

# CURRICULUM VITAE

## **Boreyko Alla Vladimirovna**

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### **Date and place of birth:**

14 May 1960, Dubna, Moscow region

### **Education**

- 1978 -1984** Moscow Engineering Physics Institute, Faculty of Experimental and Theoretical Physics  
**1991** *Candidate of Sciences in Biology* (Radiobiology)  
**2005** *Doctor of Sciences in Biology* (Radiobiology)

### **Professional career**

- 1984-1986** Research Assistant, Sector of Biophysics, Laboratory of Nuclear Problem, Joint Institute for Nuclear Research  
**1986-1992** Engineer, Biophysical Department, Laboratory of Nuclear Problem, Joint Institute for Nuclear Research  
**1992-1995** Researcher, Biophysical Department, Laboratory of Nuclear Problem, Joint Institute for Nuclear Research  
**1995-2009** Senior Researcher, Biophysical Department, Division of Radiation and Radiobiological Research, Joint Institute for Nuclear Research  
**2009-2015** Leading Researcher, Laboratory of Radiation Biology, Joint Institute for Nuclear Research  
**2015-2019** Head of Sector, Laboratory of Radiation Biology, Joint Institute for Nuclear Research  
**2019-2024** Deputy Director, Laboratory of Radiation Biology, Joint Institute for Nuclear Research

### **Professional activities**

- Board Member of Council on Radiation Biology, Russian Academy of Sciences
- Co-leader of LRB research project “Molecular, genetic, and organism effects of ionizing radiation with different physical characteristics”
- Leader of projects on cooperation programs with JINR member countries (Romania, Czech Republic) and Russian scientific centers ( Obninsk, Puschino)
- Member of the program and organizing committees of international workshops and conferences
- Co-leader of the scientific seminar “Radiation biology”, Council on Radiation Biology, Russian Academy of Sciences and LRB

- Member of the editorial board of the journal *Physics of Elementary Particles and Atomic Nuclei Letters*
- Member of LRB Science and Technology Council
- Member of the editorial board of the journal *Natural Science Review*

### **Educational activities**

- Deputy Head, Biophysics Department, Dubna State University
- Professor, Biophysics Department, Dubna State University
- Supervisor of theses and diploma papers

### **Grants and awards**

2006, 2009	JINR Honorary Diplomas
2009	JINR's 2 <sup>nd</sup> Prize for a series of works entitled "Mutation process mechanisms in microorganisms after exposure to ionizing radiation with different physical characteristics"
2009, 2011, 2016	JINR's letters of commendation
2017-2019	Russian Foundation for Basic Research, dedicated research grant 17-29-01007 "Research on the molecular and physiological disorders of the central nervous system structures induced by accelerated charged particles"
2019	JINR's 1 <sup>st</sup> Prize for a series of works entitled " Research on molecular damage formation in genetic structures of human and mammalian cells after exposure to low and intermediate-energy accelerated heavy ions "
2020	Commendation from the Ministry of Science and Higher Education of the Russian Federation
2021	Honorary JINR Employee Diploma
2018, 2019, 2024	Dubna State University Honorary Diplomas
2024	Jubilee Medal "300 Years of the Russian Academy of Sciences"

### **Scientific interests**

General and molecular radiobiology. Radiation-induced mutagenesis. DNA damage and repair. The problem of radiosensitivity enhancing of tumor cells under radiotherapy. Radiation biology of accelerated heavy ions. The space radiobiology problems.

#### **Molecular radiobiology**

*DNA clustered double-strand break induction and repair; mechanism and kinetic of enzymatic DNA double-strand break formation; molecular mechanisms of low/high-LET irradiation action on normal and tumour cells; visualisation of DNA damages of irradiation cells and image analysis*

- Mechanisms of the formation and repair of molecular abnormalities in the DNA of normal and tumor cells of higher eukaryotes and humans

- Immunocytochemical and immunohistochemical analysis disorders of genetic structures in mammalian and human cells
- Expression of the genes of mammalian and human cells under the action of ionizing radiation with different physical characteristics
- Molecular disorders in the neuronal structures of various parts of the mammalian brain under the action of heavy charged particles

### **Molecular and radiobiological aspects of radiation therapy**

*Radiomodifying factors of DNA damages induction; tumour cell radiosensitization for radiotherapy; the radiosensitizing effect of molecular biological complex modifiers on tumor growth; radiation-induced cell death*

- Radiosensitizing effect of cytosine arabinoside (AraC) *in vivo* in combination with other molecular biological complexes on melanoma tumor growth in mice following the combined exposure to these agents and proton radiation;
- The influence of the combined action of AraC and other molecular biological complexes on the survival of different normal and tumor cell lines based on clonogenic survival criterion upon X-ray and proton irradiation;
- The kinetics of the formation and elimination of DNA damage in U87 glioblastoma and other radioresistant cell cultures after proton and X-ray exposure in the presence of AraC and other molecular biological complexes;
- DNA DSB formation in different components of the central nervous system after *in vivo* and *in vitro* irradiation with protons and X-rays in the presence of a combination of radiomodifiers.

### **Innovations**

A fundamentally new method for increasing the biological effectiveness of proton beams on melanoma has been developed and patented. Introduction of DNA synthesis inhibitor AraC enhances the antitumor effect of proton radiation through the implementation of several mechanisms, including increased induction of DNA double strand breaks, decrease in the number of tumor stem cells, inhibition of cell proliferation and angiogenesis in the tumor against the background of changes in the immune response in the primary lesion and its infiltration by lymphocytes.

### **Patents:**

- The method for increasing the effectiveness of proton therapy on melanoma stem cells / Matchuk O.N., Boreyko A.V., Bugay A.N., Chausov V.N., Kaprin A.D., Koryakin S.N., Krasavin E.A., Mosina V.A., Selivanova E.I., Solovyov A.N., Yakimova A.O., Zamulaeva I.A. // Patent RU 2798733, Russia's Federal Service for Intellectual Property (Rospatent). 23 June 2023, Bulletin No. 18.
- The Method for increasing the effectiveness of ionizing radiation on melanoma / Zamulaeva I.A., Boreyko A.V., Bugay A.N., Kaprin A.D., Koryakin S.N., Krasavin E.A., Matchuk O.N., Mosina V.A., Selivanova E.I., Chausov V.N. // Patent RU 2774032, Russia's Federal Service for Intellectual Property (Rospatent). 14 June 2022. Bulletin No. 17.

- The method for increasing the frequency of double-strand DNA breaks formation in human cells after ionizing irradiation under the influence of radiomodifiers. Krasavin E.A., Boreyko A.V., Zadneprianetc M.G., Kulilova E.A., Timoshenko G.N., , Chausov V.N. // Patent RU №2699670, Russia's Federal Service for Intellectual Property (Rospatent). 09 September 2019.

## **Bibliography**

Author and co-author of more than 158 scientific publications.

### **SELECTED PUBLICATIONS for 2019-2024**

#### **Journal papers**

1. E.A. Krasavin, **A.V. Boreyko**, M.G. Zadnepryanetc, E.V. Ilyina, R.A. Kozhina, E.A. Kuzmina, E.A. Kulikova, E.V. Smirnova, G.N. Timoshenko, S.I. Tiouchnik, V.N. Chausov *Effect of DNA Synthesis Inhibitors on the Biological Efficiency of a Proton Beam in a Modified Bragg Peak* // Phys. Part. Nuclei Lett. 2019, V.16, No.2, P.153–158.
2. Bulanova T.S., **Boreyko A.V.**, Zadneprianetc M.G., Krasavin E.A., Kulikova E.A., Smirnova E.V., Severiukhin Y.S., Timoshenko G.N. *Formation of DNA Double-Strand Breaks in Rat Brain Neurons after Irradiation with Krypton Ions (78Kr)*, Physics of Particles and Nuclei Letters, 2019, Vol. 16, No. 4, pp. 402–408.
3. Hausmann M., Neitzel C., Bobkova E., Nagel D., Hofmann A., Chramko T., Smirnova E., Kopečná O., Pagáčová E., **Boreyko A.**, Krasavin E., Falkova I., Heermann D.W., Pilarczyk G., Hildenbrand G., Bestvater F. and Falk M. *Single Molecule Localization Microscopy Analyses of DNA-Repair Foci and Clusters Detected Along Particle Damage Tracks* // Front. Phys. 2020. P.578662.
4. M. Zadneprianetc, **A. Boreyko**, L. Jezkova, M. Falk, A. Ryabchenko, T. Hramco, M. Krupnova, E. Kulikova, A. Pavlova, D. Shamina, E. Smirnova and E. Krasavin *Clustered DNA Damage Formation in Human Cells after Exposure to Low- and Intermediate-Energy Accelerated Heavy Ions.* // Phys. Part. Nuclei Lett. – 2022. – V. 19. No. 4. P. 440–451.
5. R.A. Kozhina, **A.V. Boreyko**, V.N. Chausov, S.E. Erhan, E.V. Ilyina, S.N. Koryakin, E. A. Kuzmina, O.N. Matchuk, E.I. Selivanova, S.I. Tiouchnik. *The Effect of DNA Synthesis Inhibitor on DNA Damage Induction in Melanoma Cells after Exposure to Protons.* // Phys. Part. Nuclei Lett. 2022. V.19, P.590–593.
6. S.-E. Erhan, **A.V. Boreyko**, R.A. Kozhina, E.A. Kuzmina, E.V. Ilyina, S.I. Tiouchnik, V. N. Chausov *Induction of DNA Damage in Neuronal Cells of Mice under the Influence of Repair Inhibitors under the Action of Gamma-Rays in vivo.* // Phys. Part. Nuclei Lett. 2022. V.19, No.5, P.586–589.

7. **A.V. Boreyko**, M.G. Zadneprianetc, V.N. Chausov, T.S. Hramko, R.A. Kozhina, E.A. Kuzmina, S.I. Tiouchik and E.A. Krasavin *Combined Action of DNA Synthesis Inhibitors and Accelerated Protons on Malignant Tumor Cells*// Phys. Part. Nuclei Lett. 2023, V.20, No.4, P.683–689.
8. I.A. Zamulaeva, O.N. Matchuk, E.I. Selivanova, A.O. Yakimova, V.A. Mosina, S.N. Koryakin, A.D. Kaprin, **A.V. Boreyko**, A.N. Bugay, V.N. Chausov, E.A. Krasavin *Radiobiological effects the combined action of 1- $\beta$ -D-arabinofuranosylcytosine and proton radiation on B16 melanoma in vivo* // Phys. Part. Nuclei Lett. 2023. V.20, No.1, P. 63-75.
9. I.A. Zamulaeva, O.N. Matchuk, E.I. Selivanova, V.A. Mosina, M.R. Abramova, V.O. Saburov, S.N. Koryakin, S.A. Ivanov, A.D. Kaprin, **A.V. Boreyko**, V.N. Chausov, E.A. Krasavin *Effects of fractionated proton irradiation in combination with 1- $\beta$ -D-arabinofuranosylcytosine on B16 murine melanoma in vivo* // Phys. Part. Nuclei Lett., 2024, V. 21, No. 6, P. 1208–1218.
10. T.A. Belyakova, O.M. Rozanova, E.N. Smirnova, N.S. Strelnikova, E.A. Krasavin, **A.V. Boreyko**. *Modifying Effect of 1- $\beta$ -D-arabinofuranosylcytosine on the Growth of the Solid Tumor Ehrlich Carcinoma in Mice Under In Vivo and Ex Vivo Proton Irradiation of Cells* // Phys. Part. Nuclei Lett. 2025. Vol. 22. No.2 (in press).

### **Book Chapters**

1. Pre-mutational DNA Damage and Accelerated Heavy Ions / *National Guide to Radiation Biology* (Edited by Acad. E.A. Krasavin, I.B. Ushakov). Moscow: Nauka, 2024, 800 pages. Chapter 1, PP. 20 -35. (in press).
2. Mutagenic Effect of Ionizing Radiation on Bacterial Cells / *National Guide to Radiation Biology* (Edited by Acad. E.A. Krasavin, I.B. Ushakov). Moscow: Nauka, 2024, 800 pages. Chapter 1, PP. 40 -78. (in press).