which APC limits the secretion of MC in these conditions has not been understood yet. At the same time, the effect of Th at these conditions depends on its concentration that might be caused by a decline in the sensitivity of PAR-1 to thrombin at diabetes. We argue that diabetes and hyperglycemia significantly change protease-mediated regulation of mast cells activation in contrast to the inflammation.

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Construction and analysis of an interactome between nucleosomes and chromatin proteins

Построение и анализ интерактома нуклеосом и белков хроматина

Anna Gribkova

Faculty of Biology, Department of Bioengineering

Keywords: *nucleosome, chromatin, protein-protein interactions*

One of the major factors that regulate the cell fate is histone turnover from canonical histones to variants. These events define nucleosomal protein-protein interactions, which change chromatin condensation and modulate access to DNA for transcription machinery. Despite the fact that histones are highly conserved evolutionarily, they have their own set of chromatin-associated proteins. However, the nucleosome recognition mechanism by its interactors and further influence on chromatin organization remain open questions.

In this work, the list of all known human histone genes and pseudogenes and their corresponding proteins with splice-isoforms was downloaded from MS_HistoneDB database [1] and updated. To provide available search in protein-protein interaction databases information conversion about genes and proteins between HGNC and Ensembl identifiers was implemented. The initial data about nucleosome interactions, including known and predicted protein-protein associations, integrated and transferred across organisms, was downloaded from STRING database [2]. However, the data contain imbalance in the count of interactors for canonical histones that could be caused by the inaccuracy in the identification of histones with similarity in sequence and structure. To eliminate the identified imbalance we varied the probability score from the experimental channel (including experiments transferred from other organisms) and the score that is computed by combining the probabilities from the other channels. The following functional types of proteins were chosen for interactor classification: chromatin remodelers, histone chaperones, post-translational modifiers, post-translational modification readers, transcription factors and a minor group with other functional activities.

The result of research is the constructed nucleosome interactome that contains information about both physical and functional interactions between histones and chromatin-associated proteins. Criteria for probability score selection were identified in order to ensure high quality of data. For any histone set with selected probability thresholds three types of interactors (common for histone type, unique for histone and other) are presented in an interactive histogram. The categorization of interactors is carried out in accordance with the designed functional hierarchical classification. The next stage of our research will be the qualitative and quantitative analysis of nucleosome interactors.

One of the potential applications of our code would be the choice of proteins for further identification of physical principles of nucleosome interactions using molecular dynamics simulation methods. The knowledge about unique interaction between histone variants and chromatin-associated proteins would identify new targets for anticancer therapies.

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Life and Death of Antipodal Cells of Wheat Embryo Sac

Жизнь и смерть антиподальных клеток зародышевого мешка пшеницы

Tatiana Doronina

Biology Faculty, Department of Cell Biology and Histology

Keywords: *Antipodal cells, plant polytene chromosomes, wheat*

Polytene chromosomes are formed in the nuclei of cells that require intense synthesis of substances. Details of the plant polytene chromosome organization are not currently well known. It is not clear what substances plant cells with polytene chromosomes produce, how they function and die. The antipodal cells of the embryo sac of *Poaceae* are a unique model that allows answering these questions. The antipodal cells are located at the edge between the maternal tissues and the emerging endosperm. The antipodal complex consists of three cell layers. The main function of antipodals with polytene chromosomes is synthesis of substances necessary for the formation and protection of endosperm syncytium. During ontogenesis, the antipodal cells of *Poaceae* pass through consecutive stages of proliferation, differentiation and death. In the course of their differentiation, antipodal cells nourish the emerging endosperm and the endosperm cellularization induces antipodal cells death.

The aim of this work is to study structural and functional features of the antipodals during the process of their differentiation and death.

The work was performed on total specimens of embryo sacs isolated from fixed wheat ovules. We used methods of light microscopy (DAPI staining, acridine orange staining, Ag-Nor staining, immunocytochemical staining by the antibodies to fibrillarin, cyt c, KDEL and 58K) and transmission electron microscopy.

In the process of differentiation, antipodal basal layer cells have small round nuclei with diffuse chromatin and a low ploidy. Middle and apical layer cells have large nuclei, clearly differentiated chromosomes and a high ploidy. The nuclei contain from two to four large nucleoli and mini-nucleoli. The cytoplasm reveals numerous ER cisterns, dictyosomes, mitochondria, plastids. During the process of death, nuclei of cells become flattened and elongated. The chromatin changes, the chromosomes come together, cavities appear in chromosomes. Nucleoli segregate into individual protein complexes moving to the surface of chromosomes and into the cavities of the chromatin. Cytochrome c is released from mitochondria into the cytoplasm. The number of ER cisterns and dictyosomes decreases.

To sum up, the nuclei of the antipodals vary in ploidy, size, location, and, probably, function. The presence of numerous ER cisterns and dictyosomes indicates an active secretory function of the antipodals. During the death process the chromatin of the nuclei changes; segregation of nucleolar components and the release of cytochrome c from mitochondria are observed.

The role of electron transport chain components' coding genes in regulation of electron transport through photosystem I in cyanobacteria *Synechocystis* sp. PCC6803

Роль генов, кодирующих компоненты дыхательной электрон-транспортной цепи, в регуляции транспорта электронов через фотосистему I у цианобактерии *Synechocystis* sp. PCC6803

Kseniia Zapadinskaia

Faculty of biology, Department of Genetics

Keywords: *Synechocystis* sp., gene, oxidase, photosystem I, mutant

Synechocystis sp. PCC6803 is cyanobacteria whose thylakoid membranes contain photosynthetic and respiratory electron-transport chains which share some compartments: plastoquinone pool, cytochrome-*b₆f*-complex and plastocyanin. The respiratory electron-transport chain also contains oxidases: CtaI - an *aa₃*-type cytochrome oxidase, and Cyd - a cytochrome *bd*-type quinol oxidase. The purpose of the research was to estimate the role of genes that code these oxidases in electron transport through photosystem I of *Synechocystis* sp. PCC6803. This research contributes to our understanding of the process of photosynthesis which could result in improvement of agricultural techniques.

In order to study the role of the genes, mutants lacking genes *cyd* and *ctaI* separately as well as a double mutant lacking both genes were created. Mutated genes were also inserted in the chromosome of mutant $\Delta flv1/flv3$ which lacks flavoproteins. This mutant is deficient in transferring electrons from photosystem I to oxygen. Comparative analysis of the activity of photosystem I in wild type and in created mutants was conducted by obtaining red-ox state of reaction centre of photosystem I (P700) which was calculated as the difference in optic consumption in the area between 810 and 860 nm.

In previously adapted to darkness cells of wild type and mutant lacking oxidase *Cyd* fast oxidation of P700 was observed when cells were illuminated with far-red light (730 nm) for 5 seconds. Mutants lacking gene *ctaI* and both genes *ctaI* and *cyd* showed a much slower increase of the amplitude of the signal from P700⁺ than wild type cells. Many more light signals were necessary in order that these mutants could reach maximum oxidation. Oxidation of P700 in previously adapted to darkness mutants simultaneously lacking flavoproteins and oxidase *CtaI* was almost suppressed, but the amplitude of the signal from P700⁺ started slowly increasing after the following cycles of illumination.

Collected data show that cytochrome oxidase *CtaI* is the main terminal oxidase that is functional in the thylakoid membrane of the cyanobacteria during respiration. The increased reduction of the plastoquinone pool of mutants Δ *ctaI* previously incubated in darkness leads to an active transfer of electrons from plastoquinol to oxidized P700 and a decrease of the amplitude of the signal from it at the beginning of illumination. Inactivation of flavoproteins *Flv1* and *Flv3* blocks the flow of electrons from photosystem I and causes an additional decrease of the amplitude of the signal from P700⁺. Therefore, cytochrome oxidase *CtaI* as well as flavoproteins *Flv1* and *Flv3* are necessary for the activation of photosystem I in previously adapted to darkness cells.

Polyamidoacids as promising materials for Li-organic accumulators

Полиамидокислоты как перспективные материалы для Литий-органических аккумуляторов

Roman Kozlov

Faculty of Fundamental Physical and Chemical Engineering

Keywords: *Ecology, sustainable development, alternative energy*

Polymeric electrode materials are promising candidates for the next generation of sustainable energy resources as they have attracted attention for the apparent large-scale applications. The batteries based on organic structures possess a row of advantages: diversity and subjective design feasibility of molecular structure, flexibility, light weight, control on the molecular level, resource renewability and relatively low cost comparing with existing inorganic solutions. However, the accumulators have the disadvantages, such as low stability, low reversibility and slope voltage.

This work is dedicated to design a new approach to organic accumulators, to test novel substances with promising electrochemical properties and to reach higher working parameters. Polyamidoacids present a high theoretical capacity, it is easy to synthesize and recycle them as well. For the last few years a series of works appealing to carbonyl compounds has been enlarged, indicating an increasing interest

in the field. The essence of the designed approach is in application of polyamidoacids as active electrode materials and as binding additives at the same time. At first, target polyamidoacids were obtained, characterized, and then thin aluminum foil electrodes were prepared. After that, the cathode mixture consisting of a polyamidoacid, a black carbon additive and Lithium salt of iron, was prepared, homogenized and then it covered the surface of the electrode. Finally, the accumulator was assembled. Target polyamidoacids undergo the process of imidization when heated. Hence the cathode mixture was fixed without utilization of binding additives (a “glue” to fix the active material on the electrode’s surface), what eventually increased the amount of the active material in the cathode mixture. Another feature of the work is a combination of a polyamidoacid and a polyimide in the mixture and a further test. The results of the approach demonstrate good voltage and stability in comparison to the cells assembled only with a single-component cathode mixture.

These results have an impact on the development of organic electronics. The utilization of organic structures for modern gadgets will be profitable in a long-term perspective, as soon as they are recyclable, eco-friendly and easy to obtain. Nevertheless, further research is required for stability and voltage increase.

Ecological and physiological characteristics of micromycetes derived from the White Sea sediments

Эколого-физиологическая характеристика микромицетов из донных грунтов Белого моря

Nikita Komissarov

Faculty of Biology, Department of Mycology and Algology

Keywords: *fungi, the White Sea, sediments, ecology*

Marine sediments are unique environments characterized by high salinity, pressure, lack of nutrients and low temperature. Despite this, fungi develop under these harsh conditions. Little is still known about the role of sediment-derived fungi in marine ecology.

Our work aimed to study the ability of a number of marine-derived fungal strains from the White Sea sediments to develop, analyze the effect of environmental factors on growth and then identify what kind of compounds they produce to survive in harsh environment.

20 fungal strains were used in this research, most derived from the White Sea. We investigated their ability to grow under a wide range of temperatures, salinity levels, on different nutrients common in marine environments, such as algal extract, starch, chitin, keratin and cellulose. In the second stage of this study, we selected 12 strains which proved to be the fittest for this environment, and conducted an experiment aimed to find out whether these strains would successfully develop in sludge. Sterile

sediment and water were inoculated with fungal spores of these strains and placed in Eppendorf test-tubes and then were incubated under +5C. Samples of soil from these Eppendorf test-tubes then were placed on agar plates for 7 days, after which the number of fungal colonies was calculated. Derivation of fungal strains from the Kara Sea sediments and samples of Arctic ice was conducted. Potato dextrose agar and malt extract agar were used as media with addition of antibiotics (0,625 mgr/ml of ceftriaxone) to suppress bacterial growth.

We have determined that most of the studied strains were able to grow on media with high level of salinity, at low temperatures and use nutrients common in marine environments. Fungal strains demonstrated the most active growth on agar medium with algae extract, which may mean that in sea they prefer to develop on dead algae.

At this moment, the experiment with test-tubes is still underway, but preliminary results are that half of the strains used demonstrate ability to grow and successfully develop at +5C. Several strains were derived from the deep sea sediments of the Kara Sea and Arctic ice, mostly yeasts.

Further stages will include microscopy of new strains, identification of yeast species, ribosomal DNA-analysis. After the identification is completed they will undergo the same tests that were described above.

Polymer membranes: stabilization of gas transport properties

Стабилизация газотранспортных свойств полимерных мембран

Krivova Victoria

Faculty of Fundamental Physical and Chemical Engineering

Key words: *polymer membrane, gas separation, aging*

Physical aging of glassy polymers is the process of rearranging the main polymer chains and reducing the fractional free volume available for molecular transport. Attempts to solve this problem usually affect other properties in a negative way. Additives can significantly increase gas permeability, but they do not inhibit physical aging of super-glassy polymers, while the rigidity of polymer chains reduces the rate of physical aging due to permeability.

Pure polymers are initially very porous and ultra-permeable, and physical aging leads to rearranging the main chains into a denser phase (less porous and permeable). Aging of glassy polymers such as poly(trimethylsilylpropyne) (PTMSP), reduces stability of gas permeability in time and limits PTMSP gas separation applications. This problem can be solved by addition of ultraporous fillers that maintain low density, “linking” part of the polymer chains in their pores and thereby keeping the chains in their open position.

The introduction of PAF fillers into highly permeable glassy polymers matrix increases gas permeability and noticeably suppresses physical aging of the hybrid material due to high porosity of PAF and “physical” cross-linking of polymer matrix (partial penetration of polymer chains into the pores of PAF). This principle was successfully demonstrated by the introduction of PAF-1 into dense films of PTMSP, PMP and PIM-1 with thickness of 100-150 μm and PAF-11 into thinner films of PTMSP 30 - 40 microns.

In this work, it was shown that the introduction of 10 wt. % of PAF-FC, which was recently developed at Moscow State University, into PTMSP matrix made it possible to achieve preservation of the gas transport characteristics of thin membranes at previously obtained level of values for the analogous one with the classical PAF-11. Using NMR and IR analysis, the similarity of previously synthesized PAF-11 and PAF-FC was shown. Besides, low-temperature adsorption-desorption of nitrogen showed high porosity values of the new material ($S_{\text{BET}} = 768 \text{ m}^2/\text{g}$). However, PAF-11 was previously synthesized by the Suzuki cross-coupling reaction between tetrakis-(p-bromophenyl) methane and biphenyldiboric acid, requiring large amount of expensive reagents. The advantage of the alternative method of cross-linking aromatic fragments of monomer molecules using the Friedel-Crafts reaction is substantially lower costs of reagents and simplicity of synthesis.

How do the fungal communities from desert soils react to the impact of high energy electrons (HEE) irradiation?

Как грибные сообщества пустынных почв реагируют на облучение высокоэнергетичными электронами?

Margarita Kriuchkova
Soil Science Faculty, Soil Biology Department

Keywords :*Astrobiology, HEE, fungi, fungal communities, desert soils, high doses, Martian conditions*

One of the methods of astrobiology is modeling extraterrestrial environments using the natural microbial communities of extreme Earth habitats as the objects of investigation. The impact of high energy electrons (HEE) is one of the factors that limit the existence of biological life on Mars.

The aim of this study was to analyse the impact of simulated Martian conditions, viz. HEE radiation with low temperature and pressure, on the structure of culturable microfungi communities and fungal biomass in desert soil. Samples from the upper humic horizon of grey soil (Negev desert, Israel) were the objects of the present research. The samples were irradiated by high-energy electrons (HEE) in the climatic chamber allowing to maintaining the pressure of $8\text{-}9 \times 10^{-3}$ Torr and temperature of -130°C during the whole time of irradiation. The radiation intensity was 2,8 kGy/s. The samples had

obtained 0,05 MGy; 1 MGy; 2 MGy; 3 MGy; 4 MGy and 5 MGy total doses. One part of the samples were affected only by temperature and pressure without any irradiation.

For culturing of fungi the method of soil suspensions inoculation was applied using solid Czapek medium [3] and alkaline agar [1]. Soil suspensions were warmed before inoculation (52°C, 2 min) [2]. The fungi were cultivated at temperature 5°C, 25°C, 37°C. The amount of fungal biomass in situ and its morphological structure were evaluated by the method of direct fluorescent microscopy with calcofluor white dye [3].

The number of fungal propagules in control samples was $1-5 \times 10^4$ colony forming units (CFU) per gram of soil. The impact of low temperature and pressure had no significant effect on CFU. However, after the irradiation (0,05 MGy, 1 MGy) CFU significantly increased. After the higher irradiation (≥ 2 MGy) CFU slightly decreased.

The change in the number of species had an opposite relation to the dose of irradiation. The structure of soil fungal communities also changed after the irradiation: the level of biodiversity was lower in irradiated samples compared to control ones, some species that were quite rare in control samples became dominants in irradiated samples (*Penicillium*, *Aspergillus*, *Trichoderma*), the number of yeasts increased significantly.

Biomass measurements showed a negative correlation between fungal biomass and doses of irradiation. It was shown that fungal communities from desert soil could survive after the influence of high doses of irradiation by HEE, low temperature and pressure. The irradiation led to the increase of CFU and the decrease of biodiversity at the same time.

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[Site-directed mutagenesis of the TRPV1 reveals amino acid residues crucial for receptor gating](#)

Сайт-направленный мутагенез остатков TRPV1, значимых для управления рецептором

Kseniya Lubova

Faculty of Biology, Department of Bioorganic Chemistry

Keywords: *ion channels, TRPV1, molecular modelling, site-directed mutagenesis, structure–function relationship*

The research is focused on the gating process of TRPV1, probably the main cation channel involved in pain perception, especially noxious heat. Improper functioning of TRPV1 leads to pain syndromes with quite challenging treatment. Identification of the specific amino acid residues involved in the pore domain functioning may allow to take a completely different look at the present approach to development of new TRPV1-targeted drugs for inflammation and pain syndrome treatment.

To determine functionally important amino acids we examined a set of TRPV1 mutants. Using molecular dynamics we proposed “hot spot” residues that might be engaged in channel gating. Then single point mutations of TRPV1 were introduced by site-directed mutagenesis. To test chemical activation of the channel we expressed TRPV1 mutants in *Xenopus laevis* oocytes and performed two-microelectrode voltage-clamp experiments. In addition, we measured thermal activation rate in Chinese hamster ovary cell line expressing TRPV1 mutant forms.

We identified five amino acid residues crucial for pore domain functioning. The first two residues, I679 and A680, form the inner pore region. The double mutant TRPV1^{I679A+A680G} was highly toxic when expressed in *Xenopus laevis* oocytes suggesting abnormally increased activity of TRPV1. Indeed, blocking TRPV1^{I679A+A680G} with ruthenium red led to better oocyte survival. Another residue located in pore domain G643 seems to be involved in thermal sensitivity. The mutant TRPV1^{G643A} demonstrated a significant reduction in thermal-evoked response compared to the wild type, while it was normally gated in electrophysiological experiments. The last identified residue in pore region is N676, which was proposed to be responsible for calcium desensitization according to molecular dynamics. However, the TRPV1^{N676S} turned out to be a non-functional mutant, suggesting this residue is necessary for channel gating. The next residue K688 located near the pore region appears to be crucial for channel activation in response to thermal as well as chemical stimuli. Substitution of K688 with G enhanced channel sensitivity to both heat exposure and agonist activation. Mutant TRPV1^{K688G} was activated faster compared to wild type and underwent rapid desensitization.

Therefore, we found five residues crucial for TRPV1 gating. These results show the relationship between structure and function and could provide insight into underlying gating mechanisms of the key player in pain perception.

Spatial structure of flora within agricultural landscapes: a case study of Samoylovsky district,
Saratov region

Пространственная структура флоры с условиях агроландшафтов (на примере Самойловского
района Саратовской области)

Viktoria Pashkina

Faculty of Biology, Department of Geobotany

Keywords: *steppe flora, Saratov region, grid mapping, route method*

Although the steppe area is not extensive compared to others zones, its value is hard to overestimate. Because of its great importance for economy the steppe zone of Russia is well studied. There were multiple studies which focused on steppe flora. However, few researchers have addressed the issue of its spatial structure.

Samoylovsky district is one of the largest districts of Saratov region. The spatial structure of its flora was studied via grid mapping method. The whole territory was divided into 22 squares 5' in latitude and 10' in longitude. Each square, in turn, was divided into four segments: 2.5'×5'. The map of the territory was composed in programs MapSource and OziExplorer. In the field seasons 2017-2018 I explored, as minimum, one segment of each square with route method. Each route was built out of necessity to visit maximum habitat types: rivers, ponds, woods, meadows, railways, salt licks, etc. Special attention was paid to last steppe areas remaining intact.

Annotated checklist and distribution maps of species were made. I marked common species accurate to square, and rare species – to the exact spot.

515 species of vascular plants are in the checklist now, of which 6 species are gymnosperms (3 horsetails, 1 water fern, 2 conifers), 109 are angiosperms. The full checklist is expected to include no less than 600 species.

The key families are Asteraceae (88 species), Poaceae (48), Fabaceae (35), and Rosaceae (30). Species of Lamiaceae (25), Brassicaceae (24), Caryophyllaceae (17), Apiaceae (17), Scrophulariaceae (17), and Liliaceae (15) have noticeable representation in the flora as well. The richest square contains 412 species, which can be associated with both its variety of habitats and its location in the centre of the investigated territory, since in order to reach distant squares a researcher has to cross central ones, so naturally they are better examined. Range boundaries of several species (*Asarum europaeum*, *Euonymus europaeus*, etc.) should be specified.

Most rare species prefer habitats which are minimally affected by human activity (*Corydalis marschaliana*, *Dipsacus strigosus*, *Lactuca saligna*). But there are also weeds which became rare (*Setaria verticillata*, *Veronica agrestis*) and gradually spreading adventive species (*Centaurea diffusa*). Many aliens are transferred along railways (*Chaenorhinum minus*, *Collomia linearis*), and

roads (*Geranium sibiricum*, *Phalacrolooma septentrionale*). Invasion of quarantine weeds (*Ambrosia artemisiifolia*, *Ambrosia psyllostachia*) was registered, so appropriate measures must be taken.

Correlation between ecological parameters of plant communities on Payariasary island and their position in the relief

Взаимосвязь экологических параметров растительных сообществ острова Паяринсари с положением в рельефе

Arina Semenova

Faculty of Soil Science

Payarinsari island is a part of the national park “Ladoga Skerries”. Ecosystems of that area are known for the uniqueness of their flora, fauna and varying relief. Unfortunately, this area suffers from frequent fires causing the risk of loss of these ecosystems. To prevent the loss, it is necessary to carry out fire damage restoration. However, for rational restoration, it is necessary to know the ecological parameters of the communities located at different heights above the lake level. The objective of the study is to identify patterns of changes in the ecological parameters of plant communities, depending on their position in the relief.

To conduct research on the island, 2 transects 200 meters long each were laid. By leveling along these transects, terrain profiles were constructed. The description of plant communities was carried out according to the following method: the species diversity and thickness of the humus layer were described within 50x50- centimeter plots. In the course of the study 9 plant communities in total were described: 5 pine forests, 1 birch forest, 1 mixed forest, 1 birch plantation and 1 forb community. The data on the species composition of these communities were subsequently processed by means of amplitude scales in the computer program EcoScaleWin, which allows to identify some characteristics of ecosystems, based on data on species composition. The following environmental parameters were revealed: soil richness in nitrogen, soil moisture, soil acidity, moisture contrast and the degree of illumination of the area.

The study revealed the following patterns of changes in soil characteristics with increasing elevation above the water level:

1. The humus layer depletes.
2. Soil acidity increases.
3. Soil moisture declines.
4. The nitrogen content in the soil declines.
5. Significant changes in moisture contrast and the degree of illumination were not observed.

Moreover, the following regularities of changes in the plant communities were established: pine forests are present predominantly on the highlands, birch forests - on the lowlands, mixed forests exist on the terrains with transitional conditions. The grass-shrub layer, unlike the moss-lichen cover, is widely represented on the lowlands.

On the basis of the data obtained, some recommendations were drawn up for conducting after-fire restoration work on the territory of the National Park.

In particular, after a fire in low-lying areas it is recommended to plant birch, on the raises - pine. Conducting reforestation in areas with transitional conditions is not mandatory, since these ecosystems are capable of self-restoration. We expect that these recommendations will be used in further preservation of the National park.

Insect gustatory receptors as an instrument for manipulating ion currents in mammalian cells

Вкусовые рецепторы насекомых как инструмент управления ионными токами в клетках
млекопитающих

Elena Sokolinskaya

Faculty of Biology, Department of Molecular Biology

Keywords : *chemogenetics, chemoreceptors, gustatory receptors, neuronal stimulation, neurophysiology, neuroscience*

In this work we shall present a novel chemogenetic instrument based on wild-type insect chemoreceptors that will enable selective activation of neuronal subpopulations.

One of the most promising problems of molecular biology seems to be manipulation of intracellular processes via external effects. In neuroscience, it is commonly achieved through optogenetics – a technique which allows to manipulate biochemical processes in cells using stimulation with light of specific wavelengths [1]. In this case, genes encoding light-sensitive proteins – opsins – are expressed in a target cell population to modulate electric excitability using light. While working with neurons, channelrhodopsin-2, halorhodopsin, archaerhodopsin or their mutated variants are generally used [2], [3], [4]. However, there are alternative approaches to the solution of the problem. For example, chemogenetics – a relatively new approach to manipulation of intracellular activity using chemical stimulation [5]. The method is based on the activation of ion-conducting proteins by specific chemical ligands. Nevertheless, today's chemogenetics mostly relies on DREADD family receptors [6], which cannot ensure simultaneous stimulation of several neuronal subpopulations in a single experiment. In the present study, we have focused on the development of the multi-channel chemogenetic tool based on the gustatory receptors of the silkworm *Bombyx mori*.

Bombyx mori larvae were reared at room temperature in our laboratory. Total RNA isolation, cDNA synthesis and molecular cloning were performed according to the standard protocols. Constructed expression vectors

were analyzed using Sanger sequencing. BmGr-9 and BmGr-10-expressing vectors were transfected into HEK293T cells. Electrophysiological analysis was performed using whole-cell voltage-clamp recording. Fluctuations of Ca²⁺ in cells were imaged using the fluorescent genetically encoded calcium indicator gCaMP6s.

Electrophysiological analysis revealed the BmGr9 and BmGr10 response to their specific ligands (fructose and *myo*-inositol, respectively). Detection of the Ca²⁺ influx confirmed our results. To characterize the receptors properly, the current-voltage characteristics were also recorded. According to the obtained results, we can confirm that BmGr9 and BmGr10 successfully localize in the plasma membrane and respond to their chemical stimuli.

On the basis of these results, we can preliminarily postulate that our chemogenetic tool based on the gustatory receptors of *Bombyx mori* works properly in mammalian cells and can be further tested on neuronal populations.

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Regulation of functional activity and splicing of MCL-1 to combat tumor resistance to apoptotic cell death

Регуляция функциональной активности и сплайсинга Mcl-1 для снижения резистентности опухолевых клеток к апоптозу

Alena Streletskaia

Faculty of Fundamental Medicine, The Department of Biochemistry and Molecular Medicine

Keywords: *Mcl-1, tumor cells, apoptosis, cell cycle, alternative splicing, chemical inhibition, PPI (protein-protein interactions)*

Contemporary oncotherapy focuses on the induction of apoptosis in tumor cells. However, cancer cells are able to develop resistance to apoptosis, that is frequently accomplished through the elevated expression of Bcl-2 family proteins, particularly Mcl-1L. The increased level of Mcl-1L is found in many hematological and solid neoplasms. A great effort has been made to target Mcl-1L using small molecules; this recently has culminated in the discovery of Mcl-1L-selective BH3-mimetics. Moreover, a conceptually new approach has emerged that allows not only to antagonize the antiapoptotic functions of Mcl-1L but also to set Mcl-1 on the apoptotic track – the approach of alternative splicing (AS) switch toward Mcl-1S isoform.

In the study we have evaluated the extent of tumor cells sensitizing to the apoptotic effect of a DNA damaging agent cisplatin upon Mcl-1L inhibition. The cancer cell lines (ovarian carcinoma Caov-4, cervical adenocarcinoma Hela) were selected as they are derived from the tumors that demonstrate clinically significant overexpression of Mcl-1L. The high-affinity BH3-mimetic A-1210477 was used to block the binding of BH3-motif of pro-apoptotic proteins to Mcl-1L. Besides the small-molecule mediated inhibition, the level of Mcl-1L was adjusted by siRNA knockdown technique. Analysis of apoptosis and monitoring of Mcl-1 inhibition were implemented using immunoblotting and flow cytometric Annexin V/PI measurement. The obtained data points to the significant sensitizing of the studied cell lines to cisplatin under siRNA knockdown. Namely, the percentage of viable tumor cells after siRNA and cisplatin (24h) treatment declined to 57% for Caov-4 and 35.7% for Hela. Chemical inhibition did not yield comparable effects: after A-1210477 and cisplatin treatment over the same time frame, alive cancer cells constituted 81.7% for Caov-4 and 64% for Hela. Such a difference in the efficacy of genetic and pharmacological inhibition can be attributed to the inability of A-1210477 to disrupt protein complexes with remarkably high-binding affinity.

The alternative way to address Mcl-1L-dependent tumors is to cause AS switch of pre-mRNA MCL-1 toward an exon-2 deficient form MCL-1S. Mcl-1S possesses only BH3-motif, thus acting as a proapoptotic BH3-only protein. In our work, it was confirmed that the core splicing protein SF3B1 inhibitor FR901464 increases the Mcl-1S/Mcl-1L ratio and triggers significant cell death. However, the compound also changes splicing of other proteins, such as AURKB. We also demonstrated that mitotic catastrophe upon microtubule-damaging agents (Nocodazole, Monastrol) and doxorubicin causes the AS switch toward Mcl-1S. Potentially this effect can be used in oncotherapy for sensitizing tumors to apoptosis.

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