Virtual Short-Term Scientist Engagement Fellowship Program for Ukrainian Scientists with Dual-Use Relevant Expertise

Project title: Starving Cancer Cells for Semi-essential Amino acids: Toward New Targeted Metabolic Therapies

Principal Investigator. Oleh Stasyk, Dr.Sci, Head of the Department of Cell Signaling (DCS) of the Institute of Cell Biology NAS of Ukraine, Lviv, Ukraine

State of the problem. Cancer remains the second deadliest human disease worldwide, and many cancer types remain notoriously difficult to cure. There is a strong need, therefore, for novel therapies that are efficient, selective, and non-toxic.

In contrast to normal cells, many rapidly proliferating malignant cells are critically dependent on elevated supplies of various exogenous nutrients, including amino acids. Due to genetic alterations, certain cancer cells are simultaneously deficient in the anabolism of non-essential or semi-essential amino acids, such as asparagine (Asn), arginine (Arg), and glutamine (Gln). Furthermore, cancer cells also highly upregulate specific amino acid transporters to sustain their bioenergetic and biosynthetic processes. Therefore, the lack of certain amino acids often causes the death of cancerous, but not normal cells, which are not "addicted" to amino acids supply (Wang et al., 2021; doi.org/10.3389/fphar.2020.582587).

Besides the formulation of special diets, there are several therapeutic strategies to starve cancer cells for individual amino acids *in vivo*. One involves intravenous application of recombinant amino acid-degrading enzymes. For instance, unlike normal cells, acute lymphoblastic leukemia (ALL) cells cannot synthesize Asn due to the lack of Asn synthase activity (ASNS), making their proliferation and survival fully dependent on exogenous Asn. Thus, recombinant bacterial L-asparaginase (ASNase, converts plasma Asn to aspartic acid and ammonia) treatment is efficiently used for ALL patients in clinics (Bender et al., 2021; doi.org/10.2147/BLCTT.S245210). Many tumors are deficient in Arg biosynthetic enzyme argininosuccinate synthetase (ASS) and are therefore sensitive to Arg deprivation. Thus, ARG-degrading recombinant enzymes, such as human arginase (ARGase, converts Arg to ornithine and urea), are currently tested at stages I-III of clinical trials as prospective anticancer agents (Chu et al., 2023; https://doi.org/10.3390/ijms241310668).

As an alternative or concomitant approach, certain transporters can be blocked in cancer cells to prevent amino acid influx. As an example, abrogation of Asn uptake was shown to cause the death of ALL cells but not normal cells [4]. Inhibition of Gln-Leucine (Leu) transporters, in particular, SLC7A5/LAT1 and/or SLC3A2/CD98-LAT1 complex, was shown to mimic Gln starvation conditions (Kahya et al., 2021; doi.org/10.3390/cancers13010125).

Yet another approach to create amino acid starvation conditions may involve specific inhibition of amino acid biosynthetic enzymes. One example is blocking the enzymatic activity of intracellular glutaminase (GLS1) with developed specific low molecular weight inhibitors, e.g., CB-839 (Mukha et al., 2021; doi.org/10.7150/thno.58655).

It has to be emphasized that, contrary to the classical methods of anticancer chemotherapy mentioned above, metabolic approaches are well tolerated by patients. Although such a therapy has a history of clinical success, as exemplified by ASNase, it still requires certain important improvements.

This project aims to analyze *in vitro* new rational combination approaches to anticancer metabolic therapy based on the deprivation of individual semi-essential amino acids, namely Arg, Asn and Gln. Different modes of amino acid starvation conditions will be modeled *in vitro* with the help of recombinant human ARGase, recombinant bacterial ASNase (which also possesses a glutaminase activity), and/or inhibitors of certain anabolic enzymes and amino acid transporters.

The working hypothesis of the project. It is well established that the limitation of certain individual non-essential amino acids, Arg, Asn, and Gln in particular, exerts antiproliferative effects on certain malignant cells. However, they do not always convert into efficient cancer cell death. The question of the effects of simultaneous combined starvation for two or more such amino acids has not been previously addressed. **Here, we propose for the first time that simultaneous**

deprivation of cancer cells for several non-essential amino acids, achieved via application of the available amino acid degrading enzymes or inhibition of biosynthetic enzymes and/or transporter, will produce an additive anticancer effect.

Experimental models. Cultured cancer cells representative of human head and neck squamous cell carcinomas (HNSCC) (Cal-33, SAS, FaDu), and/or prostate carcinomas (PC), (PC3 and LNCaP) will be utilized in this study as experimental models. HNSCC and PC cells are characterized by elevated amino acids requirements and are often refractive to traditional chemotherapy. Recombinant human ARGase produced in-house by the project's team and commercial preparations of ASNase will be used in this study.

Methods. We will utilize in the proposed study methods of modern cell biology, biochemistry, molecular biology and advanced microbial biotechnology. Laboratory of the EU collaborating partner from OncoRay - National Center for Radiation Research in Oncology, Technische Universität Dresden (TUD), Germany, Prof. Anna Dubrovska, will aid in the identification of the genetic markers of the model cancer cells relative to the studied metabolic therapies. Mining of the publicly available patient datasets for HNSCC and PC (e.g. The Cancer Genome Atlas – TCGA, Metabolic Atlas (https://metabolicatlas.org/) will be utilized as well.

Main tasks of the project (in consecutive partially overlapping order, each lasting appr. 1-2 months):

1. *In silico* analysis of the databases for the expression of selected amino acid biosynthetic enzymes (ASS, ASNS, GLS1) and amino acid transporters (CD98, LAT1) in HNSCC and PC versus normal tissues. Analysis of possible correlation between the gene expression pattern and survival rate of the patients with HNSCC or PC. Analysis of the gene expression levels of amino acid biosynthetic enzymes and amino acid transporters in the model HNSCC and PC cell lines.
2. Analysis of the effect of the CD98 gene knockdown on model cells' sensitivity to individual and combined amino acid deprivation conditions and on growth in complete medium (CM).
3. Analysis of the combined effects of Arg, Gln, and/or Asn deprivation on viability and residual proliferative potential of cultured HNSCC and PC cells. To model amino acid starvation conditions *in vitro*, defined media lacking Arg or Gln, recombinant ARGase and/or ASNase, inhibitor of GLS1 (CB-839), and inhibitors of selected amino acid transporters will be applied in different combinations. Analysis of the selected most efficient therapeutic combinations on motility and clonogenic potential of the model cancer cells.
4. Identification of molecular prognostic markers of malignant cells sensitivity to the metabolic combination approaches with the help of biochemical and RT-PCR techniques (DCS ICB as well as EU collaborating partner, OncoRay - National Center for Radiation Research in Oncology, Technische Universität Dresden (TUD), Germany).

Project schedule. The project is predicted to be fully executed in 6 calendar months provisionally starting from July 2024 (the starting date may be changed according to funding availability):

Task	**Months**					
	1	**2**	**3**	**4**	**5**	**6**
Task 1	X	X				
Task 2		X	X			
Task 3			X	X		
Task 4				X	X	X

Project milestones. Main project milestones, which are set to be dependent on the results of the mentioned above experimental tasks, will be the following:

1. Find a possible correlation between expression levels of selected amino acid biosynthetic enzymes and amino acid transporters and disease progression in patients with HNSCC and PC (After completion of task 1).
2. Draw a conclusion on whether tested multimodal amino acid starvation conditions produce additive anticancer effects (after completion of tasks 2-3).
3. Propose molecular prognostic markers of cancer cells' sensitivity to developed combined metabolic anticancer approaches (after completion of task 4).
4. Preparation of the final report and dissemination of the project results

Desired outcomes and deliverables. Developed new efficient on in vitro models combined anticancer approaches based on amino acid starvation and formulated recommendations on their further testing on alternative cellular and/or animal models. Experimental results will also be presented at scientific conferences, published in peer-reviewed scientific journals, and/or patented in case their commercialization is feasible. We also plan to present results of the project on institutional websites and to organize online seminars for disseminating the data among a wider audience. For instance, a seminar devoted to the project and its goals will be organized for the students of the biological faculty of I. Franko Lviv National University and schoolchildren attending classes and practical courses of Lviv Open Lab initiative.

Progress reports and the final report will be prepared and submitted in the form and in due time as requested by the grant administering authority.

Project team (detailed CVs of all researchers with relevant personal data and selected publications for each team member are provided in separate files; additional information, if needed, will be promptly provided on request):

Team member	Role in project
Oleh Stasyk, Dr. Sci.	Principal Investigator (PI)
Galyna Shuvayeva, PhD	Researcher
Olena Vovk, PhD	Researcher
Dmytro Demash, PhD	Researcher
Olena Stasyk, PhD	Researcher
Nikita Polishchuk	PhD student
Svitlana Chernyshuk	Technician

The research team consists of experienced and young researchers. It has all the necessary skills and possesses significant previous experience and relevant equipment to fulfill the project. The results of this study will greatly extend ongoing research on different aspects of amino acid deprivation carried out in the Department of Cell Signaling. The acquired data on cancer cells' response to artificial amino acid deprivation can be further corroborated on alternative cell models and could potentially lead to the development of efficient combination co-targeting metabolic therapies.

Ukrainian Collaborators: None

Foreign collaborators: The Department of Cell Signaling (Institute of Cell Biology NAS of Ukraine, DCS ICB) has been fruitfully collaborating with the group of Prof. Anna Dubrovska (OncoRay - National Center for Radiation Research in Oncology, Technische Universität Dresden (TUD), Germany) for several years. This collaboration has already resulted in important joint publications. Both scientific groups have long-standing mutual research interests that concern metabolic adaptations of cancer cells and identifying new metabolism-related targets for anticancer therapies.

Amount of funding requested: $ 11 987.80, detailed budget is provided in a separate document:

Personnel costs	**$ 6 000**
Supplies	**$ 4 898.00**
Equipment	**$ 0.00**
Overheads (10%)	**$ 1 089.80**
Total	**$ 11 987.80**

Institute details: The research team represents the Department of Cell Signaling (DCS) of the Institute of Cell Biology NAS of Ukraine (ICB NASU, Lviv, Ukraine). DCS possesses all necessary equipment and has experience in relevant cell biology and biotechnology methods to conduct the planned work successfully. ICB NASU is the leading Ukrainian scientific center with a long history of studies and discoveries in the fields of cell biology and biotechnology.

Postal address: Drahomanov str. 14/16, Lviv 79005, Ukraine,

Website: http://cellbiol.lviv.ua

APPLICANT'S PERSONAL INFORMATION

Applicant's full name: Oleh Stasyk, Dr.Sci,
Date of birth: September 27th, 1969
Gender: Male
Nationality/Country of passport issuance: Ukraine
Job title: Head of the Department of Cell Signaling of Institute of Cell Biology of National Academy of Sciences of Ukraine
Institution: Institute of Cell Biology, National Academy of Sciences of Ukraine,
Applicant's current email address: olehst11@gmail.com
Applicant's current phone number: +380972768068
Internal Passport: KA 234758
Personal identification number: 2547201976

Name of Institution:	**Institute of Cell Biology NAS of Ukraine**
City:	**Lviv**
Budget Point of Contact (name and email address)	**Dr. Oleh Stasyk olehst11@gmail.com**

Personnel costs (including staff salary and consultants)

#	Item	Unit Cost	#Units	Cost
1	Principal Investigator (per 6 months)	$ 1 100,00	1	$ 1 100,00
2	Researchers (per 6 months)	$ 900,00	4	$ 3 600,00
3	PhD Student (per 6 months)	$ 700,00	1	$ 700,00
4	Technician (per 6 months)	$ 600,00	1	$ 600,00
			Sub-Total	$ 6 000,00

Supplies

#	Item	Unit Cost	#Units	Cost
1	Dulbecco's Modified Eagle's Medium, high glucose (4500 mg/L) and L-Glutamine w/o sodium bicarbonate, powder 10x1L	$ 125,00	1	$ 125,00
2	Dulbecco's Modified Eagle's Medium, high glucose, w/o glutamine, 0.5L	$ 30,00	3	$ 90,00
3	Fetal Bovine Serum, Non-USA origin, 500 ml	$ 400,00	1	$ 400,00
4	Glutamine assay kit	$ 1 175,00	1	$ 1 175,00
5	OxyBlot Protein Oxidation Detection Kit	$ 1 460,00	1	$ 1 460,00
6	Sterile cryovials, 2 ml, 50 pcs/pack	$ 14,50	4	$ 58,00
7	Petri dishes, 100 mm, 10 pc/pack	$ 4,00	10	$ 40,00
8	Plastic plates, 6 wells for cell culture, TC treated, sterile	$ 2,50	20	$ 50,00
9	Plastic plates, 96 wells for cell culture, TC treated, sterile	$ 2,50	20	$ 50,00
10	Plastic serological pipettes, 5 ml	$ 0,30	100	$ 30,00
11	Plastic serological pipettes, 10ml	$ 0,40	100	$ 40,00
12	Pipette tips, 200 ul, 96 pcs/box	$ 5,30	10	$ 53,00
13	Pipette tips, 1000 ul, 96 pcs/box	$ 5,40	5	$ 27,00
14	Asparaginase from E.coli, 100U	$ 600,00	1	$ 600,00
15	PeroxiDetect™ Kit	$ 700,00	1	$ 700,00
			Sub-Total	$ 4 898,00

Other Direct Costs - sub-contracts, communications, certificates, printing, etc.

#	Item	Unit Cost	#Units	Cost
				-
			Sub-Total	-
			TOTAL DIRECT COSTS	$ 10 898,00
			INDIRECT COST (10%)	$ 1 089,80
			TOTAL	$ 11 987,80

CURRICULUM VITAE

Oleh Stasyk, Dr.Sci (PI)

Personal data
Date of birth: September 27th, 1969.
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Gender: Male

Business address:
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14/16 Drahomanov Str., Lviv 79005 Ukraine.

Personal profiles in scientific databases:
ORCID: https://orcid.org/0000-0001-8135-6102;
Scopus Author ID: 6603272093;
Google Scholar: https://scholar.google.com/citations?user=DQ9QcR8AAAAJ
Hirsch index (SCOPUS) – 23;

Scientific activity
Author of more than 70 full-length scientific articles including several reviews, 1 US patent, 2 domestic patents and more than 130 abstracts of international conferences. Scientific supervisor of 3 PhD dissertations, including 2 in frame of EU Mary Sklodovska-Curie Action at Nencki Institute of experimental biology PAN, Warsaw, Poland.

Education:
1986-1992 - I.Franko Lviv National University, Biological Faculty, Department of Biochemistry, diploma with honors degree

Degrees and qualifications:
1992 - MSc (Biochemistry) Faculty of Biology Ivan Franko State University Lviv, Ukraine
2014 - PhD (Cell Biology and Cytology), Institute of Cell Biology, NAS of Ukraine
Thesis "Identification of the gene *GCR1* that controls catabolite repression in the yeast *Hansenula polymorpha*"

2918 - Scientific title "Senior researcher"
2019 - DrSc (Cell Biology and Cytology), Institute of Cell Biology, NAS of Ukraine
Thesis "Molecular mechanisms of carbon catabolite regulation and peroxisome homeostasis in the methylotrophic yeasts".

Professional experience:
2007 – till now - Head of the Department of Cell Signaling of Institute of Cell Biology of National Academy of Sciences of Ukraine, Lviv, Ukraine (ICB NASU), senior researcher

2017-2021 - Member of the Scientific Committee of the National Council of Ukraine on the developmentof science and technologies
2007-2017 - Deputy director for science of the Institute of Cell Biology. NAS of Ukraine.
1992-2007 – Research scientist at the Department of Molecular Genetics and Biotechnology of the Institute of Cell Biology. NAS of Ukraine.

Research interests:
Specialist in the fields of signaling mechanisms of eukaryotic cells, biochemistry, genetics, molecular biology, and biotechnology of non-conventional yeasts and regulation of metabolism in malignant cells. In particular, studied transcriptional regulation of methylotrophic metabolism, autophagic mechanisms and organelle homeostasis, heterologous gene expression, and production of recombinant proteins of biotechnological and medical importance. Presently, the Department of Cell Signaling, headed by O. Stasyk works in the field of signaling mechanisms in lower and higher eukaryotes, including (from 2007) cancer cell signaling and the development of novel combinational metabolic anticancer therapies based on nutrient deprivation, in particular single amino acid starvation.

Awards and Memberships
2005 - Individual research grant from the National Academy of Sciences of Ukraine
2002- Individual one-year stipend from Lviv regional state administration for young scientists.
2001 - First award at Biochemistry Conference of Young Scientists, ICB NASU,
2001 - Second award at Conference of Young Scientists of the Institute of Molecular Biology and Genetics NASU, Kyiv.
2000 – First award at Conference of Young Scientists of the Palladin Institute of Biochemistry NASU, Kyiv.
1993 - Individual research grant from the Ukrainian Ministry of Science and Education for youngscientists.

Member of Ukrainian scientific Societies of Geneticists and Selectioners, of Biochemistry and Societyof Cell Biology.
Sabbaticals
2004-2005 (October-January) - Keck Graduate Institute, Claremont, CA, USA (visiting research scientist).
2003 (July-November) – Keck Graduate Institute, Claremont, CA, USA (visiting graduate assistant).
1996-1998 - Oregon Graduate Institute, Portland, OR, USA (visiting graduate assistant).

Participated as a leading scientist or PI in a number of International grants awarded by Fogarty International Research Collaboration Awards, USA (1995-1998, 2002-2005); **CRDF, USA (2002-2004), CRDF-STEP (2011)) (these awards were in frame of the programs for scientists with dual experience from the former USSR)**; two INTAS grants (EU) (2001-2003, 2002-2004), several domestic competitive projects from Ministry of Science and Education and NASU.

Languages
Ukrainian (native), Russian (fluent), English (excellent), Polish (upper-intermediate)

LIST OF SELECTED PUBLICATIONS

1. Chen O, Manig F, Lehmann L, Sorour N, Löck S, Yu Z, Dubrovska A, Baumann M, Kessler BM, Stasyk O, Kunz-Schughart LA. Dual role of ER stress in response to metabolic co-targeting and radiosensitivity in head and neck cancer cells. Cellular and Molecular Life Sciences. 2021. 78(6):3021-3044.
2. Karatsai O, Shliaha P, Jensen ON, Stasyk O, Rędowicz MJ. Combinatory Treatment of Canavanine and Arginine Deprivation Efficiently Targets Human Glioblastoma Cells via Pleiotropic Mechanisms. Cells. 2020, 9(10):2217.
3. Kurylenko OO, Ruchala J, Vasylyshyn RV, Stasyk OV, Dmytruk OV, Dmytruk KV, Sibirny AA. Peroxisomes and peroxisomal transketolase and transaldolase enzymesare essential for xylose alcoholic fermentation by the methylotrophic thermotolerant yeast, *Ogataea (Hansenula) polymorpha*. Biotechnology and Biofuels. 2018. 11:197.
4. Hinrichs CN, Ingargiola M, Käubler T, Löck S, Temme A, Köhn-Luque A, DeutschA, Vovk O, Stasyk O, Kunz-Schughart LA. Arginine Deprivation Therapy: Putative Strategy to Eradicate Glioblastoma Cells by Radiosensitization. Molecular Cancer Therapeutics. 2018. 17(2):393-406.
5. Mayevska O.M., Chen O.I., Karatsai O., Bobak Ya.P., Barska M.L., Lyniv L.S., Pavlyk Yu., Rzhepetsky Yu., Redowicz M-J., Stasyk O.V. Nitric oxide donor augments antineoplastic effects of arginine deprivation in human melanoma cells. Exp Cell Res. 2017;355(2):162-171.
6. Farré JC, Carolino K, Stasyk OV, Stasyk OG, Hodzic Z, Agrawal G, Till A,Proietto M, Cregg J, Sibirny AA, Subramani S. A new yeast peroxin, Pex36, a functional homologue of mammalian PEX16, functions in the ER-to-peroxisome traffic of peroxisomal membrane proteins. J Mol Biol., 2017;429(23):3743-3762.
7. Chen OI, Bobak YP, Stasyk OV, Kunz-Schughart LA. A Complex Scenario and Underestimated Challenge: The Tumor Microenvironment, ER Stress, and Cancer Treatment. Current Medicinal Chemistry, 2018; 25(21):2465-2502. (review)
8. Bobak Y., Kurlishchuk Yu., Vynnytska-Myronovska B., Grydzuk O., Shuvayeva G., Redowicz MJ., Kunz-Schughart L., Stasyk O. Arginine deprivation induces endoplasmic reticulum stress in human solid cancer cells. The International Journal of Biochemistry & Cell Biology, 2016; 70:29-38
9. Vynnytska-Myronovska B.; Kurlishchuk Y.; Chen O.; Bobak Y.; Dittfeld C.; Hüther M.; Kunz-Schughart M.A.; Stasyk O. Arginine starvation in colorectal carcinoma cells: sensing, impact on translation control and cell cycle distribution Exp Cell Res, 2016; 341(1):67-74
10. Kurlishchuk Y., Vynnytska-Myronovska B., Grosse-Gehling P., Bobak Y., Manig F., Henle T., Löck S., Stasyk O., and Kunz-Schughart L. Co-application of canavanine and irradiation uncouples anticancer potential of arginine deprivation from citrulline availability" Oncotarget, 2016; 7(45):73292-73308.

CURRICULUM VITAE

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Scopus Author ID: 41162040400;
Google Scholar: https://scholar.google.com.ua/citations?hl=uk&user=CPTzwcEAAAAJ
Hirsch index (SCOPUS) – 4;

Scientific activity
24 peer-reviewed articles in Ukrainian and international journals.

Education:
1884-2000 – Faculty of Biology. Ivan Franko Lviv National University, Lviv, Ukraine
2001-2005 - PhD student at the Institute of Cell Biology NAS of Ukraine

Degrees:
2000 - MSc (Biochemistry), Faculty of Biology Ivan Franko Lviv National University, Lviv, Ukraine
2006 – PhD (Cytology, cell biology, histology), Institute of Cell Biology NAS of Ukraine, Lviv, Ukraine
Thesis: “Expression of adaptor protein Ruk/CIN85 isoforms in human tumors”.

Professional experience:
2006 – till now – Junior scientist, Department of cell signaling, Institute of Cell Biology NAS of Ukraine, Lviv, Ukraine
2010 - 2012 – Assistant, Department of medical biology, parasitology and genetics, Danylo Halytsky Lviv National Medical University, Lviv, Ukraine
2000-2005 - Engineer in the Department of Cell Signaling, Institute of Cell Biology NAS of Ukraine, Lviv, Ukraine.

Grants:

2009 - Travelling fellowship grants of JCS (Journal of Cell Science) and Italian biotechnology and CIB (Consorzio Interuniversitario per le Biotecnologie) for visiting Laboratory of Molecular Pathology, Department of Medical Sciences, "Amedeo Avogadro" University, Novara, Italy. Project: "To study the dynamic interaction of Bcl2-Beclin 1 and how this influences the outcome of an antiblastic treatment in cancer cells".

2008-2009 - Grant of West-Ukrainian BioMedical Research Center "Optimization of anticancer therapy based on amino acid deprivation: the role of autophagy"

2007-2008 - Grant of the President of Ukraine for gifted youth "The development of new approaches in cancer enzymotherapy".

2005-2006 - Grant of West-Ukrainian BioMedical Research Center "The study of expression and functional role of adapter protein Ruk/CIN85 isoforms in urological tumors".

2001-2002 - Grant of West-Ukrainian BioMedical Research Center "The expression and functional role of adapter protein Ruk isoforms in human tumors".

Professional skills:

Cell culture methods, Hybridoma technology, Transfection and generation of stable cell lines, Electrophoresis methods (DNA, RNA, and protein- electrophoresis), Immunological methods (Western Blotting, Immunoprecipitation, Immunocytochemistry, ELISA), Protein expression and purification (E.coli expression system, Yeast expression system), Gene engineering (DNA, RNA purification, PCR, construction of vectors, transformation), Fluorescence microscopy

Research interests:

Applied Biotechnology (hybridoma technology); Cell and Molecular Biology (cell signalling involved in the coordinated control of proliferation, differentiation and apoptosis in normal and transformed cells, the role of autophagy and endoplasmic reticulum stress in tumor cells response to arginine deprivation)

Languages

Ukrainian (native), Russian (fluent), English (upper-intermediate)

LIST OF SELECTED PUBLICATIONS

1. Shuvayeva GY, Bobak YP, Vovk OI, Kunz-Schughart LA, Fletcher MT, Stasyk OV. Indospicine combined with arginine deprivation triggers cancer cell death via caspase-dependent apoptosis. Cell Biol Int. 2020 Feb 18. doi: 10.1002/cbin.11321

2. Bobak Y, Kurlishchuk Y, Vynnytska-Myronovska B, Grydzuk O, Shuvayeva G, Redowicz MJ, Kunz-Schughart LA, Stasyk O. Arginine deprivation induces endoplasmic reticulum stress in human solid cancer cells. Int J Biochem Cell Biol. 2016 Jan;70:29-38. doi: 10.1016/j.biocel.2015.10.027.

3. Shuvayeva G., Bobak Y., Igumentseva N., Titone R., Morani F., Stasyk O., and Isidoro C. Single Amino Acid Arginine Deprivation Triggers Prosurvival Autophagic Response in Ovarian Carcinoma SKOV3 // BioMed Research International. 2014;2014:505041. doi: 10.1155/2014/505041.

4. Samoylenko A, Vynnytska-Myronovska B, Byts N, Kozlova N, Basaraba O, Pasichnyk G, Palyvoda K, Bobak Y, Barska M, Mayevska O, Rzhepetsky Y, Shuvayeva H, Lyzogubov V, Usenko V, Savran V, Volodko N, Buchman V, Kietzmann T, Drobot L. Increased levels of the HER1 adaptor protein Rukl/CIN85 contribute to breast cancer malignancy. Carcinogenesis. 2012 Oct;33(10):1976-84. doi: 10.1093/carcin/bgs228.

5. Basaraba O. I., Bobak Ya. P., Shuvayeva H. Yu., Marchenko S. M., Mayevska O. M., Igumentseva N. I., Volodko N. A., Buchman V. L., Drobot L. B. Study of adapter proteins RUK/CIN85 and CD2AP/CMS expression in human uterus tumors. Med. Chemistry. 2009; 11 (3): 9-12.

6. Basaraba O. I., Barska M.L., Bobak Ya. P., Shuvayeva H. Yu., Marchenko S. M., Savran V.R., Volodko N.A., Buchman V. L., Drobot L. B. Expression of adapter proteins RUK/CIN85 and CD2AP/CMS in human breast cancer. Clin. and experim. pathol. 2009; 8(4):125-130.

7. Basaraba O. I., Bobak Ya. P., Shuvayeva H. Yu., Mayevska O. M., Igumentseva N. I., , Buchman V. L., Drobot L. B. Comparative study of expression of adaptor proteins Ruk/CIN85 and CD2AP/CMS in normal and tumor human uterus tissues. Studia Biologica. 2009; 3(3):5-16.

8. Mayevska O, Shuvayeva H, Igumentseva N, Havrylov S, Basaraba O, Bobak Y, Barska M, Volod'ko N, Baranska J, Buchman V, Drobot L. Expression of adaptor protein Ruk/CIN85 isoforms in cell lines of various tissue origins and human melanoma. Exp Oncol. 2006 Dec;28(4):275-81.

9. Bobak Ya., Basaraba O., Shuvayeva G., Mayevska O., Ihumentseva N., Vynnytska B., Fedorko O., Drobot L. A study of CIN85/Ruk isoforms expression in human glioblastoma multiforme. Annales Universitatis Mariae Curie-Sklodowska. 2006; 19:183-185.

CURRICULUM VITAE

Olena Vovk, PhD

Personal information:

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Business address:

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Personal profiles in scientific databases:

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Scopus Author ID: 36864124600;
Google Scholar: https://scholar.google.com.ua/citations?hl=uk&user=tw3Z6RkAAAAJ
Hirsch index (SCOPUS) – 3;

Scientific activity

24 peer-reviewed articles in Ukrainian and international journals.

Education:

1985-1990 - Faculty of Biology, Ivan Franko Lviv State University

Degrees:

1990 – MSc (Biochemistry), Faculty of Biology, Ivan Franko Lviv State University
2005 - PhD (Cytology, cell biology, histology), Institute of Cell Biology NAS of Ukraine, Lviv, Ukraine
Thesis “Role of NO-dependent signaling in the regulation of morphology and functional state of platelets under type 1 diabetes mellitus”

Professional experience:

2004 – till now - Junior Scientist, Department of Cell Signaling, Institute of Cell Biology NAS of Ukraine, Lviv, Ukraine

Research interests:

Correction of metabolic processes under type 1 diabetes mellitus, expression and purification of recombinant proteins, development of combinational methods of arginine-deficient cancer therapy on experimental models of malignantly transformed cells *in vitro*, testing the effectiveness of new combinational therapy methods on experimental tumor models *in vivo*, the study of molecular mechanisms of acquired resistance to therapy based on arginine starvation.

Participation in collective research projects:
2017-2018 - State Fund for Fundamental Research of Ukraine grants for joint scientific projects of higher educational institutions and scientific institutions of the National Academy of Sciences of Ukraine (F-76): "Synthesis and analysis of new structural analogs of arginine and canavanine as components of metabolic anticancer therapy."

Membership in independent research organizations:
2012 – till now - Secretary of the All–Ukrainian Public Organization “Ukrainian Society of Cell Biology” at the Institute of Cell Biology, NAS of Ukraine,
1997 – till now - member of the Ukrainian Biochemical Society

Additional information:
2016 – till now - Head of Non-Structural Division for Technology Transfer, Innovation and Intellectual Property of Institute of Cell Biology, NAS of Ukraine

Languages
Ukrainian (native), Russian (fluent), English (upper-intermediate)

LIST OF SELECTED PUBLICATIONS

1. Shuvayeva G.Y., Bobak Y.P., Vovk O.I., Kunz-Schughart L.A., Fletcher M.T., Stasyk O.V. Indospicine combined with arginine deprivation triggers cancer cell death via caspase-dependent apoptosis. Cell Biology International. 2020. https://doi.org/10.1002/cbin.11321
2. Hinrichs C.N., Ingargiola M., Käubler T., Löck S., Temme A., Köhn-Luque A., Deutsch A., Vovk O., Stasyk O., Kunz-Schughart L.A. Arginine Deprivation Therapy: Putative Strategy to Eradicate Glioblastoma Cells by Radiosensitization. Mol Cancer Ther. 2018. Vol.17, №2. P. 393-406. DOI: https://doi.org/10.1158/1535-7163.MCT-16-0807
3. Stasyuk N., Gayda G., Zakalskiy A., Zakalska O., Fayura L., Vovk O., Stasyk O., Sibirny A., Gonchar M. Recombinant forms of arginase and arginine deiminase as catalytic components of Argitest enzymatic kit for L-arginine analysis. Science and innovation. 2017. Vol.13, Issue 4. P. 56-63 DOI: 10.15407/scine13.04.056
4. Vovk O.I., Chen O.I., Igumentseva N.I., Senchuk O.Yu., Barska M.L., Sybirna N.O., Stasyk O.V. Effects of the combined arginase and canavanine treatment on leukemic cells in vitro and in vivo. Ukr. Biochem. J. 2016. Vol. 88, № 2. P. 45-55 DOI: https://doi.org/10.15407/ubj88.02.045
5. Chen O.I, Barska M.L., Lyniv L.S., Igumentseva N.I., Vovk O.I., Sybirna N.O., Stasyk O.V. Effect of combined arginase and nitric oxide donor treatment on normal and leukemic cells in vitro. Біологічні Студії/Studia Biologica. 2016. Vol.10, №1. P. 17–28. DOI: https://doi.org/10.30970/sbi.1001.470
6. Sybirna N.O., Brodyak I. V., Barska M.L., Vovk O.I. Participation of Phosphatidylinositol-3'-kinase in Perception and Signal Transduction through Galactosyl-Containing Glycoprotein Receptors of Segmented Leukocytes under Type 1 Diabetes Mellitus. International Journal of Physiology and Pathophysiology. 2013. V. 4, №3. P. 213-230. DOI: 10.1615/IntJPhysPathophys.v4.i3.40
7. Chen O., Kavalets B., Barska M., Lyniv L., Vovk O., Sybirna N., Stasyk O. Effect of combinational arginase and canavanine treatment on normal human peripheral blood lymphocytes in vitro. Current Issues in Pharmacy and Medical Sciences. 2013. 26(4), 385-389. DOI: https://www.europub.co.uk/articles/-A-116342
8. Sybirna N.O., Brodyak I.V., Bars'ka M.L., Vovk O.I. Participation of phosphatidylinositol-3`-kinase on signal transduction through galactosyl-containing glycoprotein receptors of segmentonuclear leukocytes under type 1 diabetes mellitus. Fiziol. Zh. 2012. 58(6): 9-22. DOI: https://doi.org/10.15407/fz58.06.009 (in Ukrainian)

CURRICULUM VITAE

Dmytro Demash, PhD

Personal information:
Date of birth: January 8th, 1986
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Nationality/Citizenship: Ukraine
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Business address:
Institute of Cell Biology, National Academy of Sciences of Ukraine,
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Personal profiles in scientific databases:
ORCID: https://orcid.org/0000-0002-1378-8402;
Scopus Author ID: 25226647900;
Google Scholar: https://scholar.google.com/citations?user=AW6fnmgAAAAJ
Hirsch index (SCOPUS) – 3;

Scientific activity
19 articles in Ukrainian and international journals, 2 book chapters, 15 Ukrainian patents.

Education:
2002-2008 - Faculty of Natural Sciences, National University "Kyiv-Mohyla Academy"

Degrees:
2008 – MSc (Biology), Faculty of Natural Sciences, National University "Kyiv-Mohyla Academy"
2015 - PhD (Oncology), RE Lavetsky Institute of Experimental Pathology, Oncology and Radiobiology, NAS of Ukraine, Kyiv, Ukraine
Thesis "Modulation of cisplatin biological effects by static magnetic field as a part of target antitumor nanosystem (experimental study)"

Professional experience:
09.2022 – till now – Junior Scientist in Department of Mechanisms of Cell Signaling, Institute of Cell Biology, National Academy of Sciences of Ukraine, Lviv, Ukraine
10.2017 – till now – Pharmaceutical Expert in Innovations Department, "ARTERIUM Corporation", Ukraine
02.2017 – 05.2017 – PhD Student, Junior Scientist, Scientist in Department of Mechanisms of Antitumor Therapy RE Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology, NAS of Ukraine

Research interests:
Search for novel methods of antitumor therapy, nanoparticles and nanotechnology, metabolic therapy, amino acid deprivation, traumatic brain injuries.

Participation in collective research projects:
2016-2017 - VACTRAIN TWINNING international project, funded by the EU HORIZON 2020 research program (GA. 692293)

Grants, Fellowships:
2014-2016 - NAS of Ukraine fellowship for young scientists.

Courses, Trainings, Internships
2017 – VACTRAIN" International research project (Lodz, Poland) for new methods of DNA-nanoparticles interaction contemplation. Performance of experimental research in terms of international project.
2017 – II Forum "Clinical Trials in Ukraine: Prospects in the Modern world" (Kyiv, Ukraine) about actual problems of clinical research organization and performance in Ukraine, the actual situation concerning its regulation by state bodies, and branch development perspectives.
2016 – Online NIH Training on GCP, elaborated by the members of the National Institute on Drug Abuse (NIDA), Center for Clinical Trials (CCTN), and Clinical Trials Network (CTN).
2015 – Researcher-Connect Project (Kyiv, Ukraine) - Series of seminars organized by the British Council Ukraine for scientists in order to improve the quality of presentations and increase the effectiveness of scientific projects.
2014 - BILAT-UKRAINA Summer School (Kyiv, Ukraine) Summer school concerning possibilities for scientists in terms of the international cooperation program "Horizon2020", preparation, and elaboration of projects to participate in this program.

Languages
Ukrainian (native), Russian (fluent), English (upper-intermediate), Polish (basic)

Additional information:
Member of the Ukrainian Public Organization "Ukrainian Society of Cell Biology"
Secretary of Bioethics Committee of Institute of Cell Biology NAS of Ukraine
Member of Non-Structural Division for Technology Transfer, Innovation andIntellectual Property of Institute of Cell Biology, NAS of Ukraine

LIST OF SELECTED PUBLICATIONS

1. Chekhun V.F., Lukianova N.Y., Polishchuk L.Z., Nalieskina L.A., Zadvornyi T.V., Storchai D.M., Todor I.N., Sobchenko S.O., Demash D.V., Yalovenko T.M., Borikun, T.V. «The Role of Lactoferrin Expression in Initiation and Progression of Most Common Hormone-Dependent Cancers». (pp. 51-85). In «Horizons in Cancer Research» (Vol 66., Chapter 3) / Ed.: Watanabe H.S. - NOVA Science Publishers, 2017. ISBN: 978-1-53611-011-1

2. Chekhun V.F., Lozovska Y.V., Naleskina L.A., Borikun T.V., Burlaka A.P., Todor I.N., Demash D.V., Yalovenko T.M., Zadvornyi T.V., Pavlova A.O., Storchay D.M., Lukianova N.Yu. Modifying effects of 5-azacytidine on metal-containing proteins profile in Guerin carcinoma with different sensitivity to cytostatics // Experimental Oncology. – 2016. - 38(4). – pp. 283-287. DOI: 10.31768/2312-8852.2016.38(4):283-287

3. Chekhun V.F., Lozovska Yu.V., Burlaka A.P., Ganusevich I.I., Shvets Yu.V., Lukianova N.Yu., Todor I.M., Demash D.V., Pavlova A.A., Naleskina L.A. Metalloproteins during development of Walker-256 carcinosarcoma resistant phenotype // Ukrainian Biochemical Journal. – 2015. – 87(2). – pp. 103-112 DOI: 10.15407/ubj87.02.103

4. Demash D.V., Lukianova N.Yu., Chekhun V.F. Evaluation of magnetosensitive cytostatic concentration and different mechanisms of their antitumor effects // J Appl Life Sci Intern. – 2015. - 2 (2). – pp. 2394-1103 DOI: 10.9734/JALSI/2015/15179

5. Chekhun V.F., Naleskina L.A., Polishchuk L.Z., Todor I.M., Demash D.V., Lukianova N.Y. Evaluation of biological effects of nanosystems of directed transport in experiments in vivo and their application possibilities in anti-tumor therapy // Advances in Nanoparticles. – 2013. – 2. – pp. 145-153 DOI: 10.4236/anp.2013.22023

6. Chekhun V., Lukianova N., Demash D., Borikun T., Chekhun S., Shvets Y. Manifestation of Key Molecular Genetic Markers in Pharmacocorrection of Endogenous Iron Metabolism in MCF-7 and MCF-7/DDP Human Breast Cancer Cells // CellBio. – 2013. – 2. – pp. 217-227 DOI: 10.4236/cellbio.2013.24025

7. Chekhun V.F., Demash D.V., Naleskina L.A. Evaluation of biological effects and possible mechanisms of static magnetic field action // International Journal of Physiology and Pathophysiology. – 2013. - 4 (1). - pp. 69-81 DOI: 10.1615/IntJPhysPathophys.v4.i1.80

8. Chekhun V.F., Yurchenko O.V., Naleskina L.A., Demash D.V., Lukianova N.Yu., Lozovska Yu.V. In vitro modification of cisplatin cytotoxicity with magnetic fluid // Experimental oncology. – 2013. – 35 (1). — p. 15-19

CURRICULUM VITAE

Olena Stasyk, PhD

Personal information:

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Personal profiles in scientific databases:

ORCID: https://orcid.org/0000-0002-0253-2372 ;
Scopus Author ID: 6603272092;
Google Scholar: https://scholar.google.com/citations?hl=uk&user=rFBw91cAAAAJ
ResearcherID: http://www.researcherid.com/rid/K-9254-2017
Hirsch index (SCOPUS) – 8;

Scientific activity

23 articles in Ukrainian and international journals, 2 monographs.

Education:

1992-1997 - Department of Genetics and Biotechnology, Faculty of Biology, Ivan Franko State University of Lviv

Degrees:

1997 – MSc (Genetics), Faculty of Biology, Ivan Franko State University of Lviv
2008 - PhD (Cytology, cell biology, histology), Institute of Cell Biology, NAS of Ukraine, Lviv, Ukraine
Thesis “Identification of new genes involved in catabolic regulation in methylotrophic yeast *Hansenula polymorpha*”

Academic status: Associate professor

Professional experience:

2010 – till now – associate professor of the Department of Biochemistry, Faculty of Biology, Ivan Franko National University of Lviv.
2008 – till now – Junior Scientist, Department of Cell Signaling Mechanisms of the Institute of Cell Biology of National Academy of Sciences of Ukraine

2006-2008 - Leading engineer, Department of Cell Signaling Mechanisms of the Institute of Cell Biology of National Academy of Sciences of Ukraine
2005-2006 – Leading engineer, Department of Molecular Genetics and Biotechnology of the Institute of Cell Biology of National Academy of Sciences of Ukraine
2004-2005 – Engineer of the 1st category, Department of Molecular Genetics and Biotechnology of the Institute of Cell Biology of National Academy of Sciences of Ukraine
1998-2004 – Engineer, Department of Molecular Genetics and Biotechnology of the Institute of Cell Biology of National Academy of Sciences of Ukraine;

Pedagogical activity

teaching courses "Molecular Biology", "Metabolic Engineering", "Research Methodology in Biochemistry", "Foremsic Biology: in the footsteps of a criminal", "Modern methods of experimental biology", practical course "Design and analysis of strains of methylotrophic yeast *Hansenula polymorpha*, capable of producing heterologous proteins"

Research interests:

Neurodegeneration, Parkinson's disease, Yeasts, Genetic engineering.

Research projects and grants:

2020-2022 - RESBIOS - H2020-SwafS-2018-2020 / H2020-SwafS-2019-1 (RESponsible research and innovation grounding practices in BIOSciencies).
2017-2019 - Study of the mechanisms of low-molecular compounds induced autophagic degradation of abnormal forms of human alpha-synuclein in model biosystems", which was performed at the expense of the state budget. Bh-48F (2017-2019) The project involved scientific groups of the Department of Biochemistry, Department of Genetics and Biotechnology of Ivan Franko National University of Lviv and Department of Cell Signaling Mechanisms, Institute of Cell Biology, National Academy of Sciences of Ukraine.
2015-2019 - "Modeling in yeast cells of molecular processes of Parkinson's disease and analysis of the influence of exogenous and endogenous factors on the processes of aggregation and degradation of human α-synuclein" target comprehensive interdisciplinary research program of the NAS of Ukraine "Molecular and cellular biotechnologies for the needs of medicine, industry and agriculture", approved by the resolution of the Presidium of the NAS of Ukraine
2006 - Grant of the President of Ukraine for gifted youth "Development of domestic genetically engineered yeast producers of medical proteins (human insulin, hepatitis B vaccine)".
2006 - Individual grant of FEMS Research Fellowship 2006-1 "Evaluation of the physiological roles of transporter-like glucose sensors in the methylotrophic yeast *Hansenula polymorpha* and human pathogen *Candida albicans*".

Languages

Ukrainian (native), Russian (fluent), English (upper-intermediate)

Additional information:

Member of the editorial board of the journal "Biological Studies / Studia Biologica",

Member of the Publishing Council of Ivan Franko National University of Lviv

Member of the Ukrainian Public Organization "Ukrainian Society of Cell Biology", the Society of Microbiologists of Ukraine; Ukrainian Biochemical Society

LIST OF SELECTED PUBLICATIONS

1. Nishtuk Y.V., Stasyk O.V., Stasyk O.G. Spermidine activates autophagy but does not rescue human neuroblasoma SH-SY5Y cells from effects of arginine starvation. Biol. Stud. 2022; 16(3): 35–48 • DOI: https://doi.org/10.30970/sbi.1603.691
2. Hrushanyk NV, Stasyk OV, Stasyk OG. Oxidative stress regulation in the yeast Ogataea polymorpha producer of human α-synuclein. Ukr Bioch J. 2020;92(5):120-133. https://doi.org/10.15407/ubj92.05.120
3. Stasyk OG, Stasyk OV. Glucose Sensing and Regulation in Yeasts. In book: Non-conventional Yeasts: from Basic Research to Application. Edited by Sybirny AA. Springer International Publishing, 2019. ISBN 978-3-030-21109-7. P. 477-519.
4. Stasyk OG, Denega IO, Padhorny D, Dmytruk KV, Kozakov D, Abbas C, Stasyk OV. Glucose regulation in the methylotrophic yeast Hansenula (Ogataea) polymorpha is mediated by a putative transceptor Gcr1. Int J Biochem Cell Biol. 2018 Aug 3;103:25-34. doi: 10.1016/j.biocel.2018.08.002
5. Farré JC, Carolino K, Stasyk OV, Stasyk OG, Hodzic Z, Agrawal G, Till A, Proietto M, Cregg J, Sibirny AA, Subramani S. A New Yeast Peroxin, Pex36, a Functional Homolog of Mammalian PEX16, Functions in the ER-to-Peroxisome Traffic of Peroxisomal Membrane Proteins. J Mol Biol. 2017 Nov 24;429(23):3743-3762. doi: 10.1016/j.jmb.2017.10.009
6. Petryk N, Zhou YF, Sybirna K, Mucchielli MH, Guiard B, Bao WG, Stasyk OV, Stasyk OG, Krasovska OS, Budin K, Reymond N, Imbeaud S, Coudouel S, Delacroix H, Sibirny A, Bolotin-Fukuhara M. Functional study of the Hap4-like genes suggests that the key regulators of carbon metabolism HAP4 and oxidative stress response YAP1 in yeast diverged from a common ancestor. PLoS One. 2014 Dec 5;9(12):e112263. doi: 10.1371/journal.pone.0112263
7. Stasyk OG, Maidan MM, Stasyk OV, Van Dijck P, Thevelein JM, Sibirny AA. Identification of hexose transporter-like sensor HXS1 and functional hexose transporter HXT1 in the methylotrophic yeast Hansenula polymorpha. Eukaryot Cell. 2008 Apr;7(4):735-46. doi: 10.1128/EC.00028-08
8. Stasyk OG, van Zutphen T, Ah Kang H, Stasyk OV, Veenhuis M, Sibirny AA. The role of Hansenula polymorpha MIG1 homologues in catabolite repression and pexophagy. FEMS Yeast Res. 2007 Oct;7(7):1103-13. doi: 10.1111/j.1567-1364.2007.00286.x
9. Krasovska OS, Stasyk OG, Nahorny VO, Stasyk OV, Granovski N, Kordium VA, Vozianov OF, Sibirny AA. Glucose-induced production of recombinant proteins in Hansenula polymorpha mutants deficient in catabolite repression. Biotechnol Bioeng. 2007 Jul 1;97(4):858-70. doi: 10.1002/bit.21284

CURRICULUM VITAE

Nikita Polishchuk

Personal information:
Date of birth: August 4th, 1999
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Nationality/Citizenship: Ukraine
Gender: Male

Education:
2016-2021 - Faculty of Biology, Ivan Franko National University of Lviv

Degree:
2021 – MSc (Biochemistry), Faculty of Biology, Ivan Franko National University of Lviv

Thesis: «Influence of canavanine on the viability, proliferative potential and cell death of SKOV3 ovarian carcinoma cells under arginine starvation»

Professional experience:
Since 2023 – PhD Student in the Department of Cell Signaling Mechanisms of the Institute of Cell Biology of the National Academy of Sciences of Ukraine
2021-2022 – Data Analyst, YOUTEAM LTD
2021 – Engineer, Department of Cell Signaling Mechanisms of the Institute of Cell Biology of the National Academy of Sciences of Ukraine
2021 - Laboratory Assistant, Department of Biochemistry, Faculty of Biology, Ivan Franko National University of Lviv. Summer working University Practice. Project: "Resistance to arginine deprivation therapy: unraveling mechanisms and future treatment options"
2019 - Laboratory Assistant, Department of Cell Signaling Mechanisms of the Institute of Cell Biology of the National Academy of Sciences of Ukraine/
Summer Scientific Practice at the Department of Cell Signaling of the Institute of Cell Biology of NASof Ukraine. Project: “Effect of taxol on viability and motility of colorectal carcinoma cells and human ovarian cancer cells under arginine starvation|”.

Workshops, courses
2021 – Online summer school «Functional foods – New challenges for balanced nutrition and the treatment of metabolic disorders» Participation in Summer school «Functional foods – New challenges for balanced nutrition and the treatment of metabolic disorders».
2021 –German Science School DAAD 2021 «Lessons in Biomedicine Learnt from Nanotechnology and Artificial Intelligence» Participation on German Science School DAAD 2021 «Lessons in Biomedicine Learnt from Nanotechnology and Artificial Intelligence»,
2019 – Biophysical methods of research in neuroscience and physiology Travel Grant for Workshop NEUROTWIN Horizon 2020 Project of the 13th SCHOOL-SEMINAR 2019
2019 - Youth and progress of biology, XV international scientific conference of students and PhD, dedicated to the 135th anniversary of J. Parnas. 3rd Prize for Oral Presentation in Section

“Biochemistry”. Youth and progress of biology, XV international scientific conference of students and PhD, dedicated to the 135th anniversary of J. Parnas. Lviv, April 9-11.2019
2019 – DAAD Summer school 2019 «Perspectives in biomedicine with a focus on cancer immunotherapy» Travel Grant for Workshop and summer school DAAD Summer school 2019 «Perspectives in biomedicine with a focus on cancer immunotherapy»,

Languages
Ukrainian (native), Russian (fluent), English (upper-intermediate), German (basic)

Additional information:
An active member of the student scientific society of the Faculty of Biology of LNU, co-founder of the Science Debating Society (SDS), member of the Biochemistry Student Group