**CURRICULUM VITAE**

**Personal details**

Full name: Shirokov Alexander Alexandrovich

Date of birth: 24.01.1982

PhD, Cand. Biol. Sci. Associate Professor

**ID**

WoS J-6832-2018

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**Affiliation**

Senior Researcher at the Laboratory of Immunochemistry, Head of the Center for Collective Use "Symbiosis" of the Institute of Biochemistry and Physiology of Plants and Microorganisms of the Russian Academy of Sciences.

Institute of Biochemistry and Physiology of Plants and Microorganisms of the Russian Academy of Sciences, 13 Entuziastov Avenue, Saratov, 410049, Russian Federation

Senior Researcher at the Smart Sleep Laboratory, Head of the Central Research Center of the Saratov National Research State University named after N.G. Chernyshevsky from 2020 to the present.

Saratov National Research State University, 83 Astrakhan str., 410012 Saratov, Russia.

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**Education**

1999-2004 (specialist-chemist, specialization organic and Bioorganic chemistry. Saratov State University, Astrakhanskaya Str. 83, Saratov 410012, Russia)

2004 -2008 (postgraduate study in specialty 03.02.03-Microbiology (biological Sciences); candidate of biological Sciences degree in specialty 03.02.03-Microbiology (biological Sciences), Institute of Biochemistry and Physiology of Plants and Microorganisms, Russian Academy of

Sciences, Prospekt Entuziastov 13, Saratov, 410049, Russian Federation

**Specialization**

03.02.03 - microbiology

19.03.01 – biotechnology

**Research interests**

Immunochemistry, cell biology, biotechnology

**Keywords**

antigens, cell biology, cytology, histology, immunochemical analysis, confocal microscopy, transmission electron microscopy, glioblastoma, vascular and lymphatic systems of the brain, optical technologies.

**Education activity**

Lectures of special courses:

1. Aerobiological studies of plant pollen and fungal spores for calendars dusting.
2. Basic principles of light microscopy and its practical application biology applications.

Direction of preparation

06.06.01 Biological Sciences

04.06.01 Chemical Sciences

The management of the diploma projects of six students (2012,2013, 2016, 2017, 2018 and 2019).

The management of the projects one postgraduate thesis (2014-2017, 2020-2021):

Budanov Angelina Andreevna.

Dissertation topic "Visualization of surface antigens of *Azospirillum brasilense* bacteria» specialties-biochemistry, Microbiology.

Shushunova Natalia Alexandrovna

Dissertation topic "Development of a microcapsulated form of immunosuppressors and an effective way of addressing them for local therapy of glomerulonephritis", Specialty 03.01.06 Biotechnology (including bionanotechnology)

**Public activity**

* Since 2009, the Chairman of the Council of young scientists of the RAS IBPPM;
* Since 2010, the Chairman of the Council of young scientists of the scientific centre of RAS and RAS IBPPM representative in the Regional Council of young scientists and specialists of the Saratov region;
* Since 2013 member of the Presidium of the Saratov scientific center of RAS.
* Co-Chairman of the V all-Russian conference of young scientists "Strategy of interaction of microorganisms and plants with the environment". (Saratov, September 28-October 1, 2010).
* Co-Chairman of the VI all-Russian conference of young scientists "Strategy of interaction of microorganisms and plants with the environment". IBFM WOUNDS. September 24-September 28, 2012, Saratov
* Member of the expert Council at the Regional competition of scientific works of students of higher educational institutions of the Saratov region "student science-2011" Saratov. Committee on youth policy, protection of cultural heritage and tourism of the Saratov region. June 2011
* Member of the expert Council at the Regional competition of scientific works of students of higher educational institutions of the Saratov region "student science-2012" Saratov. Committee on youth policy, protection of cultural heritage and tourism of the Saratov region. 23 April-27 June 2012
* In June 2013, A. A. Shirokov was elected to the Presidium of the Saratov scientific center of RAS.

**Honors and Awards**

* For his achievements in scientific work, he was awarded with gratitude and a certificate of honor from the Ministry of Industry and Energy of the Saratov Region (2010 and 2015).
* In 2013, he became a laureate of the P.A. Stolypin Youth Prize (for outstanding achievements in science for young scientists, the government of the Saratov region).

**Participation in grants and research projects**

* The co-PI of the RSF grant under the agreement 21-75-10088 "Digital technologies for studying the lymphatic system of the brain and its membranes: an interactive 3D atlas" (2021-2023).
* The co-PI of the grant of the National Science Foundation of China "Development of technologies for optical illumination of the skull": NSFC No. 61860206009, 812111313, 30911120074 (2018-2022).
* The co-PI of the grant of the Russian Science Foundation under agreement No. 14-15-00128, the "Gateway" project of the blood-brain barrier: mechanisms of regulation, their dependence on the state of the body and age, methods of correction using supramolecular transport systems (2014-2016).
* The co-PI of the Russian Science Foundation grant under agreement No. 17-15-01263 project "Achilles' heel of the blood-brain barrier": the conducting role of the glymphatic system in the management of the barrier function of the brain, new informative platforms for pharmacological correction of cerebral vascular permeability (2017-2019).
* The co-PI of the grant of the Russian Science Foundation under agreement No. 17-75-20069 "Development of innovative technologies for imaging the lymphatic system of the brain in vivo and understanding its role in the progression of glioblastoma" (2017-2019).
* The co-PI of the RFBR grant 16-34-00720 "Study of the regularities of the functioning of plant associations with microsymbionts in model (in vitro) and natural (ex vitro and in vivo) symbiotic systems in order to develop environmentally friendly agrobiotechnologies" (2016-2017).
* The co-PI of the RFBR grant 19-016-00116 A "Creation of highly productive plant-microbial communities during potato coinoculation with rhizosphere bacteria" (2019-2020).
* The co-PI of the RFBR grant No. 18-015-00298 "Ways and molecular mechanisms of programmed cell death (autophagy, apoptosis and necrosis) in the culture of human kidney cancer cells under the action of a flavonoid-containing extract of Avran medicinal Gratiola officinalis and its individual fractions" (2018-2020)
* The co-PI of the RFBR grant 20-015-00308 "Pilot studies of the functions of the lymphatic system of the brain and its membranes" (2020-2021).
* The co-PI of the RFBR grant 19-515-55016 "Photomodulation of cleansing brain tissue from beta-amyloid during sleep: new non-invasive technologies for the treatment of Alzheimer's disease" (2020-2021).
* The co-PI of the grant of the Ministry of Education and Science for the implementation of research work within the framework of the project part of the state task in the field of scientific activity, Task No. 12.1223.2017 / PCh on the topic "Development of technologies for the optical" opening "of the blood-brain barrier and personalized treatment of aggressive forms of glial tumors" ( 2017-2019).
* The co-PI of the grant of the Ministry of Science and Higher Education for the implementation of research work within the framework of the project part of the state assignment in the field of scientific activity, Task No. 075-15-2019-1885 on the topic "Discovery of fundamental sleep mechanisms for breakthrough technologies of neurorehabilitation medicine" (2019-2021).
* Co-executor of RFBR grants No. 03-04-49382-a (2003-2005), 03-04-48446 (2004), 02-04-49446 (2006), 01-04-48736, 16-34-00720 and more 16-34-00720 (2016), 18-015-00298 (2018), 19-016-00116 (2019). Scientific supervisor of RFBR grant No. 11-04-90823-most (2011).

**Patents**

* Patent RU 2 572 350 C2 of the Russian Federation. A method for detection of bacteria of the genus Azospirillum having common antigenic determinants in the composition of lipopolysaccharides. Pub.: 10.01.2016; Bull. No. 1.
* RF patent 2688013. Method for non-invasive increase in the permeability of the blood-brain barrier / Yu.G. Kurtz, E.W. Rafailov, V.V. Tuchin, D.E. Bragin, A.B. Salmina, V.V. Salmin, A.A. Shirokov, N.A. Navolokin, E.G. Borisova, M.V. Ulanova, A.V. Morgun, A.A. Bodrov, A.P. Khorovodov, A.A. Shushunova, A.E. Sharif, M.M. Klimova, A.V. Terskov, Dubrovsky A.A .; Publ. 05/17/2019. Bul. No. 14.
* RF patent 2699754. Fluorescent cell line of glioma and a method for its production / А.А. Shirokov, A.S. Fomin, O.V. Semyachkina-Glushkovskaya .; Publ. 09.09.2019. Bul. No. 25.
* RF Patent No. 2019103550 dated 08.02.2019 for the invention of Arylidene derivatives of 3,4-dihydro-1 (2H)-naphthalene having cytotoxic effect.
* RF Patent No. 2714932, 02/21/2020. A drug with cytotoxic activity // Russian Patent No. 2714932. 2020. Byul. No. 6.

**Main publications (2017-2021):**

Semyachkina-Glushkovskaya, O., Fedosov, I., Shirokov, A., Vodovozova, E., Alekseeva, A., Khorovodov, A., Blokhina, I., Terskov, A., Mamedova, A., Klimova, M., Dubrovsky, A., Ageev, V., Agranovich, I., Vinnik, V., Tsven, A., Sokolovski, S., Rafailov, E., Penzel, T., Kurths, J. Photomodulation of lymphatic delivery of liposomes to the brain bypassing the blood-brain barrier: New perspectives for glioma therapy // Nanophotonics – 2021 – Vol. 10, No. 12 – P. 3215-3227. DOI: 10.1515/nanoph-2021-0212, IF=8.45 (Q1)

E. Vetchinkina, A. Fomin, Navolokin N. A., Shirokov A. A. Proteins and polysaccharides of medicinal basidiomycete *Lentinus edodes* vegetative mycelium and fruiting bodies display cytoxicity towards human and animal cancer cell lines // [Int J Biol Macromol.](https://www.ncbi.nlm.nih.gov/pubmed/29966669) - 2021 - Vol. 16, No. 195. - pp. 398-414. DOI: 10.1016/j.ijbiomac.2021.12.059, IF=6.95 (Q1)

Semyachkina-Glushkovskaya, O., Khorovodov, A., Fedosov, I., Pavlov, A., Shirokov, A., Sharif, A.E., Dubrovsky, A., Blokhina, I., Terskov, A., Navolokin, N., Evsukova, A., Karandin, G., Elovenko, D., Tzoy, M., Ageev, V., Agranovich, I., Telnova, V., Tsven, A., Saranceva, E., Iskra, T., Kurths, J. A Novel Method to Stimulate Lymphatic Clearance of Beta-Amyloid from Mouse Brain Using Noninvasive Music-Induced Opening of the Blood–Brain Barrier with EEG Markers // Appl. Sci. 2021, 11, 10287. <https://doi.org/10.3390/app112110287>, IF=2.68 (Q2)

Tkachenko, O.V., Evseeva, N.V., Terentyeva, E.V., Burygin, G.L., Shirokov, A.А., Burov, A.М., Matora, L.Y., Shchyogolev, S.Y. Improved Production of High-Quality Potato Seeds in Aeroponics with Plant-Growth-Promoting Rhizobacteria // Potato Research – 2021 – Vol. 64, No. 1 – P. 55-66.  DOI: 10.1007/s11540-020-09464-y, IF=2.070 (Q2)

Kurchatova M.N., Fomin A.S., Shirokov A.A., Durova N.A. Comparative analysis of the cytotoxic effect of flavonoid-containing extracts on the cell line of CHO. Cytology - 2021 - Vol. 63, No. 4. - pp. 390-397. DOI: 10.31857/S0041377121040040, IF=0.56 (Q3)

Shirokov A. A., Grinev V.S., Polukonova N.V., Verkhovsky R.N., Doroshenko A.P., Mudrak D., Navolokin N. A., Polukonova A., Bucharskaya A., Maslyakova G.N. Isolation and biological activity of fractions of the flavonoid-containing Gratiola officinalis L. extract // Molecules. – 2021 **(in press)**

Shirokov A. A., Budanova A. A., Burygin, G. L., Evseev N.V., Matora L. Y., Shchyogolev S. Y. Flagellin of polar flagellum from Azospirillum brasilense Sp245: Isolation, structure, and biological activity // Int J Biol Macromol. - 2020. https://doi.org/10.1016/j.ijbiomac.2019.10.092, IF=6.953 (Q1)

Tkachenko, O.V., Evseeva, N.V., Terentyeva, E.V., Burygin, G.L., Shirokov, A.А., Burov, A.М., Matora, L.Y., Shchyogolev, S.Y. Improved Production of High-Quality Potato Seeds in Aeroponics with Plant-Growth-Promoting Rhizobacteria // Potato Research – 2021 – Vol. 64, No. 1 – P. 55-66. DOI: 10.1007/s11540-020-09464-y, IF=2.070 (Q2)

Oxana Semyachkina-Glushkovskaya, Ivan Fedosov, Alexander Shirokov, Elena Vodovozov, Anna Alekseev, Alexandr Khorovodov, Inna Blokhina, Andrey Terskov, Aysel Mamedova, Maria Klimova, Alexander Dubrovsky, Vasily Ageev, Ilana Agranovich, Valeria Vinnik, Anna Tsven, Sergey Sokolovski, Edik Rafailov, Thomas Penzel, Jürgen Kurths. Photomodulation of lymphatic delivery of liposomes to the brain bypassing the blood-brain barrier: new perspectives for glioma therapy. Nanophotonics. 2021, pp. 000010151520210212. <https://doi.org/10.1515/nanoph-2021-0212> IF =8.499 (Q1)

O. Semyachkina-Glushkovskaya, A. Esmat, D. Bragin, O. Bragina, A. A. Shirokov, N. Navolokin, Y. Yang, A. Abdurashitov, A. Khorovodov, A. Terskov, M. Klimova, A. Mamedova, Fedosov I., V. Tuchin, J. Kurths. Phenomenon of music-induced opening of the blood-brain barrier in healthy mice. Proc. R. Soc. B 2020 287: 20202337. <https://doi.org/10.1098/rspb.2020.2337> IF=5.386 (Q1)

Zdorovenko E., Besarab N., Shashkov A., Novik G., Shirokov A., Burov A., Knirel Yu. Investigation of lipopolysaccharides from bacterial strains of Pseudomonas genus as potential receptors of bacteriophage BIM BV-45 // Int J Biol Macromol. - 2018. p. 1065-1072. doi: 10.1016/j.ijbiomac.2018.06.165. IF=6.953 (Q1)

Oxana Semyachkina-Glushkovskaya, Arkady Abdurashitov, Alexander Dubrovsky, Maria Klimova, Ilana Agranovich, Andrey Terskov, Alexander Shirokov, Valeria Vinnik, Anna Kuznecova, Nikita Lezhnev, Inna Blokhina, Anastassia Shnitenkova, Valery Tuchin, Edik Rafailov, and Jurgen Kurths. Photobiomodulation of lymphatic drainage and clearance: perspective strategy for augmentation of meningeal lymphatic functions. Biomedical Optics Express Vol. 11, Issue 2, pp. 725-734 (2020) •https://doi.org/10.1364/BOE.383390 IF=3.910 (Q1)

Zhinchenko, E., Navolokin, N., Shirokov, A., Khlebcov, B., Dubrovsky, A., Saranceva, E., Abdurashitov A., Khorovodov, A., Terskov A., Mamedova, A., Klimova, M., Agranovich, I., Martinov, D., Tuchin, V., Semyachkina-Glushkovskaya, O., Kurths, J. Pilot study of transcranial photobiomodulation of lymphatic clearance of beta-amyloid from the mouse brain: breakthrough strategies for nonpharmacologic therapy of Alzheimer’s disease. Biomedical Optics Express. 10(8): 4003–4017 doi.org/10.1364/BOE.10.004003 (2019). WOS:000478097400022. IF= 3.732 (Q1)

Elina A. Genina, Alexey N. Bashkatov, Daria K. Tuchina, Polina A. Dyachenko (Timoshina), Nikita Navolokin, Alexander Shirokov, Alexander Khorovodov, Andrey Terskov, Maria Klimova, Aysel Mamedova, Inna Blokhina, Ilana Agranovich, Ekaterina Zinchenko, Oxana V. Semyachkina-Glushkovskaya, and Valery V. Tuchin. Optical properties of brain tissues at the different stages of glioma development in rats: pilot study. Biomedical Optics Express Vol. 10, Issue 10, pp. 5182-5197 (2019) •https://doi.org/10.1364/BOE.10.005182. IF= 3.732 (Q1)

Grinev V.S., Tregubova K.V, Anis’kov A.A., Sigida E. N., Shirokov A. A., Fedonenko Y.P., Yegorenkova I.V. Isolation, structure, and potential biotechnological applications of the exopolysaccharide from Paenibacillus polymyxa 92 // Int J Biol Macromol. - 2020. https://doi.org/10.1016/j.carbpol.2019.11578. IF=6.953 (Q1)

Oxana Semyachkina-Glushkovskaya, Vladimir Chehonin, Ekaterina Borisova, Ivan Fedosov, Anton Namykin, ArkadyAbdurashitov, Alexander Shirokov, Boris Khlebtsov, Yelena Lyubun, Nikita Navolokin,Mariya Ulanova, Natalia Shushunova, Alexander Khorovodov, Ilana Agranovich,Anastasia Bodrova, Madina Sagatova, Ali Esmat Shareef, Elena Saranceva, Tatyana Iskra, Mariya Dvoryatkina, Ekaterina Zhinchenko, Olga Sindeeva, Valery Tuchin, and Jurgen Kurths. Photodynamic opening of the blood-brain barrier and pathways of brain clearing pathways / J Biophotonics. 2018 11(8):e201700287. doi: 10.1002/jbio.201700287. IF =3.763 (Q1)

Agranovich I., Borisova E., Navolokin N., Bucharskaya A., Maslyakova G., Shirokov A., Abdurashitov A., Angelov I., Khorovodov A., Terskov A., Mamedova A., Klimova M., Semyachkina-Glushkovskaya O. Phenomenon of atypical vascular effects of epinephrine and an increase of photodynamic response by nitroglycerin in rats with colon adenocarcinoma: adrenergic and nitrergic mechanisms and novel applied aspects // Biomedical Optics Express. ‒ 2019. ‒ T. 10, № 8. ‒ C. 4115-4125. doi: 10.1364/BOE.10.004115. IF=3.732 (Q1)

Semyachkina-Glushkovskaya O., Kurths J., Borisova E., Sokolovsky S., Mantareva N., Angelov I., Shirokov A., Navolokin N., Shushunova N., Khorovodov A., Ulanova M., Sagatova M., Ahranovich I., Sindeeva O., Gekalyuk A., Bordova A., Rafailov E. Photodynamic opening of blood-brain barrier / Biomedical Optics Express. 2017. 8(11). doi.org/10.1364/BOE.8.005040. IF=3.732 (Q1)

Semyachkina-Glushkovskaya O., Abdurashitov A., Dubrovsky A., Bragin D., Bragina O., Shushunova N., Maslyakova G., Navolokin N., Bucharskaya A., Tuchin V., Kurths J., Shirokov A. Application of optical coherence tomography for in vivo monitoring of the meningeal lymphatic vessels during opening of blood-brain barrier: mechanisms of brain clearing // Journal of Biomedical Optics. ‒ 2017. ‒ T. 22, № 12, 121719 doi: 10.1117/1.JBO.22.12.121719. IF=3.732 (Q1)

O. Semyachkina-Glushkovskaya, D. Bragin, O. Bragina, Y. Yang, A. Abdurashitov, A. Esmat, A. Khorovodov, A. Terskov, M. Klimova, I. Agranovich, I. Blokhina, A. Shirokov, N. Navolokin, V. Tuchin, J. Kurths. Mechanisms of sound-induced opening of the blood-brain barrier” were accepted for inclusion in the upcoming Springer book “Oxygen Transport to Tissue XLII”, which will be published under the series "Advances in Experimental Medicine and Biology". Advances in Experimental Medicine and Biology. 2021. Vol. 1269. doi: 10.1007/978-3-030-48238-1\_31. IF=2.622 (Q2)

O. Semyachkina-Glushkovskaya, M. Klimova, T. Iskra, D. Bragin, A. Abdurashitov, A. Dubrovsky, A. Khorovodov, A. Terskov, I. Blokhina, N. Lezhnev, V. Vinnik, I. Agranovich, A. Mamedova, A. Shirokov, N. Navolokin, B. Khlebsov, V. Tuchin, J. Kurths. “Transcranial Photobiomodulation of Clearance of Beta-Amyloid from the Mouse Brain: Effects on the Meningeal Lymphatic Drainage and Blood Oxygen Saturation of the Brain”. Advances in Experimental Medicine and Biology.

Advances in Experimental Medicine and Biology. 2021;1269:57-61. doi: 10.1007/978-3-030-48238-1\_9. IF=2.622 (Q2)

Semyachkina-Glushkovskaya, O.; Khorovodov, A.; Fedosov, I.; Pavlov, A.; Shirokov, A.; Sharif, A.E.; Dubrovsky, A.; Blokhina, I.; Terskov, A.; Navolokin, N.; Evsukova, A.; Karandin, G.; Elovenko, D.; Tzoy, M.; Ageev, V.; Agranovich, I.; Telnova, V.; Tsven, A.; Saranceva, E.; Iskra, T.; Kurths, J. A Novel Method to Stimulate Lymphatic Clearance of Beta-Amyloid from Mouse Brain Using Noninvasive Music-Induced Opening of the Blood–Brain Barrier with EEG Markers. Appl. Sci. 2021, 11, 10287. https://doi.org/10.3390/app112110287. IF =2.679 (Q2)

Оxana Semyachkina-Glushkovskaya, Ekaterina Borisova, Vanya Mantareva, Ivan Angelov, Ivelina Eneva, Andrey Terskov, Aysel Mamedova, Alexander Shirokov, Alexander Khorovodov, Maria Klimova, Ilana Agranovich, Inna Blokhina, Nikita Lezhnev and Jurgen Kurths. Photodynamic Opening of the Blood–Brain Barrier Using Different Photosensitizers in Mice / Appl. Sci. 2020, 10, 33/doi:10.3390/app10010033. IF=2.679 (Q2)

Semyachkina-Glushkovskaya O, Klimova M, Iskra T, Bragin D, Abdurashitov A, Dubrovsky A, Khorovodov A, Terskov A, Blokhina I, Lezhnev N, Vinnik V, Agranovich I, Mamedova A, Shirokov A, Navolokin N, Khlebsov B, Tuchin V, Kurths J. Transcranial Photobiomodulation of Clearance of Beta-Amyloid from the Mouse Brain: Effects on the Meningeal Lymphatic Drainage and Blood Oxygen Saturation of the Brain. Advances in Experimental Medicine and Biology. 2021;1269:57-61. doi: 10.1007/978-3-030-48238-1\_9. IF=2.622 (Q2)

O. Semyachkina-Glushkovskaya, N. Navolokin, A. Shirokov, A. Terskov, A. Khorovodov, A. Mamedova, M. Klimova, E. Rafailov, and J. Kurths. Meningeal Lymphatic Pathway of Brain Clearing From the Blood After Haemorrhagic Injuries. P.-D. Ryu et al. (eds.), Oxygen Transport to Tissue XLI, Advances in Experimental Medicine and Biology 1232. Springer Nature Switzerland AG 2020. https://doi.org/10.1007/978-3-030-34461-0\_9

Advances in Experimental Medicine and Biology. 2020;1232:63-68. doi: 10.1007/978-3-030-34461-0\_9. IF=2.622 (Q2)

Ekaterina Zhinchenko, Maria Klimova, Aysel Mamedova, Ilana Agranovich, Inna Blokhina, Tatiana Antonova, Andrey Terskov, Alexander Shirokov, Nikita Navolkin, Andrey Morgun, Elena Osipova, Boytsova Elizaveta, Tingting Yu, Dan Zhu, Juergen Kurths. Oxana Semyachkina-Glushkovskaya. Photostimulation of extravasation of beta-amyloid through the model of blood-brain barrier / Electronics 2020, 9, 1056 doi:10.3390/electronics9061056. IF=2.412 (Q2)

Semyachkina-Glushkovskaya O., A. Abdurashitov, A. Pavlov, A. Shirokov, N. Navolokin, O. Pavlova, A. Gekalyuk,M. Ulanova, N. Shushunova, A. Bodrova, E. Saranceva, A. Khorovodov, I. Agranovich, V. Fedorova, M. Sagatova, A. E. Shareef, C. Zhang, D. Zhu and V. Tuchin. Laser speckle imaging and wavelet analysis of cerebral blood flow associated with the opening of the blood–brain barrier by sound. Chinese Optical Letters. 2017. 15(9), 090002(2017). IF=2.448 (Q2)

Semyachkina-Glushkovskaya O., Borisova E., Abdurashitov A., Shirokov A., NavolokinN., Saranceva E. Blood-brain barrier and laser technologies for drug brain delivery. Journal of Innovative Optical Health Sciences. 10(5) (2017) 1730011. doi: 10.1142/S1793545817300117. IF=1,77 (Q2)

Shirokov A. A., Budanova A. A., Burov A. M., Khlebtsov B. N., Krasov A. I., Shchyogolev S. Y., Matora L. Y. Immunoelectron Microscopy Investigation of the Cell Surface of Azospirillum brasilense Strains // Microbiology. ‒ 2017. ‒ T. 86, № 4. ‒ C. 487-492. DOI: 10.7868/S0026365617040140. IF=1,156 (Q3)

Vetchinkina E.P., Shirokov A.A., Fomin A.S., Nikitina V.E. Comparative analysis of cytotoxicity of protein and polysaccharide fractions of basidial macromycetes // Advances in medical mycology. National Academy of Mycology, 2018. Vol. 19. pp. 260-267. DOI: 10.14427/amm.2018.xix.07

Nepovinykh N.V., Novokshanova A.L., Mogilny M.P., Lyamina N.P., Semina A.I., Ababkova A.A., Shirokov A.A., Grinev V.S., Ptichkina.N.M. Development and evaluation of the possibility of using a new oxygen cocktail with an increased protein content in the diet therapy of patients with a cardiological profile. Vopr. nutrition. 2018. vol. 87, No. 2. pp. 94-102. doi: 10.24411/0042-8833-2018-10023. IF=0,19 (Q4)

Budanova A. A., Shirokov A. A., Shchyogolev S. Y., Matora L. Y. Analysis of Congo Red-Induced Changes in the Cell Surface and Macrocolony Structure of the Bacterium Azospirillum brasilense // Microbiology. ‒ 2018. ‒ T. 87, № 1. ‒ C. 60-65. DOI: 10.1134/S0026261718010046. IF=1,156 (Q3)

Burygin G.L., Matora L.Yu., Evseeva N.V., Shirokov A.A., Krasov I.A., Filipecheva Yu.A., Budanova A.A., Popova I.A., Shchegolev S.Yu. Investigation of major antigens of the cell surface of bacteria of the genus Azospirillum and their contribution to plant-microbial interactions // Biomika. - 2018. - Vol.10. - No.2. - pp.169-174. DOI: 10.31301/2221-6197.bmcs.2018-23.

Kanevskii, M.V., Grinev, V.S., Polukonova, N.V., Navolokin, N.A., Belyachenko, Y.A., Bucharskaya, A.B., Durnova, N.A., Maslyakova, G.N., Shirokov, A.A. Comparative Spectroscopic and HPLC Analyses of Phenolic Compounds in Extracts of Anthocyanin Maize Purple Saratov Variety Grown Under Various Wetting Conditions // Pharmaceutical Chemistry Journal. ‒ 2020 ‒ V. 54 , № 3, pp. 279-283. DOI: 10.1007/s11094-020-02191-1. IF=0,538(Q4)

Kurchatova M.N., Fomin A.S., Shirokov A.A., Durova N.A. Comparative analysis of the cytotoxic effect of flavonoid-containing extracts on the cell line of CHO. Cytology - 2021 - Vol. 63, No. 4. - pp. 390-397. DOI: 10.31857/S0041377121040040