

## Резюме: Бочаров Эдуард Валерьевич



### Адрес

Федеральное государственное  
бюджетное учреждение науки  
Институт биоорганической химии им.  
академиков М.М. Шемякина и Ю.А.  
Овчинникова Российской академии  
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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

2002–наст.вр.	Старший научный сотрудник
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### 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 H1-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

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 Р450-зависимых систем человека с использованием методов интегративной структурной биологии</a>
2018–	<a href="#">Структурные аспекты воздействия онкогенных мутаций в трансмембранных доменах</a>

2020	<a href="#">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

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- 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](#)
- Петухов МВ, Ракитина ТВ, Агапова ЮК, Петренко ДЕ, Конарев ПВ, Бритиков ВВ, Бритикова ЕВ, **Бочаров ЭВ**, Штыкова ЭВ (2023). СРАВНИТЕЛЬНОЕ СТРУКТУРНОЕ ИССЛЕДОВАНИЕ ГИСТОНОПОДОБНЫХ БЕЛКОВ НУ МЕТОДОМ МАЛОУГЛОВОГО РЕНТГЕНОВСКОГО РАССЕЯНИЯ. *Кристаллография* 68 (6), 914–921, [10.31857/S0023476123600143](#)
- 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](#)
- 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](#)
- Krasnobaev VD, Bershatsky YV, Bocharova OV, **Bocharov EV**, Batishchev OV (2023). Amyloid Precursor Protein Changes Arrangement in a Membrane and Its Structure Depending on the Cholesterol Content. *Membranes (Basel)* 13 (8), , [10.3390/membranes13080706](#)
- Semenova MA, Bochkova ZV, Smirnova OM, Ignatova AA, Parshina EY, Ziganshin RH, **Bocharov EV**, Brazhe NA, Maksimov GV, Kirpichnikov MP, Dolgikh DA, Chertkova RV (2023). Development of a System for Biosynthesis, Isolation and Purification of the Holoform of Recombinant Human Neuroglobin and Its Characteristics. *Russ. J. Bioorganic Chem.* 49 (3), 550–561, [10.1134/S1068162023030196](#)
- 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](#)
- 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](#)
- 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](#)
- 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](#)
- 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](#)
- Britikov VV, Britikova EV, **Bocharov EV**, Bershatsky YV, Kuzmina NV, Boyko KM, Usanov SA (2022).

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16. Urban AS, Bershatskii YV, Pavlov KV, **Bocharov EV** (2021). Structural Study of Membrane Glycoprotein-Precursor of  $\beta$ -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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18. 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)
19. 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)
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23. Kuznetsov AS, Zamaletdinov MF, Bershatsky YV, Urban AS, Bocharova OV, Bennasroune A, Maurice P, **Bocharov EV**, Efremov RG (2020). Dimeric states of transmembrane domains of insulin and IGF-1R receptors: Structures and possible role in activation. *BIOCHIM BIOPHYS ACTA* 1862 (11), 183417, [10.1016/j.bbamem.2020.183417](https://doi.org/10.1016/j.bbamem.2020.183417)
24. 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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26. Shtykova EV, Petoukhov MV, Mozhaev AA, Deyev IE, Dadinova LA, Loshkarev NA, Goryashchenko AS, **Bocharov EV**, Jeffries CM, Svergun DI, Batishchev OV, Petrenko AG (2019). The dimeric ectodomain of the alkali-sensing insulin receptor-related receptor (ectoIRR) has a drop-like shape. *J Biol Chem* 294 (47), 17790–17798, [10.1074/jbc.RA119.010390](https://doi.org/10.1074/jbc.RA119.010390)
27. Dadayan AK, Borisov YA, **Bocharov EV**, Zolotarev YA, Nagaev IY, Myasoedov NF (2019). Solid-State Catalytic Isotope Exchange of Hydrogen for Deuterium in Cyclopropylglycine. *DOKL PHYS CHEM* 484 (1), 15–19, [10.1134/S0012501619010056](https://doi.org/10.1134/S0012501619010056)
28. **Bocharov EV**, Nadezhdin KD, Urban AS, Volynsky PE, Pavlov KV, Efremov RG, Arseniev AS, Bocharova OV (2019). Familial L723P Mutation Can Shift the Distribution between the Alternative APP Transmembrane

- Domain Cleavage Cascades by Local Unfolding of the  $\eta$ -Cleavage Site Suggesting a Straightforward Mechanism of Alzheimer's Disease Pathogenesis. *ACS Chem Biol* 14 (7), 1573–1582, [10.1021/acschembio.9b00309](https://doi.org/10.1021/acschembio.9b00309)
29. Lesovoy DM, Dubinnyi MA, Nolde SB, **Bocharov EV**, Arseniev AS (2019). Accurate measurement of dipole/dipole transverse cross-correlated relaxation  $\Gamma_2$  in methylenes and primary amines of uniformly  $^{13}\text{C}/^{15}\text{N}$ -labeled proteins. *J Biomol NMR* 73 (5), 245–260, [10.1007/s10858-019-00252-6](https://doi.org/10.1007/s10858-019-00252-6)
  30. Babailov SP, Zapolotsky EN, Kruppa AI, Stabnikov PA, Godovikov IA, **Bocharov EV**, Fomin ES (2019). Two types of conformational dynamics and thermo-sensor properties of praseodymium-DOTA by  $^1\text{H}/^{13}\text{C}$  NMR. *Inorganica Chim Acta* 486, 340–344, [10.1016/j.ica.2018.10.044](https://doi.org/10.1016/j.ica.2018.10.044)
  31. Polyansky AA, **Bocharov EV**, Velghe AI, Kuznetsov AS, Bocharova OV, Urban AS, Arseniev AS, Zagrovic B, Demoulin JB, Efremov RG (2019). Atomistic mechanism of the constitutive activation of PDGFRA via its transmembrane domain. *BIOCHIM BIOPHYS ACTA* 1863 (1), 82–95, [10.1016/j.bbagen.2018.09.011](https://doi.org/10.1016/j.bbagen.2018.09.011)
  32. (конференция) Lesovoy DM, Nolde SB, Dubinnyi MA, **Bocharov EV**, Mineev KS, Arseniev AS (2018). Assortment and optimization of NMR relaxation techniques for  $^{13}\text{CH}_2$ ,  $^{13}\text{CH}_3$  and  $^{15}\text{NH}_2$  groups of the protein side chains. *XXVIIIth International conference on Magnetic Resonance in Biological Systems, University College Dublin, Ireland*, 169–170.
  33. **Bocharov EV**, Pavlov KV (2018). Lipid-mediated mechanisms in protein functioning. *Tsitologiya* 60 (7), 510–518, [10.31116/tsitol.2018.07.04](https://doi.org/10.31116/tsitol.2018.07.04)
  34. **Bocharov EV**, Lesovoy DM, Bocharova OV, Urban AS, Pavlov KV, Volynsky PE, Efremov RG, Arseniev AS (2018). Structural basis of the signal transduction via transmembrane domain of the human growth hormone receptor. *BIOCHIM BIOPHYS ACTA* 1862 (6), 1410–1420, [10.1016/j.bbagen.2018.03.022](https://doi.org/10.1016/j.bbagen.2018.03.022)
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  36. (книга) Pavlov KV, Akimov SA, Batishchev OV, Chekashkina KV, Bashkirov PV, **Bocharov EV** (2018). Protein-lipid interplay in vital biological functions. , 133–199.
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