

## Резюме: Бочаров Эдуард Валерьевич



### Адрес

Федеральное государственное  
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Институт биоорганической химии им.  
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### Контакты

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### Образование

1993–1997	Москва	аспирантура ИБХ РАН
1987–1993	Долгопрудный	ФФХБ МФТИ

### Работа

2002–наст.вр.	Москва	ИБХ РАН	старший научный сотрудник
1999–2002	Москва	ИБХ РАН	научный сотрудник

### Работа в ИБХ

2024–наст.вр.	Главный научный сотрудник
2002–2024	Старший научный сотрудник

### Навыки

Методы гетероядерной ЯМР-спектроскопии высокого разрешения и молекулярного моделирования для исследования структуры и динамики низкомолекулярных соединений и биологических макромолекул.

### Владение языками

русский, английский, немецкий

### Научные интересы

Научные интересы относятся к области структурно-динамических исследований белков и их комплексов с биомолекулами (липидами, ДНК, РНК и т.д.) методами гетероядерной ЯМР-спектроскопии высокого разрешения в интеграции с другими методами структурной биологии и биофизики. Разработка новых методик ЯМР-спектроскопии для изучения подвижных белковых комплексов.

Основные работы посвящены исследованиям молекулярных механизмов биологической активности мембранных и мембраноактивных белков в норме и при патогенезе различных заболеваний человека (в том числе, онкологических и нейродегенеративных). В последние годы основные исследования направлены на установление биофизических принципов проведения сигнала рецепторами через мембрану клетки, а также функционирования мембранных белков в макромолекулярных комплексах. Особое внимание уделяется изучению аллостерических конформационных перестроек, белок-белковых и белок-липидных взаимодействий компонент цитохром Р450-зависимых систем, рецепторных тирозинкиназ (РТК) и РТК-подобных рецепторов, белка-предшественника  $\beta$ -амилоида (мутации в которых связаны с онкогенезом и болезнью Альцгеймера) для разработки перспективных лекарственных соединений. В то же время, часть работ направлена на исследования структурно-динамических свойств растворимых белков и их комплексов, в том числе рибосомных белков, цитокинов, цитохромов, гистонотипных НУ-белков из патогенных бактерий, пептидных и белковых токсинов из растений и животных.

Реализация научных Проектов в качестве Руководителя:

- 2001 г., РФФИ 01-04-48651-а и 01-04-06130-мас по теме «Пространственная структура и динамика рибосомного белка L7/L12 из *Escherichia coli* в растворе»;
- 2001-2002 г.г., РФФИ 01-04-06130-мас и 02-04-06650-мас «Исследование фемто-микросекундной внутримолекулярной динамики белков с использованием новых методов гетероядерной спектроскопии ЯМР»;
- 2003 г., РФФИ 03-04-06408-мас «Исследование взаимосвязи пространственной структуры и внутримолекулярной подвижности биологически активных полипептидов с их функцией»;
- 2003-2005 г.г., РФФИ 03-04-49011-а «Учет конформационной подвижности при описании электростатических взаимодействий в белках с помощью новых методов гетероядерной спектроскопии ЯМР и молекулярной динамики»;
- 2006-2008 г.г., РФФИ 06-04-49740-а «Структурно-динамические исследования трансмембранных доменов рецепторных протеинкиназ современными методами гетероядерной спектроскопии ЯМР и молекулярной динамики»;
- 2009-2011 г.г., РФФИ 09-04-00551-а «Структурно-динамический анализ специфических взаимодействий трансмембранных доменов рецепторных тирозинкиназ в норме и патологии»;
- 2012-2014 г.г., РФФИ 12-04-01816-а «Структурные, кинетические и термодинамические аспекты специфических взаимодействий трансмембранных доменов рецепторных тирозинкиназ в норме и патологии»;
- 2015-2017 г.г., РФФИ 15-04-07983-а «Установление молекулярных механизмов влияния патогенных мутаций в трансмембранных доменах на активность рецепторных тирозинкиназ»;
- 2018-2020 г.г., РФФИ 18-04-01289-а «Структурные аспекты воздействия онкогенных мутаций в трансмембранных доменах рецепторных тирозинкиназ на проведение сигнала через мембрану клетки»;
- 2020-2022 г.г., РФФИ 20-54-00041-Бел-а «Анализ взаимодействия мембран-связанных компонентов цитохром Р450-зависимых систем человека с использованием методов интегративной структурной биологии»;
- 2020-2022 г.г., РФФИ 20-64-46027 «Структурно-динамические исследования внутри- и межмолекулярных взаимодействий амилоидогенных пептидов и их предшественников для установления молекулярных механизмов патогенеза и разработки таргетных методов терапии нейродегенеративных заболеваний»;
- 2023-2025 г.г., РФФИ 23-44-10021 (международный, совместно с БРФФИ) «Конформационная динамика в образовании и функционировании биомакромолекулярных комплексов для биомедицинских и фармацевтических разработок».

## Членство в сообществах

Российское общество Биохимиков и Молекулярных Биологов, Biophysical society, FEBS.

## Степени и звания

2024	Доктор наук (Физико-математические науки, 1.5.2. — Биофизика)
1998	Кандидат наук (Химические науки, 02.00.10 — Биоорганическая химия)

## Ссылки и контакты

ResearcherID: [R-5231-2016](#), Scopus: [7004085574](#), ORCID: [0000-0002-3635-1609](#)

## Гранты и проекты

2024– наст.вр.	<a href="#">Онкотераностика и проблемы резистентности к противоопухолевым и антибактериальным препаратам</a>
2011– 2014	<a href="#">Структурно-динамические модели белков высокой точности, верифицированные при помощи расширенного массива данных ЯМР-спектроскопии</a>

2023– наст.вр.	<a href="#">Конформационная динамика в образовании и функционировании биомакромолекулярных комплексов для биомедицинских и фармацевтических разработок</a>
2020– 2023	<a href="#">Бел: Анализ взаимодействия мембран-связанных компонентов цитохром P450-зависимых систем человека с использованием методов интегративной структурной биологии</a>
2018– 2020	<a href="#">Структурные аспекты воздействия онкогенных мутаций в трансмембранных доменах рецепторных тирозинкиназ на проведение сигнала через мембрану клетки</a>
2019– 2022	<a href="#">Структурная биология мембранных белков для создания новых лекарственных и диагностических средств</a>
2014– 2018	<a href="#">Структурные основы молекулярных механизмов передачи сигнала интегральными мембранными белками I типа</a>

## Публикации

1. Lushpa VA, Lin C, Talyzina IA, Goncharuk MV, **Bocharov EV**, Arseniev AS, Wang X, Goncharuk SA, Mineev KS (2025). The intracellular domain of TLR2 is capable of high-affinity Zn binding: possible outcomes for the receptor activation. *FEBS Lett* , , [10.1002/1873-3468.70026](#)
2. Oparin P, Khokhlova O, Cherkashin A, Nadezhdin K, Palikov V, Palikova Y, Korolkova Y, Mosharova I, Rogachevskaja O, Baranov M, Shaidullova K, Ermakova E, Lushpa V, Bruter A, Deykin A, Ivanova E, Silaeva Y, Dyachenko I, **Bocharov E**, Sitdikova G, Andreev-Andrievskiy A, Poteryaev D, Shuster A, Murashev A, Kolesnikov S, Stepanenko V, Grishin E, Vassilevski AA (2025). Potent painkiller from spider venom antagonizes P2X3 receptors without dysgeusia. *Mol Ther* 33 (2), 771–785, [10.1016/j.ymthe.2024.12.036](#)
3. Volynsky PE, Urban AS, Pavlov KV, Bershatsky YV, Bocharova OV, Kryuchkova AK, Zlobina VV, Gavrilenkova AA, Dolotova SM, Kamynina AV, Zangieva OT, Taldaev A, Batishchev OV, Okhrimenko IS, Rakitina TV, Efremov RG, **Bocharov EV** (2025). Diverse Interactions of Sterols with Amyloid Precursor Protein Transmembrane Domain Can Shift Distribution Between Alternative Amyloid- $\beta$  Production Cascades in Manner Dependent on Local Lipid Environment. *Int J Mol Sci* 26 (2), 553, [10.3390/ijms26020553](#)
4. Bedanokova DR, Goncharuk MV, Shabalkina AV, Lushpa VA, Arseniev AS, **Bocharov EV**, Mineev KS, Goncharuk SA (2024). Production and Refolding of the Ligand-Binding Domain of TrkA Receptor with the Extracellular Juxtamembrane Region. *Russ. J. Bioorganic Chem.* 50 (6), 2589–2595, [10.1134/S1068162024060232](#)
5. Motov VV, Kot EF, Kislova SO, **Bocharov EV**, Arseniev AS, Boldyrev IA, Goncharuk SA, Mineev KS (2024). On the Properties of Styrene–Maleic Acid Copolymer–Lipid Nanoparticles: A Solution NMR Perspective. *Polymers (Basel)* 16 (21), 3009, [10.3390/polym16213009](#)
6. Konshina AG, **Bocharov EV**, Konovalova EV, Schulga AA, Tolmachev V, Deyev SM, Efremov RG (2024). Structural Basis of Activity of HER2-Targeting Construct Composed of DARPin G3 and Albumin-Binding Domains. *Int J Mol Sci* 25 (21), 11370, [10.3390/ijms252111370](#)
7. Petoukhov MV, Rakitina TV, Agapova YK, Petrenko DE, Podshivalov DD, Timofeev VI, Peters GS, Gaponov YA, **Bocharov EV**, Shtykova EV (2024). Molecular Dynamics and Small-Angle X-ray Scattering: Comparison of Computational and Experimental Approaches to Studying Structures of Biological Complexes. *Cryst. Rep* 69 (5), 674–681, [10.1134/S1063774524601540](#)
8. Lushpa VA, Goncharuk MV, Talyzina IA, Arseniev AS, **Bocharov EV**, Mineev KS, Goncharuk SA (2024). TIR domains of TLR family-from the cell culture to the protein sample for structural studies. *PLoS One* 19 (7), e0304997, [10.1371/journal.pone.0304997](#)
9. Serebrennikova M, Gafskaia E, Maltsev D, Ivanova K, Bashkurov P, Kornilov F, Volynsky P, Efremov R, **Bocharov E**, Lazarev V (2024). TriPEP-CPP: Algorithm for Predicting the Properties of Peptide Sequences. *Int J Mol Sci* 25 (13), 6869, [10.3390/ijms25136869](#)
10. Smirnova EV, Timofeev VI, Rakitina TV, Petrenko DE, Elmeeva OS, Saratov GA, Kudriaeva AA, **Bocharov EV**, Belogurov AA (2024). Myelin Basic Protein Attenuates Furin-Mediated Bri2 Cleavage and Postpones Its Membrane Trafficking. *Int J Mol Sci* 25 (5), 2608, [10.3390/ijms25052608](#)
11. Pham DD, Pham TH, Bui TH, Britikova EV, Britikov VV, **Bocharov EV**, Usanov SA, Phan VC, Le TBT (2024).

- In vitro and in vivo anti-tumor effect of Trichobakin fused with urokinase-type plasminogen activator ATF-TBK. *Mol Biol Rep* 51 (1), 130, [10.1007/s11033-023-09036-6](https://doi.org/10.1007/s11033-023-09036-6)
12. Петухов МВ, Ракитина ТВ, Агапова ЮК, Петренко ДЕ, Конарев ПВ, Бритиков ВВ, Бритикова ЕВ, **Боcharov ЭВ**, Штыкова ЭВ (2023). СРАВНИТЕЛЬНОЕ СТРУКТУРНОЕ ИССЛЕДОВАНИЕ ГИСТОНОПОДОБНЫХ БЕЛКОВ НУ МЕТОДОМ МАЛОУГЛОВОГО РЕНТГЕНОВСКОГО РАССЕЯНИЯ. *Кристаллография* 68 (6), 914–921, [10.31857/S0023476123600143](https://doi.org/10.31857/S0023476123600143)
  13. Petoukhov MV, Rakitina TV, Agapova YK, Petrenko DE, Konarev PV, Britikov VV, Britikova EV, **Bocharov EV**, Shtykova EV (2023). Comparative Structural Investigation of Histone-Like HU Proteins by Small-Angle X-ray Scattering. *Cryst. Rep* 68 (6), 912–919, [10.1134/S1063774523600953](https://doi.org/10.1134/S1063774523600953)
  14. Goncharuk MV, Vasileva EV, Ananiev EA, Gorokhovatsky AY, **Bocharov EV**, Mineev KS, Goncharuk SA (2023). Facade-Based Bicelles as a New Tool for Production of Active Membrane Proteins in a Cell-Free System. *Int J Mol Sci* 24 (19), , [10.3390/ijms241914864](https://doi.org/10.3390/ijms241914864)
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  17. Bozin T, Berdyshev I, Chukhontseva K, Karaseva M, Konarev P, Varizhuk A, Lesovoy D, Arseniev A, Kostrov S, **Bocharov E**, Demidyuk I (2023). NMR structure of emfourin, a novel protein metalloprotease inhibitor: insights into the mechanism of action. *J Biol Chem* 299 (4), 104585, [10.1016/j.jbc.2023.104585](https://doi.org/10.1016/j.jbc.2023.104585)
  18. Bershatsky YV, Kuznetsov AS, Idiatullina AR, Bocharova OV, Dolotova SM, Gavrilenkova AA, Serova OV, Deyev IE, Rakitina TV, Zangieva OT, Pavlov KV, Batishchev OV, Britikov VV, Usanov SA, Arseniev AS, Efremov RG, **Bocharov EV** (2023). Diversity of Structural, Dynamic, and Environmental Effects Explain a Distinctive Functional Role of Transmembrane Domains in the Insulin Receptor Subfamily. *Int J Mol Sci* 24 (4), , [10.3390/ijms24043906](https://doi.org/10.3390/ijms24043906)
  19. Petrenko DE, Karlinsky DM, Gordeeva VD, Arapidi GP, Britikova EV, Britikov VV, Nikolaeva AY, Boyko KM, Timofeev VI, Kuranova IP, Mikhailova AG, **Bocharov EV**, Rakitina TV (2023). Crystal Structure of Inhibitor-Bound Bacterial Oligopeptidase B in the Closed State: Similarity and Difference between Protozoan and Bacterial Enzymes. *Int J Mol Sci* 24 (3), 2286, [10.3390/ijms24032286](https://doi.org/10.3390/ijms24032286)
  20. Gaponov YA, Timofeev VI, Agapova YK, **Bocharov EV**, Shtykova EV, Rakitina TV (2022). Comparative structural analysis of a histone-like protein from *Spiroplasma melliferum* in the crystalline state and in solution. *MENDELEEV COMMUN* 32 (6), 742–744, [10.1016/j.mencom.2022.11.011](https://doi.org/10.1016/j.mencom.2022.11.011)
  21. Britikov VV, **Bocharov EV**, Britikova EV, Dergousova NI, Kulikova OG, Solovieva AY, Shipkov NS, Varfolomeeva LA, Tikhonova TV, Timofeev VI, Shtykova EV, Altukhov DA, Usanov SA, Arseniev AS, Rakitina TV, Popov VO (2022). Unusual Cytochrome c552 from *Thioalkalivibrio paradoxus*: Solution NMR Structure and Interaction with Thiocyanate Dehydrogenase. *Int J Mol Sci* 23 (17), , [10.3390/ijms23179969](https://doi.org/10.3390/ijms23179969)
  22. Britikov VV, Britikova EV, **Bocharov EV**, Bershatsky YV, Kuzmina NV, Boyko KM, Usanov SA (2022). PHYSICAL AND CHEMICAL PROPERTIES OF Δ3–12 CYSTEINE-DEPLETED CYTOCHROME P450 3A4 WITH AMINO ACID SUBSTITUTION OF S291C. *DNASB* , , [10.29235/1561-8323-2022-66-2-176-186](https://doi.org/10.29235/1561-8323-2022-66-2-176-186)
  23. Volynsky P, Maltseva D, Tabakmakher V, **Bocharov EV**, Raygorodskaya M, Zakharova G, Britikova E, Tonevitsky A, Efremov R (2022). Differences in Medium-Induced Conformational Plasticity Presumably Underlie Different Cytotoxic Activity of Ricin and Viscumin. *Biomolecules* 12 (2), , [10.3390/biom12020295](https://doi.org/10.3390/biom12020295)
  24. **Bocharov EV**, Gremer L, Urban AS, Okhrimenko IS, Volynsky PE, Nadezhdin KD, Bocharova OV, Kornilov DA, Zagryadskaya YA, Kamynina AV, Kuzmichev PK, Kutzsche J, Bolakhrif N, Müller-Schiffmann A, Dencher NA, Arseniev AS, Efremov RG, Gordeliy VI, Willbold D (2021). All-d-Enantiomeric Peptide D3 Designed for Alzheimer's Disease Treatment Dynamically Interacts with Membrane-Bound Amyloid-β Precursors. *J Med Chem* 64 (22), 16464–16479, [10.1021/acs.jmedchem.1c00632](https://doi.org/10.1021/acs.jmedchem.1c00632)
  25. Urban AS, Bershatskii YV, Pavlov KV, **Bocharov EV** (2021). Structural Study of Membrane Glycoprotein-Precursor of β-Amyloid and Proteins Involved in Its Proteolysis. *Cryst. Rep* 66 (5), 737–750, [10.1134/S1063774521050229](https://doi.org/10.1134/S1063774521050229)

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27. Bozin TN, Chukhontseva KN, Lesovoy DM, Filatov VV, Kozlovskiy VI, Demidyuk IV, **Bocharov EV** (2021). NMR assignments and secondary structure distribution of emfourin, a novel proteinaceous protease inhibitor. *Biomol NMR Assign* 15 (2), 361–366, [10.1007/s12104-021-10030-x](https://doi.org/10.1007/s12104-021-10030-x)
28. Urban AS, Pavlov KV, Kamynina AV, Okhrimenko IS, Arseniev AS, **Bocharov EV** (2021). Structural Studies Providing Insights into Production and Conformational Behavior of Amyloid- $\beta$  Peptide Associated with Alzheimer's Disease Development. *Molecules* 26 (10), , [10.3390/molecules26102897](https://doi.org/10.3390/molecules26102897)
29. Batishchev OV, Kuzmina NV, Mozhaev AA, Goryashchenko AS, Mileschina ED, Orsa AN, **Bocharov EV**, Deyev IE, Petrenko AG (2021). Activity-dependent conformational transitions of the insulin receptor-related receptor. *J Biol Chem* 296, 100534, [10.1016/j.jbc.2021.100534](https://doi.org/10.1016/j.jbc.2021.100534)
30. Dadayan AK, Borisov YA, Zolotarev YA, **Bocharov EV**, Nagaev IY, Myasoedov NF (2021). Solid-State Catalytic Hydrogen/Deuterium Exchange in Mexidol. *RUSS J PHYS CH* 95 (2), 273–278, [10.1134/S0036024421020096](https://doi.org/10.1134/S0036024421020096)
31. Albrecht C, Kuznetsov AS, Appert-Collin A, Dhaideh Z, Callewaert M, Bershatsky YV, Urban AS, **Bocharov EV**, Bagnard D, Baud S, Blaise S, Romier-Crouzet B, Efremov RG, Dauchez M, Duca L, Gueroult M, Maurice P, Bennasroune A (2020). Transmembrane Peptides as a New Strategy to Inhibit Neuraminidase-1 Activation. *Front Cell Dev Biol* 8, 611121, [10.3389/fcell.2020.611121](https://doi.org/10.3389/fcell.2020.611121)
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33. Agapova YK, Altukhov DA, Timofeev VI, Stroylov VS, Mityanov VS, Korzhenevskiy DA, Vlaskina AV, Smirnova EV, **Bocharov EV**, Rakitina TV (2020). Structure-based inhibitors targeting the alpha-helical domain of the Spiroplasma melliferum histone-like HU protein. *Sci Rep* 10 (1), 15128, [10.1038/s41598-020-72113-4](https://doi.org/10.1038/s41598-020-72113-4)
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