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Биологический факультет

V Межфакультетская студенческая
научно-практическая конференция

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

23–24 января 2022 г.



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Под редакцией д.ф.н., профессора Полубиченко Л.В.

Редакционная коллегия: к.ф.н., доцент Моргун Н.Л.,

старший преподаватель Фурсова А.А.

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23–24 января 2022 г. в МГУ состоялась V 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 четырех естественнонаучных факультетов университета – почвоведения, фундаментальной физико-химической инженерии, биотехнологического и фундаментальной медицины, а также биологического факультета совместного российско-китайского университета МГУ-ППИ в г. Шэньчжэне. На конференции было сделано 104 научных доклада, 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 23–24 January 2022, the 5th 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. Traditionally, 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, and Fundamental Physical and Chemical Engineering. Also, for the first time in its history, the conference was attended by several postgraduate students from the Faculty of Biology of the joint MSU-BIT University in Shenzhen (China).

However, because of the COVID-19 pandemic, the conference brought together fewer participants than usual and was held in a Zoom and in-person hybrid meeting format. The organizing committee received 120 submissions, 104 presentations were made by students from the 6 science faculties mentioned above. The plenary session encompassed 5 topics as diverse as the protein-lipid composition of astrocytes and neurons in brain tumors, water self-purification in the wetland water filtration system, soil properties of main agroecological Uganda regions, and the anticancer drug ONC201.

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

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.

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 3 plenary and 12 sectional papers whose authors scored the most points for their English (from 94 to 100).

In conclusion, on behalf of the conference organizing committee, 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

It is an honor for me to address the distinguished assembly of English language teachers, yesterday's students and today already qualified specialists, as well as guests of the scientific conference. Yes, I was lucky enough to give several lectures to some of these students myself recently – and now they are already part of the central circle of the Moscow University community. Interpersonal and intercultural communication skills play an important role in the formation of researchers, teachers, and just good people. These skills are of particular importance in the era of disunity, fragmentation, and disruptiveness. Overcoming borders is the mission of universities as a whole and the mission of each individual member of university corporations.

In my capacity as Deputy Dean for International Cooperation of the Faculty of Biology of Moscow University, I saw how effectively the work of the department has always been organized under the leadership of Professor L. Polubichenko. Quite recently we welcomed the first student scientific conference in a small lecture room – and now this conference is being held in the M-1 auditorium beloved by all biologists. The professionalism of the staff of the English department cannot but arouse the respect of colleagues.

Students and postgraduates soulfully approached the preparation of their presentations. This is not a formal report of “topics”, but a lively presentation of the results of own scientific research. Many of my colleagues and I visit the sections with interest to learn something new for us, hear some news from neighboring departments and groups.

Finally, this wonderful event becomes possible every year with the assistance of the Faculty of Biology, the Faculty of Soil Science, other participating faculties – and, of course, the Faculty of Foreign Languages and Regional Studies. I think that all participants of this conference share my gratitude to the administration of these faculties.

I am especially pleased that this year students of our “offspring” – the Faculty of Biology of the MSU-BIT University in Shenzhen – are also taking part. The staff of the Department of English (and personally L. Polubichenko and L. Shevyrdyaeva) made an invaluable contribution to the formation of our new, dynamically developing university.

I heartily congratulate all participants and organizers of the conference and wish it further development and success, and graduates – successful achievement of life goals.

*Associated Professor Andrey Kitashov
PHD in Biology*

*Deputy Dean of the Biology Faculty, Lomonosov MSU
Dean of the Biology Faculty
Shenzhen MSU-BIT University (People's Republic of China)*

2022 STUDENT CONFERENCE LIFE SCIENCES IN THE 21ST CENTURY: LOOKING INTO THE FUTURE Programme

January 23

<p>Plenary session 10.00–13.30</p> <p>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</p> <p>Andrey Kitashov, Dean of the Faculty of Biology, Shenzhen MSU-BIT University; Deputy dean of the Faculty of Biology</p> <p>Plenary presentations</p> <ol style="list-style-type: none"> Elizaveta Denisova/ Денисова Елизавета Faculty of Soil Science, Department of Soil Geography Soil properties of main agroecological Uganda regions (Свойства почв основных агроэкологических регионов Уганды) Artem Mishukov/ Мишуков Артем Faculty of Biotechnology Long-lasting consequences of short and long exposure of BT474 human breast cancer cells to anticancer drug ONC201 (Последствия кратковременной и долго-временной обработки культуры клеток рака молочной железы человека BT474 противоопухолевым препаратом ONC201) 	<p>Afternoon session 14.00–19.00</p> <p>Session 1. General biology Session 2. Biochemistry and molecular biology Session 3. Biophysics, bioengineering, biotechnology Session 5. Genetics, histology, embryology Session 6. Ecology</p>	<p>Subsession 1.1 General biology L.Polubichenko A.Volkova</p> <p>Subsession 2.1 Biochemistry and molecular biology N.Glinskaya O.Egorova Z.Aikhaistova</p> <p>Session 3 Biophysics, bioengineering, biotechnology A.Foursova I.Alikhanova V.Ignatenko</p> <p>Subsession 5.1 Genetics, histology, embryology O.Kozlova S.Kazantseva</p> <p>Subsession 6.1 Ecology N.Morgoun E.Mikheeva</p>
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<p>3. Kseniia Morozova/ Морозова Ксения Faculty of Biology, Department of Biophysics Conformation and redox state of the mitochondrial respiratory chain complexes and protein-lipid composition of astrocytes and neurons in brain tumors (Конформация и редокс-состояние комплексов дыхательной цепи митохондрий и белок-липидный состав астроцитов и нейронов при опухолях головного мозга)</p> <p>4. Alexander Yurin/ Юрин Александр Faculty of Biology, Department of Higher Nervous Activity Weak memory formation and enhancement: a study of brain activity patterns in fear conditioning task in mice (Исследование паттернов активности мозга при формировании слабой памяти и её усилении в задаче условно-рефлекторного замирания у мышей)</p> <p>5. Cal Xiang/ Цай Сян Faculty of Biology Theory of water self-purification developed for wetland water filtration system. (Теория самоочищения воды, разработанная для системы фильтрации ветландов)</p> <p>6. Lilia Shevyrdyayeva/ Шевырдяева Лилия Николаевна Associate professor Faculty of Foreign Languages and Area Studies Using corpus methods for teaching discipline-specific academic vocabulary: biology academic word list (Использование корпусных методов для преподавания отраслевой академической лексики: список академической лексики биологических наук)</p>				
Room M1	Room 252	Room 254	Room 226	Room 290
				Room 389

January 24

Morning session 10.00–15.00					
Session 1. General biology Session 2. Biochemistry and molecular biology Session 4. Physiology and neurobiology Session 5. Genetics, histology, embryology Session 6. Ecology					
Subsession 1.2 General biology A.Foursova I.Alikhanova Z.Aikhastova	Subsession 2.2 Biochemistry and molecular biology N.Glinskaya O.Egorova	Session 4 Physiology and neurobiology O.Kozlova E.Mikheeva S. Kazantseva	Subsession 5.2 Genetics, histology, embryology L.Polubichenko A.Volkova T.Surganova	Subsession 6.2 Ecology N.Morgoun L.Frolova	Room 226
	Room 290	Room 252	Room 254	Room 389	

January 23

Afternoon session 14.00–19.00

Subsession 1.1 General biology

Moderators: L.Polubichenko, A.Volkova

Room 252

Name in Russian	Name in English	Faculty, department	Title of paper in English	Title of paper in Russian
1 Александрова Елена Андреевна	Elena Aleksandrova	Faculty of Biology, Department of Plant Physiology	Comparison of esorphysiological and genetic characteristics of <i>Cyano bacterium</i> strains	Сравнение экофизиологических и генетических характеристик штаммов рода <i>Cyano bacterium</i>
2 Бичевой Владислав Витальевич	Vladislav Vychevov	Faculty of Biology, Department of Entomology	Feature of structure genitals female some species hister beetles (<i>Coleoptera, Histeridae</i>) different subfamily	Особенности строения гениталий самок некоторых видов жуков-карапузиков (<i>Coleoptera, Histeridae</i>) различных подсемейств
3 Борман Симха Игоревич	Simkha I. Borman	Faculty of Biology, Department of Biological Evolution	Amino acid neurotransmitters in the regulation of behavior in animals without a nervous system on the example of <i>Trichoplax adhaerens</i> and other <i>Placozoa</i>	Аминокислоты-нейромедаторы в регуляции поведения у животных без нервной системы на примере <i>Trichoplax adhaerens</i> и других <i>Placozoa</i>
4 Ерещенко Мария Иннокентьевна	Maria Ereshchenko	Faculty of Biology, Department of Molecular Biology	Role of yeast cell surface proteins and their role in the induction of systemic amyloidosis and mammalian neurodegenerative pathologies.	Роль белков клеточной поверхности дрожжей и их роль в индукции системных амилоидозов и нейродегенеративных патологий млекопитающих.
5 Кислица Евгений	Evgeny Kislitsa	Faculty of Biology, Department of Ichthyology	Taste preferences and feeding behaviour in <i>Chindongo demansonii</i>	Изучение вкусовых предпочтений у цихлиды <i>Chindongo demansonii</i>

6	Колесников Иван Андреевич	Ivan Kolesnikov	Faculty of Biology, Department of Invertebrate Zoology	Structural aspects of parasite-host interactions between <i>Triaenophorus lodiolus</i> (Cestoda) plerocercoids and European perch (<i>Perca fluviatilis</i>)	Структурные аспекты паразито-хозяинных взаимодействий у плероцеркоидов <i>Triaenophorus lodiolus</i> (Cestoda) с хозяином – окуньев речной (<i>Perca fluviatilis</i>)
7	Кошачка Славяна	Slaviana Koshchavka	Faculty of Biology, Department of Anthropology	The significance of anthropometric indices in estimating the physical health of elderly women	Значимость антропометрических показателей в оценке физического здоровья взрослых женщин
8	Кудрякина Александра Игоревна	Alexandra Kudriavkina	Faculty of Biology, Department of Invertebrate Zoology	Morphology, ultrastructure and molecular-phylogenetic position of Gregarine – parasites of nemerteans <i>Lineus</i> spp. from the littoral of the White Sea.	Морфология, ультраструктура и молекулярно-филогенетическое положение грегарин – паразитов немертин <i>Lineus</i> spp. с литорали Белого моря.
9	Мичурин Михаил Витальевич	Mikhail Michurin	Faculty of Biology, Department of Anthropology	The Study of the Modern Human Skull Globularity Indicators in Comparison with Fossil Homo	Изучение показателей глобулярности черепа современного человека в сравнении с ископаемыми Homo
10	Никита Тихомиров	Nikita Tikhomirov	Faculty of Biology, Department of Ecology and Plant Geography	Genome skimming elaborates phylogeography of aquatic plant <i>Potamogeton perfoliatus</i> L.	Филогеография водного растения <i>Potamogeton perfoliatus</i> L. на основе полногеномных данных
11	Пеленицына Юлия Вадимовна	Yulia Pelenitsyna	Faculty of Biology, Department of Physical Anthropology	Paleoanthropology of Tver' in the 16th–18th centuries	Палеоантропология города Тверь XVI–XVIII вв.
12	Романов Алексей Владимирович	Alexey V. Romanov	Faculty of Biology, Department of Vertebrate Zoology	Functional morphology of the head of chimaeroid fishes (<i>Chimaeriformes</i>)	Функциональная морфология головы химеровых рыб (<i>Chimaeriformes</i>)

January 23

Afternoon session 14.00–19.00

Subsession 2.1 Biochemistry and molecular biology

Moderators: N.Glinskaya, O.Egorova, Z. Alkhasstova

Room 254

Name in Russian	Name in English	Faculty, department	Title of paper in English	Title of paper in Russian
1 Аксинина Татьяна Евгеньевна	Tatiana Aksinina	Faculty of Biology, Department of Biochemistry	Studying nucleosome remodeling during aging in baker's yeast	Изучение ремоделирования нуклеосом в ходе старения в пекарских дрожжах
2 Белошапкина Ольга Михайловна	Olga Beloshapkina	Faculty of Fundamental Medicine	Spray drying as an up-to-date method for obtaining microencapsulated substances of plant origin	Распылительная сушка как актуальный метод получения микрокапсулированных субстанций растительного происхождения
3 Войнова Елизавета	Elizaveta Voinova	Faculty of Fundamental Medicine	Changes in hormonal sensitivity of differentiating MSCs during aging	Изменение гормональной чувствительности дифференцирующихся MSC при их старении
4 Данилова Наталья Дмитриевна	Natalia Danilova	Faculty of Biology, Department of Biochemistry	Investigation of functional and structural features of NCS-1 and recoverin proteins in cancer cells	Исследование функциональных и структурных особенностей белков NCS-1 и рековерина в раковых клетках
5 Замалутдинова Софья Васильевна	Sofia Zamalutdinova	Faculty of Biology, Department of Molecular Biology	Expression of human cholesterol transporter gene in <i>Escherichia coli</i> cells and functional characteristics of heterologous protein	Экспрессия гена белка-переносчика холестерина человека в клетках <i>Escherichia coli</i> и изучение функциональных характеристик гетерологичного белка

6	Заятнина Ксения	Kseniia Zamiatnina	Faculty of Biology, Department of Molecular Biology	Characteristics of kinetoplast DNA-associated proteins of tripanosomatids.	Характеристика белков, ассоциированных с кинетопластной ДНК трипаносоматид.
7	Лейси Евгения Викторовна	Evgeniia Leisi	Faculty of Biology, Department of Biochemistry	Effect of Chaperones on Pathological Transformation of Amyloid Proteins	Влияние шаперонов на патологическую трансформацию амилоидных белков
8	Новоселова Дарья Олеговна	Daria Novoselova	Faculty of Biology, Department of Microbiology	Selection of conditions for creating a dry probiotic based on <i>Lactococcus lactis</i> subsp. <i>lactis</i>	Подбор условий получения сухого пробиотического препарата на основе <i>Lactococcus lactis</i> subsp. <i>lactis</i>
9	Пекина Юлия Владимировна	Yulia Pekina	Faculty of Biology, Department of Molecular Biology	Study of the functional role of the O _{di} and E (var) 3–9 proteins in the activity of heterochromatin gene promoters in <i>Drosophila melanogaster</i>	Изучение функциональной роли белков O _{di} и E (var)3–9 в активности промоторов гетерохроматиновых генов у <i>Drosophila melanogaster</i>
10	Романов Илья Павлович	Iliia Romanov	Faculty of Biology, Department of Cell Biology and Histology	Doxorubicin effect on the viability of cultured normal and tumor human cells of epidermoid origin	Влияние доксорубина на жизнеспособность культивируемых нормальных и опухолевых клеток человека эпидермоидного происхождения
11	Тюрина Татьяна	Tatiana Tyurina	Faculty of Biology, Department of plant physiology	Growth and triterpene glycoside accumulation in suspension cell cultures of <i>Panax japonicus</i> var. <i>repens</i> , C.A. Meyer, and <i>Polyscias fruticosa</i> L. Harms	Особенности роста и накопления тритерпеновых гликозидов в суспензионных культурах клеток <i>Panax japonicus</i> var. <i>repens</i> , C.A. Meyer и <i>Polyscias fruticosa</i> L. Harms
12	Штомпель Анастасия Сергеевна	Anastasia Shtompel	Faculty of Biology, Department of Molecular biology	Spatial organization of the human keratin gene locus during the keratinocytes differentiation from iPSC	Пространственная структура локуса кератиновых генов человека в ходе получения кератиноцитов из ИПСК

January 23

Afternoon session 14.00–19.00

Session 3 Biophysics, bioengineering, biotechnology

Moderators: A.Foursova, I.Alikhanova, V.Ignatenko

Room 226

Name in Russian	Name in English	Faculty, department	Title of paper in English	Title of paper in Russian
1 Астанина Полина	Polina Astanina	Faculty of Fundamental Physical and Chemical Engineering	The effect of magnetic nanoparticles of CoFe ₂ O ₄ on the lipid membrane	Влияние магнитных наночастиц CoFe ₂ O ₄ на липидную мембрану
2 Денисов Дмитрий	Dmitry Denisov	Faculty of Biology, Department of Biophysics	Photodynamic inactivation of <i>Escherichia coli</i> bacteria by cationic photosensitizers	Фотодинамическая инактивация клеток <i>Escherichia coli</i> катионными фотосенсибилизаторами
3 Денисова Е., Марьясина С.	Denisova E., Mariasina S.	Faculty of Biology, Department of Genetics	The HeLa S3 Landing Pad Cell Line Preparation	Получение культуры человеческих клеток HeLa S3 с платформой Landing Pad
4 Качер Юлия Германовна	Julia Kacher	Faculty of Biology, Department of Bioengineering	Development of a molecular system for nucleic acids detection based on dCas9 proteins	Создание молекулярной системы для детекции нуклеиновых кислот на основе dCas9 белков
5 Кондрашов Александр Андреевич	Alexander Kondrashov	Faculty of Fundamental Medicine, Department of Pharmacy	Theoretical substantiation and experimental modeling of the technological matrix of medicinal films' (seu lamellae) composition	Теоретическое обоснование и экспериментальное моделирование технологической матрицы составов пленок лекарственных

6	Кошкина Дарья	Daria Koshkina	Faculty of Biology, Department of Bioengineering	Comparative analysis of the chromosome structure formed by linker histones H1.0 and H1.5 using spFRET microscopy	Сравнительный анализ струк- тур хроматосом, формируемых линкерными гистонами H1.0 и H1.5 методом spFRET микроскопии
7	Муравлев Владимир Игоревич	Vladimir Muravlev	Faculty of Biology, Department of Biophysics	Intercellular calcium signaling in hippocampal astrocytes	Межклеточная кальциевая сигна- лизация в астроцитах гиппокампа
8	Паничева Ксения	Ksenia Panicheva	Faculty of Fundamental Physical and Chemical Engineering, Department of Applied Mathematics and Physics	Study of the self-diffusion of star- shaped polydimethylsiloxanes by NMR with a pulsed magnetic field gradient	Изучение самодиффузии звездо- образных полидиметилсилоксанов методом ЯМР с импульсным градиентом магнитного поля
9	Протасова Елена Александровна	Elena A. Protasova	Faculty of Biology, Department of Biophysics	Features of anti-Stokes fluorescence of cyanobacterial phycobiliproteins	Изучение антистоксовой флуо- ресценции цианобактериальных фикобиллипротеинов
10	Шаниязова Элина	Elna Shamiazova	Faculty of Fundamental Medicine, Department of Pharmacy	Development of machine learning model to predict cardiotoxicity	Разработка модели машинного обучения для предсказания кар- диотоксичности соединений
11	Шегина Елена Сергеевна	Elena Shagina	Faculty of Biology, Department of Microbiology	Novel Secondary Metabolites of Extremophilic Prokaryotes with Biocidal Activity	Новые вторичные метаболиты экстремофильных прокариот с бицидной активностью

January 23

Afternoon session 14.00–19.00

Subsession 5.1 Genetics, histology, embryology

Moderators: O.Kozlova, S. Kazantseva

Room 290

Name in Russian	Name in English	Faculty, department	Title of paper in English	Title of paper in Russian
1 Антонова Мария Александровна	Maria Antonova	Faculty of Biology, Department of Genetics	The effects of ectopic expression of vertebrate atyl hydrocarbon receptor on somatic and generative tissues in <i>Drosophila melanogaster</i> .	Эффект эктопической экспрессии арил-гидрокарбонowego рецептора позвоночных в соматических и генеративных тканях <i>Drosophila melanogaster</i> .
2 Аракелян Нелли	Nelli Arakelyan	Faculty of Biology, Department of Embryology	Reprogramming of Human Primed Induced Pluripotent Stem Cells into Naive State	Репрограммирование примированных индуцированных плюрипотентных стволовых клеток человека в наивное состояние
3 Артемова Дарья	Daria Artemova	Faculty of Biology, Department of Cell Biology and Histology	Activity of polarized macrophages as studied on murine model of endometriosis	Исследование активности поляризованных макрофагов на модели эндометриоза у мышей
4 Емельянова Ольга	Olga Emelianova	Faculty of Biology, Department of Evolutionary Biology	The Polymorphism of the mtDNA Cyt b Gene in the Polar Cod, <i>Boreogadus saida</i> (Gadidae, Gadiformes) of the Arctic Basin	Полиморфизм митохондриального гена <i>Cyt b</i> у сайки, <i>Boreogadus saida</i> (Gadidae, Gadiformes) Арктического бассейна Северного Ледовитого океана

5	Ерофеева Анастасия Владимировна	Anastasia Erofeeva	Faculty of Biology, Department of Molecular Biology	Development of a system for viral delivery of a transgene into the lung organoids of patients with cystic fibrosis for the correction of the mutation in the <i>CFTR</i> gene	Разработка системы вирусной доставки трансгена в легочные органоиды пациентов с муковисцидозом с целью исправления мутации в гене <i>CFTR</i>
6	Кудряшов Андрей	Andrei Kudriashov	Faculty of Biology, Department of Genetics	CLE peptides in <i>Medicago truncatula</i> somatic embryogenesis	CLE пептиды в соматическом эмбриогенезе <i>Medicago truncatula</i>
7	Мишукова Анастасия Алексеевна	Anastasia Mishukova	Faculty of Biology, Department of Embryology	Methods of Differentiation of Induced Pluripotent Stem Cells into Macrophage Cells	Методы дифференцировки индуцированных плюрипотентных стволовых клеток в макрофагальные клетки
8	Муромцев Антон	Anton Muromtsev	Faculty of Biology, Department of Developmental Biology	Hormonal regulation of endometrial stroma cells in mice during pre-implantation and early implantation	Особенности гормональной регуляции клеток стромы эндометрия мыши доимплантационного и раннего имплантационного периода
9	Мышлявкина Татьяна Алексеевна	Tatiana Myshlavkina	Faculty of Biology, Department of Genetics	Ecogenetic marker complex for toxic effects of ecotoxicants: search and approbation on bank voles <i>Clethrionomys glareolus</i> from the natural population near the municipal solid waste landfill «Salaryevo»	Поиск и апробация комплекса эколого-генетических маркеров токсических эффектов экотоксикантов на рыжих полевках <i>Clethrionomys glareolus</i> из природной популяции, обитающих в окрестностях полигона ТБО «Саларьево»
10	Толстолужинская Анастасия Евгеньевна	Anastasiya Tolstoluzhinskaya	Faculty of Biology, Department of Embryology	Creating the 3D model simulating the structure of the fibrotic focus	Создание 3D модели, имитирующей структуру фибротического фокуса

11	Фурса Григорий	Grigori Fursa	Faculty of Biology, Department of Cell Biology and Histology	Role of neurotrophic factors in therapeutic efficacy of olfactory ensheathing cells for spinal cord injury	Влияние нейротрофических факторов на терапевтическую эффективность обкладочных клеток обонятельной выстилки при травмах спинного мозга
12	Шитиков Александр	Alexander Shitikov	Faculty of Biology, Department of Embryology	Placental serotonin: its regulation by environmental factors in rodents and long-term consequences in offspring	Серотонин в плаценте: его регуляция факторами окружающей среды у грызунов и отдаленные последствия у потомства

January 23

Afternoon session 14.00–19.00

Subsession Subsession 6.1 Ecology

Moderators: N.Morgoun, E.Mikheeva

Room 389

Name in Russian	Name in English	Faculty, department	Title of paper in English	Title of paper in Russian
1 Аксенова Мария	Maria Aksenova	Faculty of Biology, Department of General Ecology and Hydrobiology	Fauna of Cladocera and Soperoda of Mountain Bogs of North Ossetia and Kabardino-Balkaria	Фауна Cladocera и Soperoda горных болот Северной Осетии и Кабардино-Балкарии
2 Валешная Дарья	Darya Valeshnyaya	Faculty of Soil Science, Department of Agrochemistry and Plant Biochemistry	Effectiveness of vacuum pre-sowing treatment with zinc sulfate on the development of <i>Hordeum Vulgare L</i>	Эффективность предпосевной вакуумной обработки сульфатом цинка на развитие <i>Hordeum Vulgare L</i>
3 Глуховский Иван	Ivan Glukhovskiy	Faculty of Biology, Department of General Ecology and Hydrobiology	Ecological and Sanitary State of the Moskva River in the Area of the Kuryanovsk Wastewater Treatment Plant in the Autumn-Winter Season	Эколого-санитарное состояние реки Москвы в районе Курьяновских очистных сооружений в осенне-зимний период
4 Голубева Александра	Aleksandra Golubeva	Faculty of Biology, Department of Genetics	Estimation of the number of metabolically active bacteria <i>Rhodococcus erythropolis</i> and <i>Acinetobacter spp.</i> in oil-contaminated soil	Оценка численности метаболически активных бактерий <i>Rhodococcus erythropolis</i> и <i>Acinetobacter spp.</i> в нефтезагрязненной почве

5	Карпенкова Дарья	Daria Karpenkova	Faculty of Biology, Department of Microbiology	Study of the process of methyl-reducing hydrogen-dependent methanogenesis in microbial communities from different habitats	Изучение процесса метил-редуцирующего водородзависимого метаногенеза в микробных сообществах из различных мест обитаний
6	Крыленко Сергей Вячеславович	Sergey Krylenko	Faculty of Biology, Department of General Ecology and Hydrobiology	Macrozoobenthos fauna of freshwater lakes of the central part of the Kolguev Island (Nenets Autonomous Okrug)	Фауна пресноводного макрозообентоса озёр центральной части острова Колгуев (Ненецкий автономный округ)
7	Лепихина Полина	Polina Lepikhina	Faculty of Biology, Department of Invertebrate Zoology	Changes in the quantitative characteristics of macrobenthos and meiobenthos in the Blagopoluchiya Bay from 2013 to 2020 period (Novaya Zemlya, the Kara Sea)	Изменение количественных характеристик макробентоса и мейобентоса в заливе Благополучия с 2013 по 2020 гг. (Новая Земля, Карское море)
8	Перебоев Дмитрий	Dmitry Pereboev	Faculty of Biology, Department of Mycology and Algology	Diversity of labyrinthulomycetes in littoral sediments of Barents Sea.	Разнообразие лабиринтуломцетов в литоральных грунтах Баренцева моря.
9	Чеснокова Ольга	Olga Chesnokova	Faculty of Biology, Department of Higher Plants	Spring pollen calendar of the Caucasian Black Sea coast, Russia	Особенности весеннего календаря пыления Черноморского Побережья Кавказа России
10	Шибанова Полина Юрьевна	Polina Shibanova	Faculty of Biology, Department of Vertebrate Zoology	The use of hair for evaluation of hormonal status of Baikal seal (<i>Pusa sibirica</i> , Gmelin, 1788) in the wild and in captivity	Использование волос для оценки гормонального статуса байкальской нерпы (<i>Pusa sibirica</i> , Gmelin, 1788) в природе и неволе

11	Щербакова Полина Александровна	Polina Shcherbakova	Faculty of Biology, Department of Microbiology	Microbiomes of annelids of the Kandalaksha bay, White sea	Микробиомы кольчатых червей Кандалакшского залива Белого моря
12	Юракова Ольга Юрьевна	Olga Yurakova	Faculty of Fundamental Physical and Chemical Engineering, Department of Applied Mathematics and Physics	Changes in the properties of oxidized carbon material during storage	Изменение свойств окисленного углеродного материала в процессе хранения

January 24

Morning session 10.00–15.00

Subsession 1.2 General biology

Moderators: A.Foursova, I.Alikhanova, Z.Aikhanstova

Room 226

Name in Russian	Name in English	Faculty, department	Title of paper in English	Title of paper in Russian
1 Аль Худур Сара	Sarah Al Khudhur	Faculty of Biology, Department of Immunology	Anti-inflammatory Effect of Synthetic Peptides of the Hinge Region of Ezrin in the Model of Experimental Pneumonia.	Противовоспалительное действие синтетических пептидов шарнирной области эзрина в модели экспериментальной пневмонии.
2 Брагин Андрей	Andrey Bragin	Faculty of Biology, Department of Zoology of Vertebrates	New data on diversity and biogeography of Himalayan snake-eyed skinks (Reptilia: Scincidae: Lygosominae)	Новые данные о разнообразии и биогеографии гималайских гологлазов (Reptilia: Scincidae: Lygosominae)
3 Дзизюрова Виолетта Дмитриевна	Violetta D. Dzziurrova	Faculty of Biology, Department of Ecology and Geography of Plants	Disturbances due to typhoon "Maysak" in Manchurian fir – Korean pine mixed forests and their derivatives in Primorsky Region (Russia)	Нарушения в пологе чернопихтового кедрово-широколиственных лесов и их дериватов на юге Приморского края (Россия) вследствие тайфуна «Майсак»
4 Заика Максим	Maxim Zaika	Faculty of Biology, Department of Higher Plants	<i>Scorzonera sensu lato</i> (Asteraceae, Cichorieae) – taxonomic reassessment in the light of new molecular phylogenetic and carpollogical data	<i>Scorzonera sensu lato</i> (Asteraceae, Cichorieae) – таксономическая переоценка в свете новых молекулярно-филогенетических и карпологических данных

5	Канафина Мадина Маратовна	Мадина Канафина	Faculty of Biology, Department of Invertebrate Zoology	Functional morphology of frenulate siboglinid <i>Mereilium turmanicum</i> Ivanov, 1961 (Siboglinidae, Annelida) at several ontogenetic stages	Функциональная морфология отдельных стадий онтогенеза фре- нулятной зибоглиниды <i>Mereilium</i> <i>turmanicum</i> Ivanov, 1961 (Siboglinidae, Annelida)
6	Кожевникова Юлия	Julia Kozhevnikova	Faculty of Biology, Department of Vertebrate Zoology	Ontogeny of pups and adults ultrasonic isolation calls in four gerbil species (<i>Gerbillinae</i>)	Сравнительный анализ параметров ультразвуковых криков взрослых и детёнышей четырёх видов песча- нок (<i>Gerbillinae</i>)
7	Колесников Кирилл Артурович	Kirill Kolesnikov	Faculty of Biology, Department of Biological Evolution	New finds from the Sinsk formation: the first reliable Cambrian representatives of demosponges	Новые находки из синской свиты: первые достоверные кембрий- ские представители обыкновенных губок
8	Кулеш В.С., Песков К.В., Бочаров Г.А.	V.S. Kulesh, K.V. Peskov, G.A. Bocharov	Faculty of Fundamental Medicine	Systems modeling of HIV-1 infection dynamics: an overview of key questions	Обзор критических аспектов системного моделирования дина- мики ВИЧ-1
9	Лукиных Анастасия Ивановна	Anastasiya Lukinykh	Faculty of Biology, Department of Invertebrate Zoology	Morphology of reproductive system of <i>Quatuoralsia malakhovi</i> (Hemichordata, Enteropneusta, Torquaratoridae)	Морфологию половой систе- мы <i>Quatuoralsia malakhovi</i> (Hemichordata, Enteropneusta, Torquaratoridae)
10	Меденцова Анастасия	Anastasia Medentsova	Faculty of Biology, Department of Plant Physiology	Investigation of chemical and growth parameters in <i>Taxus wallichiana</i> (Zucc.) cell culture during elicitation	Исследование химических и росто- вых параметров суспензионной культуры клеток <i>Taxus wallichiana</i> (Zucc.) в течение элиситации
11	Соколов Александр Михайлович	Alexander Sokolov	Faculty of Biology, Department of Vertebrate Zoology	Morphofunctional characteristics of jaws and sublingual apparatus of the Old World sparrows (Passeridae)	Морфофункциональная характери- стика челюстного и подъязычного аппаратов семейства Воробьиные (Passeridae)

12	Трофимец Алексей Викторович	Алексеи V. Трофимец	Faculty of Biology, Department of Vertebrate Zoology	Differentiation of the wide-ranged <i>Microhyla heymonsi</i> Vogt, 1911 (Amphibia: Microhylidae) species complex in space and time: to split or not to split?	Дифференциация широкоареаль- ного комплекса <i>Microhyla heymonsi</i> Vogt, 1911 (Amphibia: Microhylidae) во времени и пространстве: раз- делять или не разделять?
13	Целлариус Федор	Fyodor Cellarius	Faculty of Biology, Department of Vertebrate Zoology	Magnetic Declination as a Part of a Navigational Map in Migratory Birds by the Example of Garden Warbler <i>Sylvia borin</i>	Магнитное склонение как один из компонентов навигационной карты мигрирующих птиц на при- мер садовой славки <i>Sylvia borin</i>
14	Цой Юлия	Julia Tsoi	Faculty of Biology, Department of Vertebrate Zoology	Role of landmarks from the lower part of the visual field in learning the location of a goal by the common toad, <i>Bufo bufo</i> L., 1758	Роль ориентиров в нижней части поля зрения в запоминании место- положения цели серой жабой, <i>Bufo</i> <i>bufo</i> L., 1758

January 24

Morning session 10.00–15.00

Subsession 2.2 Biochemistry and molecular biology

Moderators: N.Glinskaya, O.Egorova

Room 290

Name in Russian	Name in English	Faculty, department	Title of paper in English	Title of paper in Russian
1 Афонин Дмитрий	Dmitry Afonin	Faculty of Biology, Department of Bioengineering	Histones removal from nucleosomal DNA by the histone chaperone FACT	Удаление гистонов с нуклеосомной ДНК шапероном гистонов FACT
2 Ласкина Татьяна	Tatiana Laskina	Faculty of Biology, Department of Biology and Bioengineering	Investigation of the antibacterial activity of drugs modified using nano-technologies and the ability of microorganisms to adapt to them.	Исследование антибактериальной активности лекарственных препаратов, модифицированных с использованием нано-технологий, и способности микроорганизмов к их адаптации.
3 Михайлова Александра	Alexandra Mikhaylova	Faculty of Biology, Department of Cell Biology and Histology	Regulation of PD-L1 expression in tumor cells in hypoxia and normoxia	Регуляция экспрессии PD-L1 в опухолевых клетках в условиях гипоксии и нормоксии
4 А.О. Монакова, Г.Д. Сагарадзе, Н.А. Васалова, В.Ю. Балабаньян, В.С. Попов, А.Ю. Ефименко	A.O. Monakova, G.D. Sagaradze, N.A. Basalova, V. Yu. Balabanyan, V.S. Popov, A.Yu. Efimenko	Faculty of Fundamental Medicine	Evaluation of the contribution of MSC secretome components to the restoration of the spermatogonial stem cell niche	Изучение вклада компонентов секретомы МСК в восстановление ниши сперматогонимальной стволочной клетки

5	Назаров Илья	Ilya Nazarov	Faculty of Biotechnology	Inhibition of hemolysin II by antibodies to the C-terminal domain	Ингибирование гемолизина II анти-телами к C-терминальному домену
6	Пиунова Ульяна	Uliana Piunova	Faculty of Biology, Department of Molecular Biology	Functional Characterization of mitochondrial Translation Initiation Factor 2 of baker's yeast <i>Saccharomyces cerevisia</i>	Функциональная характеристика митохондриального фактора инициации трансляции 2 дрожжей <i>Saccharomyces cerevisia</i>
7	Раднаева Арина Владиславовна	Arina Radnaeva	Faculty of Fundamental Medicine, Department of Pharmacy	Experimental study of the mechanism of action of gene therapy using a novel bicistronic plasmid construct with human HGF and VEGF165 genes	Экспериментальное исследование фармакологического действия генной терапии с использованием перспективной бицистронной плазмидной конструкции с генами VEGF165 и HGF человека
8	Слущев Андрей	Andrey Slushchev	Faculty of Biology, Department of Biochemistry	Some physicochemical properties of the human small heat shock protein HspB7	Некоторые физико-химические свойства малого белка теплового шока человека HspB7
9	Ямилева Камилла Ильгизовна	Kamilla Yamileva	Faculty of Fundamental Medicine, Department of Pharmacy	Analysis of changes in the expression of urokinase system genes in mouse brain after cognitive load	Анализ изменения экспрессии генов урокиназной системы в головном мозге мышей после когнитивной нагрузки

January 24

Morning session 10.00–15.00

Session 4 Physiology and neurobiology

Moderators: O. Kozlova, E. Mikheeva, S. Kazantseva

Room 252

Name in Russian	Name in English	Faculty, department	Title of paper in English	Title of paper in Russian
1 Баринова Анна	Anna Varinova	Faculty of Biology, Department of Immunology	Characteristics of T-lymphocytes associated with spondyloarthritis in HLA-B27-positive patients	Характеристика Т-лимфоцитов, ассоциированных со спондило-артритами у HLA-B27-позитивных пациентов
2 Болдырева Анастасия Александровна	Anastasia Boldyreva	Faculty of Fundamental Medicine, Department of Obstetrics and Gynecology.	The features of the preterm period and delivery in patients with benign ovarian neoplasms	Течение беременности и родов у пациенток с доброкачественными образованиями яичников
3 Диффина Екатерина Андреевна	Ekaterina Diffine	Faculty of Biology, Department of Higher Nervous Activity	Cognitive abilities of hooded crows as studied via Aesop's fable task	Исследование когнитивных способностей серых ворон в задачах с применением Эзопова теста
4 Емельянова Екатерина Антоновна	Ekaterina Emelianova	Faculty of Biology, Department of Human and Animal Physiology	Study of the effect of the mitochondrially-targeted antioxidant SKQ1 on behavioral and biochemical parameters in the PARK2-knock-out mice model of Parkinson's disease	Исследование влияния МИТОХОНДРИАЛЬНО-направленного антиоксиданта ПДДФ на поведенческие и биохимические признаки болезни Паркинсона на модели мышей, нокаутных по гену PARK2

5	Заморина Татьяна Александровна	Tatyana Zamorina	Faculty of Biology, Department of Higher Nervous Activity	Brain activation patterns in the formation and prevention of posttraumatic stress disorder in mice	Исследование паттернов активности мозга при формировании и блокаде развития посттравматического стрессового расстройства у мышей
6	Кадоchnikova Мария Александровна	Maria Kadochnikova	Faculty of Biology, Department of Higher Nervous Activity	Effect of cranial exposure to high energy protons on functional asymmetry of visuo-motor reactions in monkeys	Влияние краниального облучения протонами высоких энергий на функциональную асимметрию зрительно-моторных реакций у обезьян
7	Лизункова Ксения	Kseniia Lizunkova	Faculty of Biology, Department of Higher Nervous Activity	Eye movement characteristics in patients with unilateral spatial neglect	Особенности движений глаз у пациентов с синдромом одно-стороннего пространственного игнорирования
8	Мазеева Валерия	Valeriia Mazeeva	Faculty of Biology, Department of Human and Animal Physiology	The role of pannexin 1 in the pro-inflammatory activation of astrocytes	Роль паннексина 1 в провоспалительной активации астроцитов
9	Максимов Ярослав	Yaroslav Maximov	Faculty of Biology, Department of Human and Animal Physiology	The Study of the sensorimotor rhythms desynchronization associated with tactile imagery	Исследование десинхронизации сенсомоторного ритма ЭЭГ, связанной с тактильным представлением
10	Макуха Юлия	Yulia Makukha	Faculty of Biology, Department of Human and Animal Physiology	The role of reactive oxygen species in arterial tone regulation in rats during early postnatal ontogenesis	Роль активных форм кислорода в регуляции тонуса артерий у крыс в раннем постнатальном онтогенезе

11	Новикова Маргарита	Margarita Novikova	Faculty of Biology, Department of Higher Nervous Activity	Synaptic plasticity under effect of caffeine in CA1 subfield of murine hippocampus	Изучение особенностей синаптической пластичности под влиянием кофеина в поле CA1 гиппокампа Мыши
12	Полинова Альмина	Almina Polinova	Faculty of Biology, Department of Immunology	Interleukin-6 in microbiota-dependent control of colorectal cancer	Интерлейкин-6 в микробиота-опосредованном контроле колоректального рака
13	Филенко Павел Андреевич	Pavel Filenko	Faculty of Biology, Department of Bioorganic Chemistry	Molecular-cellular mechanisms of depression-like behavior and cognitive impairment under the influence of acute and chronic pro- inflammatory stress	Молекулярно-клеточные механизмы развития депрессивно-подобного поведения и когнитивных нарушений под влиянием острого и хронического провоспалительного стресса

January 24

Morning session 10.00–15.00

Subsession 5.2 Genetics, histology, embryology

Moderators: L.Polubichenko, A.Volkova, T.Surganova

Room 254

Name in Russian	Name in English	Faculty, department	Title of paper in English	Title of paper in Russian
1 Гречневикова Дарья	Daria Grechnevikova	Faculty of Biology, Department of Genetics	The differentiation of populations in Norway spruce and Siberian spruce by Single-Nucleotide Polymorphisms: in a search of the adaptive genetic variation.	Дифференциация популяций ели европейской и ели сибирской по однонуклеотидным полиморфизмам: в поисках адаптивной изменчивости
2 Жернова Даяна Александровна	Daiana Zhernova	Faculty of Biology, Department of Higher Plants	Comparative anatomy of <i>Astragalax</i> and <i>Neocussusonia</i> (Araliaceae)	Сравнительно-анатомическое изучение родов <i>Astragalax</i> и <i>Neocussusonia</i> (Araliaceae)
3 Казаков Евгений	Evgeny Kazakov	Faculty of Biology, Department of Cell Biology and Histology	Techniques for live-cell electron-dense labeling	Технологии доставки электронно-плотных меток в живые клетки
4 Мирзоян Даниил	Daniiil Mirzoyan	Faculty of Biology, Department of Vertebrate Zoology	Phylogeography and systematics of jerboas of the genus <i>Stylodipus</i>	Филогеография и систематика тушканчиков рода <i>Stylodipus</i> Allen, 1925.
5 Мун Валерий Владимирович	Valerii Mun	Faculty of Biology, Department of Embryology	Developing a method to assess the functional activity of Sertoli-like cells in vivo	Разработка методики оценки функциональной активности Сертоли-подобных клеток в условиях in vivo

6	Петрова Мария	Maria Petrova	Faculty of Biology, Department of Invertebrate Zoology	Mating behavior and early embryonic development of a sea spider <i>Phoxichilidium femoratum</i> (Rathke, 1799)	Половое поведение и раннее эмбриональное развитие морского паука <i>Phoxichilidium femoratum</i> (Rathke, 1799)
7	Яковлева Анастасия	Anastasia Iakovleva	Faculty of Biology, Department of Invertebrate Zoology	Microscopic Anatomy and Ultrastructure of Stenophores	Микроскопическая анатомия и ультраструктура гребневиков (Stenophora)

January 24

Morning session 10.00–15.00

Subsession 6.2 Ecology

Moderators: N.Morgoun, L.Frolova,
Room 389

Name in Russian	Name in English	Faculty, department	Title of paper in English	Title of paper in Russian
1 Вяткин Ярослав Александрович	Yaroslav Vyatkin	Faculty of Biology, Department of Vertebrate Zoology	Olfactory orientation of tailed amphibians to their native water body. This report presents the results of the first experiments in this year.	Обонятельная ориентация хвостатых амфибий к родному водоему. Результаты первых экспериментов.
2 Го Линь	Guo Lin	Faculty of Biology, Department of Anthropology	First Direct Evidence of Conservative Foraging Ecology of Early <i>Gigantopithecus blacki</i> (~2 Ma) in Guangxi, Southern China	Первое прямое доказательство консервативной кормовой базы раннего Гигантопитека (<i>Gigantopithecus blacki</i>) в Гуанси на юге Китая
3 Рябенко Ольга Ивановна	Olga I. Ryabenko	Faculty of Biology, Department of Ecology and Plant Geography	Classification, ecology and geography of larch forests of Tukuringra Range	Лиственничные леса хребта Тукурингра: классификация, экология и география
4 Су Цзяньцзэй	Su Jiahui	Shenzhen MSU-BIT University, Faculty of Biology	Multi-scale diversity partitioning in the testate amoeba communities along the latitudinal gradient in the Western Siberian Plain	

5	Гу Сююань	Gu Xiuyuan	Shenzhen MSU-BIT University, Faculty of Biology	The study of modern phytolith and pollen soil spectra and their use in paleoecology	Изучение современных спектров почвы фитолита и пыльцы и их использование в палеоэкологии
6	Яшин Григорий Александрович	Grigoriy Yashin	Faculty of Fundamental Physical and Chemical Engineering	Some features of modelling of combusting dispersed particles in turbulent flows	Некоторые особенности моделирования потоков с горящими дисперсными частицами в турбулентных потоках

SOIL PROPERTIES OF MAIN AGROECOLOGICAL UGANDA REGIONS

СВОЙСТВА ПОЧВ ОСНОВНЫХ АГРОЭКОЛОГИЧЕСКИХ РЕГИОНОВ УГАНДЫ

Elizaveta Denisova

Faculty of Soil Science, Department of Soil Geography

Keywords: Tropical soils; Agroecology; Nutrients

Uganda is an agricultural country with a huge ever-growing population and huge food security problems. To solve this problem, a set of actions is required, in particular, the adaptation of efficient farming systems to the local agro-climatic and soil conditions of Uganda. The natural conditions of Uganda, which are characterized by rugged terrain, heavy rainfall and compacted soils, lead to accelerated water erosion of soil and uneven development of agricultural technologies, which leads to an imbalance in the use of fertilizers and chemical plant protection products. For the convenience of searching and applying the recommendations of different countries with similar soils, work was carried out to describe the soil properties of the main agroecological regions, which still remains a difficult task due to the inaccessibility and variety of methods used.

The study was conducted in 2019–2020 at four sites. Uganda belongs to the region of subequatorial climate. Geomorphologically, this area is located on the East African plateau between two branches of the East African rift system. The parent rocks of the study site are heterogeneous; weathering products and colluvium from gneisses predominate. Objects also differ in climate, general relief, biomes and the main types of economic activity in the regions.

The work includes experimental work in the laboratory and field soil descriptions. Soil samples were taken from the middle of each horizon. Analyzes of the physical, chemical and physico-chemical properties of soils have been carried out in accordance with international methods recommended by ISRIC.

Analysis of the clay fraction showed the widespread predominance of kaolinite in the composition of minerals and the presence of quartz impurities. The lowest active kaolinite clays are found in the Ferralsol Kyriadongo soil, the least active in Stagnosol Cacherera, where illite, vermiculite and relatively many mixed-layer minerals constitute a significant proportion. In Plinthosol

Cabagnolo, agrogenic illitization and a general illite-kaolinite composition of clays are noted, in Acrisol Kumi, the composition is vermiculite-kaolinite.

The Soils of the agro-ecological regions of Uganda are potentially fertile. To realize this potential, it is necessary to use fertilizers with microelements (such as boron, manganese, molybdenum, copper), for the soils of Plinthosol Kabanyolo and Stagnosol Kacerere – additionally potash, strictly observing the techniques and application rates, and to maintain the existing level – continue the application of phosphate fertilizers.

The studied soils are characterized by varying degrees of vulnerability to erosion – the most vulnerable are mountain soils of Stagnosol Kacerere, followed by the soils of Kumi and Plinthosol Kabanyolo, and the least vulnerable are Ferralsol Kyriadongo. To prevent it, it is recommended to practice crop rotation, growing cover crops, surface mulching.

The research was carried out due to project No. 075-15-2019-1868 “Improvement of integrated soil management technologies to increase crop production in Uganda.”

LONG-LASTING CONSEQUENCES OF THE SHORT AND LONG EXPOSURE OF BT474 HUMAN BREAST CANCER CELLS TO ANTICANCER DRUG ONC201

*A.A. Mishukov^{1,2}, I.V. Odinokova², S.A. Abdullaev²,
V.K. Zhalimov³, E.L. Holmuhamedov²*

¹Center for Theoretical Problems of Physicochemical Pharmacology RAS, Moscow; ²Institute of Theoretical and Experimental Biophysics RAS, Pushchino; ³Institute of Cell Biophysics RAS, Pushchino

Keywords: Breast cancer, anticancer drugs, ONC201, imipridones

Background and goals.

ONC201 is an experimental anticancer drug, targeting mitochondrial caseinolytic peptidase, ClpP (Graves et al., 2019) is currently under investigation. Current data on the effect of ONC201 report that ONC201 specifically targets mitochondria, inducing mitochondrial dysfunction and ultimately cell death (Greer et. al 2018). Along with observations that ONC201 is cytotoxic (Greer et. al 2018), there are data demonstrating that ONC201 is rather cytostatic and does not induce cell death (Ralff et al., 2017; Graves et al., 2019; Mishukov et. al., 2021). Here we studied the long-lasting consequences of transient exposure of BT474 cells to ONC201.

Observations.

ONC201 does not induce apoptotic cell death and rather inhibits proliferation in a dose-dependent manner in BT474 cells. Cells exposed to 10 μM ONC201 accumulated in G_0/G_1 phase ($49.4 \pm 11.5\%$ vs $78.7 \pm 5.1\%$) with decreased number of cells in the S-phase of the cell cycle ($39.2 \pm 6.6\%$ vs $9.0 \pm 2.1\%$), which was accompanied with a decline in Cyclin E and Cdk2 protein levels. Exposure of BT474 cells, to 10 μM ONC201, in a time-dependent manner decreased the number of mitochondrial nucleoids from 249 ± 52 to 155 ± 38 per cell after 24 h, and longer exposure (72 h) further reduced the number of nucleoids to 84 ± 36 per cell. Decreased number of nucleoids was associated with depletion of cellular mtDNA. Along with depletion of mtDNA, ONC201 exposure was also accompanied by a reduction of mitochondrial size from $2.8 \pm 0.5 \mu\text{m}^2$ to $1.5 \pm 0.2 \mu\text{m}^2$, and a decline of mtDNA-related proteins TFAM and TFUM. Short-term treatment (24 h exposure) demonstrated the *reversible* effect of ONC201 on the expression of stress proteins (ATF4, CHOP, and GDF-15). On the contrary, long-term treatment (72 h) resulted in the *irreversible* and persistent expression of these stress proteins, which was accompanied by the sustained arrest of proliferation, further depletion of mtDNA, and mtDNA-associated proteins.

Conclusions.

The consequences of ONC201 treatment were dependent on the duration of exposure to the drug. Short-term (24 h) exposure of BT474 cells resulted in *reversible* induction of cellular stress, which was reversed following 120 h incubation in drug-free media. On the contrary, long-term (72 h) exposure of cells to ONC201 induced *irreversible* and persistent arrest of proliferation and elevation of expression of stress proteins, which was accompanied by mitochondrial dysfunction.

Thus, the consequences of ONC201 treatment depend on the duration of the treatment, and ONC201 treatment could have a «point of no return» when drug-induced changes become long-lasting and *irreversible*.

CONFORMATION AND REDOX STATE OF THE MITOCHONDRIAL RESPIRATORY CHAIN COMPLEXES AND PROTEIN-LIPID COMPOSITION OF ASTROCYTES AND NEURONS IN BRAIN TUMORS

КОНФОРМАЦИЯ И РЕДОКС-СОСТОЯНИЕ КОМПЛЕКСОВ ДЫХАТЕЛЬНОЙ ЦЕПИ МИТОХОНДРИЙ И БЕЛОК-ЛИПИДНЫЙ СОСТАВ АСТРОЦИТОВ И НЕЙРОНОВ ПРИ ОПУХОЛЯХ ГОЛОВНОГО МОЗГА

Kseniia Morozova

Faculty of Biology, Department of Biophysics

Keywords: Raman spectroscopy, cancer biology, neuroscience, redox biology

Gliomas are the most common primary brain tumors in adults resulting from the degeneration of glia cells, a significant part of which are astrocytes. The causes and mechanisms of the onset and development of gliomas are not fully understood; however, it is assumed that mitochondrial functioning plays a key role in this process.

It was previously shown that the organization of the respiratory chain complexes of mitochondria in astrocytes and neurons is different: in astrocytes, they are dissociated, and in neurons, they are assembled into clusters to provide faster and more efficient electron transfer [1]. Probably, disruption of mitochondrial functioning affects the balance of reactive oxygen species in the microenvironment of astrocytes, which can lead to their degeneration.

In our research, we have used Raman spectroscopy as a sensitive method for studying the metabolic state of the cells in the brain cortex samples obtained from patients with low-grade and high-grade gliomas. This method allows to assess the conformational and vibrational state and the microenvironment of different molecules based on their Raman scattering intensity.

In mice, significant differences were revealed in the relative content of reduced cytochromes: in astrocytes, their amount is higher, which is consistent with the data on the dissociated structure of their respiratory chain. A decrease in the relative number of reduced cytochromes was observed in astrocytes near melanoma metastases in the brain of mice compared to astrocytes in the healthy hemisphere, and the shorter the distance to the metastasis, the significantly smaller the decrease observed.

We identified an increase in the relative amount of protein in all types of gliomas compared to the healthy cortex cells, which can be linked to the enhanced metabolism and division of cancer cells. In low-grade gliomas,

we observed an increase in the relative amount of reduced cytochromes in cancer cells which could be caused by hypoxic conditions in central tumor regions. High-grade gliomas are typically characterized by better oxygenation due to active angiogenesis, and we observed specific changes in cancer cells suggesting the formation of the clusters of the respiratory chain proteins. These clusters have been previously described for other types of cancer. Their formation can prevent the reactive oxygen species synthesis and endogenously protect tumour cells from damaging.

Together, our data provide new potential targets for adjuvant therapy of gliomas and reveal some Raman biomarkers that could be used in diagnostics.

References

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SECTIONAL PRESENTATIONS

STUDYING NUCLEOSOME REMODELING DURING AGING IN BAKER'S YEAST

ИЗУЧЕНИЕ РЕМОДЕЛИРОВАНИЯ НУКЛЕОСОМ В ХОДЕ СТАРЕНИЯ В ПЕКАРСКИХ ДРОЖЖАХ

Tatiana Aksinina

Faculty of Biology, Department of Biochemistry

Keywords: Epigenetics, replicative ageing, long-read sequencing, DNA methylation, *Saccharomyces cerevisiae*

Aging is one of the most important and poorly understood problems in modern biology. It is an extremely complex process accompanied by numerous changes within the cell, including chromatin rearrangements. Previous studies showed that replicative aging includes the loss of nucleosomes, however this information has been repeatedly disputed or supplemented. Nowadays there is no clear answer to the question of what exactly happens to chromatin during aging. The reason for the exact information's absence is difficulties with the separation of old and young cells, contamination by dead cells' DNA, and the necessity to have a special method for nucleosomes mapping. The first problem can be solved by using special yeast strains included the mother enriched program (MEP). The solution for the second problem is the usage of special reagents such as propidium monoazide (PMA). Finally, one of the most promising methods for defining nucleosomes' locations is Fiber-seq with previous treatment by DNA methyltransferases. These enzymes methylate only DNA between nucleosomes and in this case locations of nucleosomes in DNA can be obtained after sequencing. Thus, the aim of current work is to optimize the methods required for the project to study the structure of chromatin in a yeast model of replicative aging. These methods include obtaining and measuring the activity of MTases Hia5 and M.SssI, elimination of dead cells' DNA, and deriving a new yeast strain included MEP and triple knockout for genes of main chromatin remodelers (TKO).

Recombinant methyltransferases (Hia5 and M.SssI) were fused with His-tag, produced in the bacterial expression system, and purified on Ni-column. Their activity was measured by "protection assay" analysis on fragments of pUC18 plasmid. The elimination of dead cells' DNA was carried out by viability assay with PMA reagent in different conditions. A new yeast strain with MEP and TKO was produced by using the pRS system for ISW2 knockout in strain with MEP and double knockout (ISW1, CHD1).

Our results show that obtained methyltransferases are highly active and can be used for chromatin methylation. We optimized conditions for removing 99% of dead cells' DNA and derived a new yeast strain combining MEP and TKO. All these results will be used for future experiments to determine the nucleosome's map of old cells. As a result, we will be able to understand the main changes in chromatin during aging and bring us closer to understanding age-related diseases such as cancer, Alzheimer's disease, diabetes, and others.

ACTIVITY OF POLARIZED MACROPHAGES AS STUDIED ON MURINE MODEL OF ENDOMETRIOSIS

ИССЛЕДОВАНИЕ АКТИВНОСТИ ПОЛЯРИЗОВАННЫХ МАКРОФАГОВ НА МОДЕЛИ ЭНДОМЕТРИОЗА У МЫШЕЙ

Daria Artemova

Faculty of Biology, Department of Cell Biology and Histology

Keywords: macrophage, genetic modifications, inflammation, endometriosis, mouse model

Endometriosis is an estrogen-dependent chronic inflammatory disease characterized by the presence of endometrial stroma and glands outside the endometrium. High rates of relapse after laparoscopy, the goldstandard treatment for endometriosis, aggravate the demand for new effective non-invasive therapies. Endometriotic lesions resemble tumors in a number of aspects including the prevalence of macrophages with anti-inflammatory M2 phenotypes within the foci. The antitumor properties of activated macrophages with the opposite, pro-inflammatory M1 phenotypes are well known. Accordingly, boosting the proportion of M1 macrophages within endometriotic lesions may be of therapeutic interest. The objectives of our work were (1) to assess gene expression profiles of macrophages within endometriotic foci in mouse model of endometriosis; (2) to test the efficacy of administration of reprogrammed M1 macrophages as a possible antiendometriotic agent in mice.

Our primary goals were (1) to study phenotypic profiles of macrophages within endometriotic foci; (2) and to assess the anti-endometriotic activity of M1 macrophages in vivo. Allogeneic endometriosis was modeled in ovariectomized mice by intraperitoneal transplantation of the uterus accompanied by 17 β -estradiol therapy. Macrophage polarization profiles within the foci were assessed by immunohistochemistry, western blot

analysis, and qPCR. The macrophage cell line RAW264 was incubated with 100 ng/ml lipopolysaccharide for 24 h to obtain M1-polarized macrophages for the treatment. M1 polarization was verified by significant upregulation of MARCO and iNOS markers assessed using western blot and qPCR analysis.

As an outcome, we obtained a reproducible mouse model of endometriosis with the lesions of characteristic morphology and histology. We revealed higher proportions of macrophages with anti-inflammatory arginase1+ phenotypes in the foci of endometriosis compared with the intact eutopic endometrium. Furthermore, macrophages with pro-inflammatory TNF- α + phenotype prevailed in the eutopic endometrium compared with the foci of endometriosis. After verification of the endometriosis development in mice, the experimental group was injected with M1-polarized macrophages, while the control group was injected with unpolarized macrophages, and the animals were monitored for two weeks. The foci significantly decreased in size and number in the animals treated with M1 macrophages compared with the control animals ($p < 0.05$).

These results allow us to conclude that (1) we gained a reproducible allogeneic mouse model of endometriosis; (2) anti-inflammatory M2 macrophages prevail over pro-inflammatory M1 macrophages within endometriotic foci; (3) lipopolysaccharide in concentration 100 ng/ml successfully induced pro-inflammatory polarization of macrophage cell line RAW264; (4) intraperitoneally injected M1 macrophages effectively promote the regression of endometriotic foci.

The work was supported by the grant of the President for support of young Russian scientists (MK-1573.2022.3)

SPRAY DRYING AS AN UP-TO-DATE METHOD FOR OBTAINING MICROENCAPSULATED SUBSTANCES OF PLANT ORIGIN

РАСПЫЛИТЕЛЬНАЯ СУШКА КАК АКТУАЛЬНЫЙ МЕТОД ПОЛУЧЕНИЯ МИКРОКАПСУЛИРОВАННЫХ СУБСТАНЦИЙ РАСТИТЕЛЬНОГО ПРОИСХОЖДЕНИЯ

Olga Beloshapkina

Faculty of Fundamental Medicine

Keywords: Microcapsules; spray drying; plant extracts

The review presents the material devoted to the peculiarities of microencapsulation of plant original substances using a spray drying method. Russian and foreign sources of open access literature were analyzed, and the

following electronic databases were used: PubMed, Elibrary, CyberLeninka, and Google-academic search engine. The possibilities of a spray drying method applicable for a wide range of additives and active substances of plant origin for obtaining microcapsules, according to the technology criteria such as flowability, moisture content, shape, and size of the particles are described. In recent years, there has been an upgrade in the technology of drug production to improve drug properties. This approach requires the development of new technological processes, the main goal of which is to increase the bioavailability of drugs and to ensure the reduction of their side effects. A balance between the frequency of administration, dosage, and method of drug delivery to the target is achieved – various dosage forms have been created: liposomes, micelles, micro- and nanocapsules [1,2].

The term «microencapsulation» originally appeared in chemical technology in the early 60s, later the technology of microencapsulation was widely used. Microencapsulation can be defined as a process in which particles are coated or enclosed in a solid material that does not react with the active substance and is known as a shell or coating. Medicinal and aromatic plants contain a wide range of biologically active compounds such as alkaloids, glycosides, saponins, resins, terpenes, oils, and pigments. Recently, the number of studies devoted to the application of plant substances in various fields (food, pharmaceutical, and cosmetic industries) has increased [1].

Microencapsulation is an effective method for obtaining substances with certain physicochemical and technological properties. Dry extracts from plants are hygroscopic and composed of heterogeneous particles, so they are characterized by low flowability, which can significantly complicate the work with the substance. Encapsulation of such extracts allows obtaining spherical particles of homogeneous size, which in turn increases the flowability and facilitates the work with the extract. Encapsulation of herbal extracts by spray drying method produces particles with high content of biologically active agents. A wide range of biodegradable materials contributes to the development of techniques for obtaining particles with specified properties, such as dissolution rate and release of the active substance. The effectiveness of the method has been shown on a variety of plant substances, which are used in the food, pharmaceutical, and cosmetic industries.

References

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FIRST DIRECT EVIDENCE OF CONSERVATIVE FORAGING ECOLOGY OF EARLY GIGANTOPITHECUS BLACKI (~2 MA) IN GUANGXI, SOUTHERN CHINA

ПЕРВОЕ ПРЯМОЕ ДОКАЗАТЕЛЬСТВО КОНСЕРВАТИВНОЙ КОРМОВОЙ БАЗЫ РАННЕГО ГИГАНТОПИТЕКА (GIGANTOPITHECUS BLACKI) В ГУАНСИ НА ЮГЕ КИТАЯ

Guo Lin

Faculty of Biology, the Department of Anthropology

Keywords: *Gigantopithecus blacki*, stable isotope analysis, conservative foraging ecology, southern China, the early Early Pleistocene

Gigantopithecus blacki, the largest hominoid known, is one of the representatives of Pleistocene mammals in southern China and northern Southeast Asia. It lasted from the early Early Pleistocene (~2 Ma) to the late Middle Pleistocene (400–320 Ka). Understanding the feeding ecology of *G. blacki* is critical to unlock the mystery of the evolution of this species.

In this study we conducted the stable isotopic (C, O) analysis of the tooth enamel of the fauna associated with *G. blacki*, to investigate the feeding ecology of *G. blacki* in its core habitat (Guangxi, Southern China) during the early Early Pleistocene, which was the early period in its evolution. The materials are 58 teeth from 12 taxa from the Liucheng Gigantopithecus Cave (~2 Ma), Guangxi, China, including the largest number of *G. blacki* teeth (n = 12). The animal species include tapirs (*Tapirus sp.*), rhinoceroses, suids, giant pandas (*Ailuropoda sp.*), hyenas (*Pachycrocuta licenti*), bovids (*Bos sp.* and unidentified genera), cervids (*Rusa sp.* and *Cervavitus sp.*), proboscids (*Sinomastodon sp.* and *Stegodon sp.*) and apes (*Gigantopithecus blacki*).

The results show that the $\delta^{13}\text{C}$ values of Liucheng fauna range from -12.9 to -19.0‰ with an average of $-16.1 \pm 1.3\text{‰}$ and the $\delta^{18}\text{O}$ values range from -4.3 to -9.6‰ with an average of $-6.9 \pm 1.2\text{‰}$. The $\delta^{13}\text{C}$ values of *G. blacki* range from -15.9‰ to -17.0‰ with an average of $-16.5 \pm 0.4\text{‰}$, and the $\delta^{18}\text{O}$ values vary from -5.9‰ to -7.5‰ with an average of $-6.6 \pm 0.5\text{‰}$.

The isotopic data show Guangxi was characterized by closed C3 forest and humid climate in the early Early Pleistocene. The Niche partitioning is

found among *G. blacki*, *Sinomastodon*, *Ailuropoda* and *Stegodon*, the typical megafauna in South China in the early Early Pleistocene. This could be one of the most important factors for them to co-exist until the Middle Pleistocene. The smallest isotopic variations of *G. blacki* are found compared with those of contemporary animals, indicating a conservative foraging ecology i.e., limited foraging area and/or narrow diet flexibility. Furthermore, the more confined foraging ecology of *G. blacki* is also seen in comparison with fossil and extant large-bodied primates. However, the unique dietary pattern of *G. blacki* does not seem to have hindered its survival. The environment in Guangxi during the early Early Pleistocene offered the suitable conditions for *G. blacki* to become one of the typical species in the faunal assemblages.

DEVELOPMENT OF A MOLECULAR SYSTEM FOR NUCLEIC ACIDS DETECTION BASED ON DCAS9 PROTEINS

СОЗДАНИЕ МОЛЕКУЛЯРНОЙ СИСТЕМЫ ДЛЯ ДЕТЕКЦИИ НУКЛЕИНОВЫХ КИСЛОТ НА ОСНОВЕ DCAS9 БЕЛКОВ

Yulia Kacher

Faculty of Biology, Bioengineering Department

Keywords: CRISPR/Cas9, diagnostics, EMSA

Highly sensitive, specific, rapid, and easy-to-use diagnostic methods for the detection of nucleic acids of pathogens are required for the diagnosis of many human, animal, and plant diseases and environmental monitoring. The approaches based on the use of the natural ability of bacterial CRISPR/Cas9 systems to recognize DNA sequences with a high specificity under isothermal conditions are an alternative to the polymerase chain reaction method that requires expensive laboratory equipment. When developing biosensors based on the specific binding of proteins to nucleic acids, a conjugation of this binding with the generation of some detectable signal from the test system is a key question. Such signal generation can be realized by a simultaneous binding of two CRISPR-dCas9 complexes with adjacent, spatially close regions of the DNA locus. In this case, catalytically dead Cas9 proteins (dCas9) can be used as carriers for a spatial convergence of different pairs of reporter protein fragments or domains pre-linked to dCas9 proteins.

In the present work, a molecular system of a biosensor based on dCas9 proteins and beta-lactamase was developed, as well as a protocol for the obtaining and purification of all its components. The system comprises two dCas9 proteins and a fused part of the reporter protein – the N- or

C-terminus of beta-lactamase. The purification of the proteins was performed on a cation exchange chromatography column. The formation of triple complexes (dCas9/sgRNA/target DNA) is essential for the appropriate work of the system. For the complex assembly, a special Cy-5 labelled DNA sequence with unique protospacers and PAM (NGG) sequences in different orientations was constructed and synthesized. The 'sgRNA generator' plasmid was used to get guide RNAs. The complex formation was confirmed by the electrophoretic mobility shift assay (EMSA). The dissociation constants were calculated for different conditions and target sequences. The classes of particles were obtained and characterized with the help of transmission electron microscopy (Jeol2100), the average distance between particles was also calculated and in good agreement with the expected model.

The results of the work indicate a fundamental possibility of the creation of highly specific nucleic acid biosensors based on a combination of CRISPR/Cas9 technologies and split enzymes.

STRUCTURAL ASPECTS OF PARASITE-HOST INTERACTIONS BETWEEN TRIAENOPHORUS NODULOSUS (CESTODA) PLEROCERCIDS AND EUROPEAN PERCH (PERCA FLUVIATILIS)

СТРУКТУРНЫЕ АСПЕКТЫ ПАРАЗИТО-ХОЗЯИНЫХ ВЗАИМОДЕЙСТВИЙ У ПЛЕРОЦЕРКОИДОВ ТРИАЕНОФОРУС NODULOSUS (CESTODA) С ХОЗЯИНОМ - ОКУНЬ РЕЧНОЙ (PERCA FLUVIATILIS)

Ivan Kolesnikov

Faculty of Biology, Department of Invertebrate Zoology

Keywords: tapeworms, Cestoda, tegument, host-parasite interaction, immune response

Host-parasite interaction has attracted increasing interest in basic and applied research for the last decades. Possible ways of interaction between cestodes and their fish hosts are not fully understood. For the first time, ultrastructural features of the interface between the tapeworm *Triaenophorus nodulosus* and the liver tissue of its fish host have been described using electron microscopy.

Plerocercoids of *Triaenophorus nodulosus* (Cestoda: Bothriocephalidea) were obtained from its host, the European perch (*Perca fluviatilis*), from the Rybinsk Reservoir, Russia. The tapeworms within parasitic capsules in the host's liver, as well as the worms out of capsules, were collected. The

ultrastructure of the tegument of the plerocercoids, the capsule wall, the tissue of infected hosts' liver, and the capsule cavity, were identified and described using transmission and scanning electron microscopy. Capsules with plerocercoids were extracted from fish liver and immediately fixed in a 2.5% glutaraldehyde solution with 0.1 M phosphate buffer for more than 1 hour. After the fixation, the samples were post-fixed in 1% OsO₄ solution with the same buffer. The capsules and free worms were then dehydrated in an ascending ethanol series and imbedded in Araldite resin for transmission electron microscopy. Ultrathin sections of the samples were cut and stained with uranyl acetate solution and lead citrate solution. For scanning electron microscopy, other samples were dehydrated, dried at the critical point using liquid CO₂, and then sputter coated with a gold-palladium alloy.

The ultrastructure of the interface between the plerocercoid and the liver tissue of the fish host was characterized. The tapeworm's tegument was shown to be active by detecting several types of discharge of secretory products such as merocrine and apocrine secretion as well as secretion via extracellular vesicles. The whole space of the capsule cavity between the tegument and the capsule wall appeared to be occupied with a fibrillary extracellular matrix, namely glycocalyx. In addition, individual inflammatory host cells were found on the inner side of the capsule wall.

The study suggests that the interactions between cestode parasites and fish hosts occur inside capsules. In other words, the parasite and the host interact structurally. On the one hand, the possible structures are responsible for the immune response of the host; on the other hand, they account for the immunomodulation and protection of the parasite against the host immunity. The host-parasite interface was shown to be structured and influenced by the host together with the parasite.

**CHANGES IN THE QUANTITATIVE CHARACTERISTICS OF
MACROBENTHOS AND MEIOBENTHOS IN THE BLAGOPOLUCHIYA
BAY FROM 2013 TO 2020 (NOVAYA ZEMLYA, THE KARA SEA)**

**ИЗМЕНЕНИЕ КОЛИЧЕСТВЕННЫХ ХАРАКТЕРИСТИК
МАКРОБЕНТОСА И МЕЙОБЕНТОСА В ЗАЛИВЕ БЛАГОПОЛУЧИЯ
С 2013 ПО 2020 ГГ. (НОВАЯ ЗЕМЛЯ, КАРСКОЕ МОРЕ)**

Polina Lepihina

Faculty of Biology, Department of Invertebrate Zoology

Keywords: Macrobenthos; meiobenthos; Kara Sea; Chionoecetes opilio

Macrobenthos and meiobenthos are related to each other by numerous types of interactions. Nevertheless, comparative studies of various aspects (trophic interactions, substrate modifications by macrobenthos organisms, etc.) of these benthic groups existing inseparably in the sediment are rare. Our study aimed to find out the quantitative changes in macrobenthos and meiobenthos between 2013 and 2020, and to test the hypothesis of macrobenthos substitution by meiobenthos as a reaction to the impact of a new predator in the bay.

The material for the study was collected during two cruises undertaken in 2013 and 2020. Overall, twelve stations were distributed over the Blagopoluchiya Bay and on the adjacent slope. The “Okean” grab or the Van Veen grab was used for macrobenthos sampling (3–5 replicates per station), while the box corer was used for meiobenthos sampling (2 replicates per station). The samples were fixed in a filtered saltwater solution with the addition of 6% formaldehyde. After that, the macrobenthos animals were sorted, identified to the lowest possible taxonomic level, counted and weighed. Meiobenthos animals were extracted from the sediment using the colloidal silica polymer Ludox HS-40 centrifugation technique, sorted by taxa and counted.

According to our results, meiobenthos abundance increased greatly, whereas macrobenthos abundance decreased between 2013 and 2020. The mean meiobenthos density values tripled (from 702 ind./10 cm² to 2293 ind./10 cm²), while the mean abundance values of macrobenthos decreased by half (from 1530 ind./m² to 645 ind./m²). In addition, macrobenthic ostracods and echinoderms, represented by ophiurians and holothurians, completely disappeared in 2020. The observed growth of meiobenthos abundance was mainly due to an increase in the density of free-living nematodes. At the same time, the taxonomic composition of meiobenthos has not changed significantly in seven years.

Summarizing all the above, macrobenthos and meiobenthos of the Blagopoluchiya Bay have undergone substantial changes in their quantitative distribution during the seven studied years. We suggest that the invasion of the snow crab *Chionoecetes opilio* in the bay was one of the most important driving forces to change the benthos distribution. Following the crab invasion, there was a reduction of macrobenthic density and biomass with a compensatory increase in those in meiobenthos in the Blagopoluchiya Bay.

THE ROLE OF REACTIVE OXYGEN SPECIES IN ARTERIAL TONE REGULATION IN RATS DURING EARLY POSTNATAL ONTOGENESIS

РОЛЬ АКТИВНЫХ ФОРМ КИСЛОРОДА В РЕГУЛЯЦИИ ТОНУСА АРТЕРИЙ У КРЫС В РАННЕМ ПОСТНАТАЛЬНОМ ОНТОГЕНЕЗЕ

Yulia Makuha

Faculty of Biology, Department of human and animal physiology

Keywords: NADPH oxidase; VAS2870; superoxide dismutases; endothelium; vascular tone

The role of reactive oxygen species (ROS) in the cardiovascular system is studied in the field of normal physiology and pathophysiology. It is known that ROS play an essential role in arterial tone regulation. Moreover, they can contribute to the development of cardiovascular diseases [1]. The proteins involved in the production of ROS in the vascular system include superoxide dismutases (SODs) and NADPH oxidases (NOXs) [2]. Nowadays, the role of ROS in the regulation of arterial tone during the early postnatal period remains unclear. Thus, this research aimed to assess the role of ROS in arterial tone regulation in rats during early postnatal ontogenesis. The results of our study are expected to help to develop a strategy for the effective treatment of cardiovascular diseases in children.

The study was carried out on the saphenous artery of young (2 weeks old) and adult (10–14 weeks old) male rats. The contraction of the arterial segments in response to methoxamine (α 1-adrenergic receptor agonist) was recorded under control conditions in a wire myograph. To evaluate the effects of ROS, we compared these contractile responses to the reactions after the incubation with solvent (DMSO) or with different concentrations of NADPH oxidase inhibitor VAS2870 ($3 \cdot 10^{-6}$, 10^{-5} and $3 \cdot 10^{-5}$ M). The contribution of ROS to arterial tone regulation was also studied under the action of inhibitors of endothelium-dependent relaxation pathways (L-NNA, UC11684, TRAM34, Indometacin). Thereafter, we determined the proteins content (SODs, NOXs) in the arteries of rats by using Western Blotting. We found that the adults' arterial responses were not affected by VAS2870. A decrease in the contractile responses of young rats' arteries was shown at VAS2870 concentrations of 10^{-5} and $3 \cdot 10^{-5}$ M. The same results were shown after the incubation with VAS2870 and the inhibitors of endothelium-dependent relaxation pathways. Finally, the content of SOD₃ and NOX₄ were both higher in young rats compared to adults. In contrast, the content of SOD₁ and SOD₂ proteins was lower in the arteries of young rats.

In summary, we assume that the contribution of ROS to arterial tone regulation is greater in young rats. Moreover, the role of ROS in early postnatal ontogenesis can be provided by the superoxide anion radical due to a decrease in the expression of SOD₁, SOD₂, and a higher content of NOX₂ in SMCs. This pro-contractile effect of ROS could be an essential mechanism of maintaining normal maturation of the cardiovascular system in the early postnatal period.

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EVALUATION OF THE CONTRIBUTION OF MSC SECRETOME COMPONENTS TO THE RESTORATION OF THE SPERMATOGENIAL STEM CELL NICHE

ИЗУЧЕНИЕ ВКЛАДА КОМПОНЕНТОВ СЕКРЕТОМА МСК В ВОССТАНОВЛЕНИЕ НИШИ СПЕРМАТОГОНИАЛЬНОЙ СТВОЛОВОЙ КЛЕТКИ

*A.O. Monakova, G.D. Sagaradze, N.A. Basalova,
V.Yu. Balabanyan, V.S. Popov, A.Yu. Efimenko*

Faculty of Fundamental Medicine, Biochemistry and molecular biology

Keywords: MSC; secretome; regenerative medicine

The key role of MSC is to support the viability and functions of stem cells and their niche components contributing to their recovery after damage. We have previously shown that multipotent mesenchymal stromal cells (MSC) and a secretome of MSC are promising therapeutic tools for male infertility treatment. It was also shown that the regenerative effects of MSC are mostly mediated by paracrine factors. We assumed the paracrine regenerative effects of MSC secretome on the niche of spermatogonial stem cells (SSC) are mainly implemented based on the growth factors such as a vascular endothelial growth factor (VEGF) and a glial cell-derived neurotrophic factor (GDNF). GDNF is the crucial factor, which maintains the viability of SSC. VEGF is one of the major growth factors, which enhances the secretion

of testosterone of one of the main types of SSC – supporting cells – Leydig cells. Another important fraction of the MSC secretome is extracellular vesicles (EVs). EVs could mediate some MSC-dependent regenerative effects, which has been shown in other models.

To check the contribution of these components to the spermatogenesis recovery after damage, the murine model of complex spermatogenesis damage with doxorubicin was performed. Then we neutralized VEGF and GDNF in the MSC secretome with specific antibodies and deleted the EVs fraction from the MSC secretome. The different groups of animals were treated with MCS secretome, EV-depleted MSC secretome, MSC secretome with VEGF and GDNF neutralizing antibodies, respectively. The contribution of factors to the spermatogenesis recovery was estimated using the histological analysis of sections of testicles stained with hematoxylin-eosin and the spermatozoa counting in a homogenate of the epididymis of experimental animals.

We discovered that mice treated with MSC secretome and VEGF neutralizing antibodies had a lower number of recovered tubules in comparison with a group after MSC secretome injection. Also, the total amount of spermatozoa and mobile spermatozoa were higher in MSC treated group, compared to the group treated with VEGF neutralizing antibodies and MSC secretome and the group of untreated mice. According to our results, GDNF and EVs do not have a significant impact on MSC-mediated spermatogenesis recovery. Obtained data are preliminary, but they have already shown the importance of VEGF for increasing the recovery of spermatogenesis.

The study was carried out under the State Assignment of Lomonosov MSU (MSC isolation and MSC secretome manufacturing) and supported by the Russian Science Foundation (project no. 19-75-30007, in vivo experiments) using the equipment provided within the Program of Development of Lomonosov MSU.

HORMONAL REGULATION OF ENDOMETRIAL STROMA CELLS IN MICE DURING PRE-IMPLANTATION AND EARLY IMPLANTATION

ОСОБЕННОСТИ ГОРМОНАЛЬНОЙ РЕГУЛЯЦИИ КЛЕТОК СТРОМЫ ЭНДОМЕТРИЯ МЫШИ ДОИМПЛАТАЦИОННОГО И РАННЕГО ИМПЛАТАЦИОННОГО ПЕРИОДА

Anton Muromtsev

Faculty of Biology, Developmental Biology Department

Keywords: implantation, decidualization, endometrium

The implantation process is the attachment and invasion of an embryo into the uterus wall, during which the embryo interacts with its inner layer, endometrium, consisting of epithelium and stroma. During the invasion, the embryo interacts with the stromal cells directly. Implantation failure is the cause of most spontaneous abortions in humans. Thus, it is important to develop a model to study interactions of the embryo with the primary endometrial stromal cells during implantation. The aim of this work is to study the role of the stromal compartment in the embryo–endometrial interactions.

Mouse endometrial stromal cells were isolated in accordance with a new specially developed protocol. Female mice were hormonally stimulated before cells isolation. For cells cultivation in the standard DMEM medium, we used a multi-gas incubator with the conditions set at 5% CO₂, 5% O₂ and 37 degrees Celsius. To perform the decidualization protocol, we used estradiol (E2) and progesterone (P4) at concentrations of 10 nM and 1 μM, respectively. The time of hormonal exposure was 3 days. Decidualization was verified by an increased expression of the marker gene PRL (detected by RT-PCR) and changes in the nucleus and cell size. The decidualization response to different hormone doses was measured. The cells were decidualized *in vitro* with the following relative concentrations of the aforementioned hormones: 0.25x, 0.5x, 0.75x, 2x, 4x (1x: the standard concentration). Additionally, different ratios of estradiol and progesterone were applied. Nucleus and cell sizes were estimated for each point to plot the hormonal response curves.

To study the expression of key decidualization genes, control and experimental groups containing 3 repeats in each were used. The expression of PRL, MMP2, BMP2, and Hand2 was measured. Finally, the subpopulation structure of endometrial stromal cells was studied using flow cytometry with visualization. The plotted hormonal curves showed that the initial concentrations of P4 and E2 and their initial ratios are optimal for decidualization. RT-PCR revealed manyfold changes of PRL and MMP2 in experimental groups, compared to the control group. An increase in the multiplicity of PRL indicates that decidualization was successful, while an increase in the multitude of MMP2 could be potentially associated with a simplified embryo invasion.

Structural analysis revealed 3 subpopulations: 2n-cells, 4n-cells and polyploid cells, which are the smallest group. Potentially, hormonal treatment will increase the proportion of polyploid cells. The role of decidualization of endometrial stromal cells is crucial for successful embryo implantation. These cells are not only specifically differentiated during the hormone treatment,

but also participate in remodeling the intercellular matrix, thereby preparing endometrium for implantation.

EXPERIMENTAL STUDY OF THE MECHANISM OF ACTION OF GENE THERAPY USING A NOVEL BICISTRONIC PLASMID CONSTRUCT WITH HUMAN HGF AND VEGF165 GENES

ЭКСПЕРИМЕНТАЛЬНОЕ ИССЛЕДОВАНИЕ ФАРМАКОЛОГИЧЕСКОГО ДЕЙСТВИЯ ГЕННОЙ ТЕРАПИИ С ИСПОЛЬЗОВАНИЕМ ПЕРСПЕКТИВНОЙ БИЦИСТРОННОЙ ПЛАЗМИДНОЙ КОНСТРУКЦИИ С ГЕНАМИ VEGF165 И HGF ЧЕЛОВЕКА

Arina Radnaeva

Faculty of Fundamental Medicine, Pharmacy Department

Keywords: Gene therapy; bicistronic plasmid; HGF; VEGF

Hind limb ischemia remains a clinical problem with no satisfactory treatment options. Numerous studies have shown that treatment with the combination of vascular endothelial growth factor 165 (VEGF165) and hepatocyte growth factor (HGF) (angiogenic growth factors) exerts angiogenic and anti-inflammatory effects on various tissues and cells. In the arena of clinical trials, therapeutic angiogenesis acts as treatment of hind limb ischemia, becoming increasingly common today. This new approach aims to restore tissue supply and relieve ischemia by gene delivery in vivo for the expression of angiogenic growth factors that stimulate blood vessel growth. As for vector construction, most non-viral gene therapy drugs encoding vascular endothelial growth factor (VEGF165) and hepatocyte growth factor (HGF) have shown plausible safety profiles. Experimental studies in animal models of ischemic disease have shown that the combined gene delivery of VEGF165 with HGF increased angiogenic response compared to these factors delivered alone. In this work, we studied the pharmacological activity of a bicistronic plasmid with human HGF and VEGF165 genes (pHGF/VEGF165).

One of the main objectives of this study is to determine the expression activity of a plasmid. The results of transfection of HEK 293 with the pHGF/VEGF165 and the control plasmid with the GFP protein gene showed that the investigated plasmid provided a synthesis of HGF and VEGF165 proteins in almost equimolar concentrations. This ratio of therapeutic factors concentrations promotes efficient formation and growth of new blood vessels.

Also in this research, we investigated the pharmacokinetics of the bicistronic plasmid pHGF/VEGF165 in a model of hind limb ischemia

in mice using the Western Blotting method. The data showed that a high content of HGF after a single intramuscular injection of the study drug to experimental animals is detected in the blood serum within 5 days. By day 10, only a residual level of expression is observed.

Additionally, our work is aimed at finding additional possible therapeutic effects of pHGF/VEGF165, for example, activation of myogenesis in an ischemic limb. The study using intramuscular injection of the drug in experimental animals with a model of hind limb ischemia showed that, on the one hand, pHGF/VEGF165 does not stimulate myogenesis. On the other hand, these results indicate the absence of mitogenic effects.

Overall, our study reports a first-in-class candidate gene therapy drug to deliver two pivotal angiogenic growth factors (HGF and VEGF165) with properties that provide the basis for future development of treatment for peripheral artery disease and associated limb ischemia.

SPRING POLLEN CALENDAR OF THE CAUCASIAN BLACK SEA COAST, RUSSIA

ОСОБЕННОСТИ ВЕСЕННЕГО КАЛЕНДАРЯ ПЫЛЕНИЯ ЧЕРНОМОРСКОГО ПОБЕРЕЖЬЯ КАВКАЗА РОССИИ

Olga Chesnokova

Faculty of Biology, Department of Higher Plants

Keywords: Caucasian Black Sea coast, pollen calendar, allergenic pollen, aeropalynology, allergy

Allergic rhinoconjunctivitis is known to be one of the most common diseases in Europe caused by airborne pollen, especially during the flowering period. Pollen monitoring and creation of the pollen calendar are an important part of allergy therapy that permits allergenic sufferers to predict and manage the symptoms. Currently, there are five stations of aerobiological monitoring in Russia: in Moscow, Saint Petersburg, Ryazan, Tyumen and Krasnodar. On the Caucasian coast of the Black Sea that is traditionally considered to be an important resort, aerobiological monitoring has never been conducted before. The lack of pollen data does not allow allergic citizens and tourists to avoid their respiratory symptoms.

Consequently, the aim of the present study was to develop the aerobiological calendar of the spring period for this territory. Our pollen data was collected with a Burkard volumetric trap according to the international standards from February to May 2018. The trap was located in Lazarevsky

City District of the city of Sochi. Totally 102 daily samples were collected and analyzed under the light microscope. In addition, a vegetation map showing the spatial distribution of the pollen sources was derived.

Fifty-eight pollen types were identified in the spring pollen spectrum. Its main body is formed by 17 taxa that are allergenic or the most abundant. The calendar was divided into two sub-periods according to the qualitative and quantitative features of the pollen spectrum. The first one is characterized by low taxonomic diversity and very high pollen production. The pollen of cypresses and the family Betulaceae was the most numerous. The second sub-period is characterized by higher taxonomic diversity but lower total pollen concentration. The most abundant species were late flowering oaks and walnuts.

Thus, this analysis provides a better understanding of the prospective pollen content of the atmosphere in different spring periods due to the accurate prediction of the beginning of flowering. The pollen calendar can be used in the daily advice for allergenic sufferers. Furthermore, the results of the present study underline the importance to continue pollen monitoring of this region throughout the year and allow us to compare the present data with the data from the other regions.

ANALYSIS OF CHANGES IN THE GENE EXPRESSION BY THE UROKINASE SYSTEM IN MOUSE BRAIN AFTER COGNITIVE LOAD

АНАЛИЗ ИЗМЕНЕНИЯ ЭКСПРЕССИИ ГЕНОВ УРОКИНАЗНОЙ СИСТЕМЫ В ГОЛОВНОМ МОЗГЕ МЫШЕЙ ПОСЛЕ КОГНИТИВНОЙ НАГРУЗКИ

Kamilla Yamileva

Faculty of Fundamental Medicine, Pharmacy Department

Keywords: Urokinase system; cognitive load; memory

Background

The urokinase system proteins play an important role in many physiological and pathophysiological functions of the body. In addition to the canonical proteolytic activity, the components of the urokinase system regulate the processes of migration, proliferation, adhesion, and survival of nerve cells. Qualitative and quantitative changes in the expression of uPAR and its canonical ligand uPA were observed in a wide variety of disorders, like epilepsy, multiple sclerosis, Alzheimer's disease, cerebral malaria, HIV-associated leukoencephalopathy, and encephalitis both in humans and in

animal models. However, there are practically no studies in the literature concerning the role of these proteins in the formation of memory, despite their role in the pathogenesis of disease connected with memory dysfunction and loss. In this regard, the study was carried out to assess the changes in the expression of the uPA and uPAR genes after exposure to cognitive load in an animal model of a mouse to stratify these genes based on the early and late response.

Methods

To assess the expression of urokinase and its receptor genes after cognitive load in mice, the following manipulations with animals were carried out: mice were placed in a gray open field $44 \times 44 \times 44$ cm in size for 10 minutes after the dissection and isolation of brain structures (anterior cortex, posterior cortex, and hippocampus) were conducted. Then, the total RNA was isolated from the frozen brain tissue of mice using the Trizol method. $1,0 \mu\text{g}$ of total RNA was reverse-transcribed for subsequent PCR in real-time. The relative transcript level was calculated using the $2^{-\Delta\Delta\text{Ct}}$ method with β -actin as the reference gene.

Results

An increase in uPA mRNA expression in the posterior cortex and hippocampus for 1 hour was found, as well as an increase in uPAR mRNA expression in the anterior cortex, posterior cortex, and hippocampus at 1 hour and 24 hours after placing the mice in an open field.

Conclusions

Thus, the study demonstrated both an early and late increase in the expression of uPAR and uPA mRNA in the brain of animals after they were placed in new environmental conditions. This discovery draws attention to the possible role of the uPA/uPAR interactome in pathological neural plasticity and raises the question of the function of the uPAR and uPA transcriptional responses to cognitive impact on normal neuronal functions, especially in learning and memory consolidation.

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