

CURRICULUM VITAE

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Education:

Baccalaureate 1977 Moscow University, USSR, B.S. in Biochemistry(*Honors*),

Graduate 1985 Moscow University, Ph. D., Molecular Biology

Training:

1977-1979 Junior Researcher, Biological Faculty, Moscow State University

1979-1985 Graduate student and pre-doctoral Junior Investigator, Dept. of
Virology and A.N.Belozersky Laboratory of Molecular
Biology and Bioorganic Chemistry, Moscow State University

1985-1990 Investigator and Senior Investigator, Dept. of Enzymology,
A.N.Belozersky Interdepartmental Laboratory of Molecular
Biology and Bioorganic Chemistry, Moscow State University

1989-1990 Visiting scientist at Dept. of Biochemistry, University of Washington
(with Dr. K.A.Walsh and Dr. J.B.Hurley), sabbatical

1990-1992 Leading Investigator, Institute of Physico-Chemical Biology,
Moscow, USSR (Russia).

1991 Visiting Scientist, Institute des Pharmacologie Moléculaire et
Cellulaire, CNRS, Sophia Antipolice, Valbonne, France
(with Dr. M. Chabre), sabbatical.

1991-1993 Associate, Howard Hughes Medical Institute (with Dr.
J.B. Hurley) and Senior Fellow, Dept. of Biochemistry,
University of Washington, WA.

Faculty appointments:

1993-1997 Research Assistant Professor, Department of Biochemistry,
University of Washington, Seattle, WA.

1997-2002 Assistant Professor, Associate Professor, Departments: Ophthalmology,
Pharmacology, Anatomy and Cell biology Wayne State University, Detroit,
Michigan.

2002-present Hafter Chair and Professor of Pharmacology, Pennsylvania College of
Optometry, Elkins Park, PA

PUBLISHED ARTICLES

Dizhoor, A.M., Ugarova, T.Yu. Suppression of the formation of preinitiator complex (Met-tRNA^f- 40S subunit of ribosomes) in Krebs II cells infected with encephalomyocarditis virus. *Dokl. Acad. Nauk.* 247, 990-993 (*Russian, English res.*) (1979)

Dizhoor, A.M., Ugarova, T.,Yu. Study on the met-tRNA^f binding activity in Krebs-2 cells infected with encephalomyocarditis virus. *FEBS Letters* 128, 43-45 (1981)

Dizhoor, A.M., Ugarova, T.Yu. Activity of initiation factors of translation in Krebs-2 cells infected with encephalomyocarditis virus. *Dokl. Acad. Nauk.* 261, 1013-1016 (*Russian, English res.*) (1981)

Dizhoor, A.M., Arshavsky, V.Yu., Shestakova, I.K., Philippov, P.P. The influence of phosphorylation of rhodopsin on the light-dependent bovine retinal rod outer segment cGMP phosphodiesterase activation. *Biol. membr.* 1, 1051-1056 (*Russian, English res.*) (1984)

Arshavsky, V.Yu., Dizhoor, A.M., Shestakova, I.K., Philippov, P.P. The effects of rhodopsin phosphorylation on the light-dependent activation of phosphodiesterase from bovine rod outer segments. *FEBS Lett.* 181, 264- 266 (1985)

Arshavsky, V.Y., Dizhoor, A.M., Kaulen, A.D., Shestakova, I.K., Philippov, P.P. A light-scattering study of the effects of rhodopsin phosphorylation on its interaction with transducin. *Biol. membr.* 2, 5-10 (*Russian, English res.*) (1985)

Dizhoor, A.M., Arshavsky, V.Yu., Rybin, V.O., Philippov, P.P. Effect of membranes on transducin-dependent activation of cyclic nucleotide phosphodiesterase from rod outer segments of bovine retina. *Biol. membr.* 2, 529- 539(*Russian, English res.*) (1985)

Arshavsky, V.Yu., Dizhoor, A.M., Antoch, M.P., Rakhilin, S.V., Philippov, P.P. Trans- ducin and phosphodiesterase activation by delipidated rhodopsin in detergent solution. *Biol. membr.* 3, 1172-1174 (*Russian, English res.*) (1986)

Dizhoor, A.M., Rakhilin, S.V., Philippov, P.P. Light -dependent activation of cyclic GMP phosphodiesterase from bovine retina by delipidated rodopsin in octylglucoside solution. *Biol. membr.* 4, 818-824 (*Russian, English res.*) (1987)

Philippov, P.P., Arshavsky, V.Yu., Dizhoor, A.M. The effects of rhodopsin phos-phorylation on the activation of visual transduction enzymes. In: *Retinal Proteins*, Yu. A. Ovchinnikov ed., VNU Press, Utrecht, 109-120 (1987)

Arshavsky, V.Yu., Antoch, M.P., Dizhoor, A.M., Rakhilin S.V., Philippov, P.P. Interaction of visual transduction enzymes in a detergent solution. In: *Retinal Proteins*, Yu. A. Ovchinnikov ed., VNU Press, Utrecht, 497-504 (1987)

Dizhoor, A.M., Arshavsky, V.Yu., Kaulen, A.D., Philippov, P.P. The mechanism of light-dependent activation of transducin: GDP/GTP-exchange or phosphorylation of transducin-bound GTP? In: *Retinal Proteins*, Yu. A. Ovchinnikov ed., VNU Press, Utrecht, 525-530 (1987)

Rakhilin, S.V., Dizhoor, A.M., Philippov, P.P. Rhodopsin-transducin-phosphodiesterase cascade quenching: the mechanism of 48 kDa - protein action. **Biol. membr.** 6, 100-102 (Russian, English res.) (1989)

Dizhoor, A.M., Nekrasova, E.R., Philippov, P.P. Study of immobilized rhodopsin interaction with G-proteins. **Biokhimiya** 54, 1507-1513 (Russian, English res.) (1989)

Dizhoor, A.M., Nekrasova, E.R., Philippov, P.P. The binding of G-proteins to immobilized delipidated rhodopsin. **Biochem. Biophys. Res. Commun** 162, 544-549 (1989)

Philippov, P.P., Arshavsky, V.Yu., Dizhoor, A.M. The phosphodiesterase cascade of a photoreceptor cells: mechanisms of activation and quenching. **Soviet Scientific Reviews. Physico- chemical Biology**. Harwood Acad. Publ., vol.9, pp. 243-307 (1990).

Dizhoor, A.M., Nekrasova, E.R., Philippov, P.P. A novel photoreceptor-specific protein with a molecular mass 26000 capable of binding to immobilized delipidated rhodopsin. **Biokhimiya** 56, 123-126 (Russian, English res.) (1991)

Dizhoor, A.M., Ray, S., Kumar, S., Niemi, G., Spencer, M., Brolley, D., Walsh, K.A., Philippov, P.P., Hurley, J.B., Stryer, L. Recoverin: a calcium-sensitive activator of retinal rod guanylate cyclase. **Science** 251, 915-918 (1991) *Comments in: Hurley, J.B., Dizhoor, A.M., Ray, S., Stryer, L. (letter) Science* 260, 740 (1993)

Ray, S., Zozulya, S., Niemi, G.I., Flaherty, K.M., Brolley, D., Dizhoor, A.M., McKey, D.B., Hurley, J.B., Stryer, L. Cloning, expression, and crystallization of recoverin, a calcium sensor in vision. **Proc. Natl. Acad. Sci. U.S.A.** 89, 5705-5709 (1992)

Dizhoor, A.M., Ericsson L.H., Johnson, R.S., Kumar, S., Olshevskaya, E., Zozulya, S., Neubert, T., Stryer, L., Hurley, J.B., Walsh, K.A. The NH₂ terminus of retinal recoverin is acylated by a small family of fatty acids. **J. Biol. Chem.** 267, 16033-16036 (1992)

Milam, A.H., Dacey, D.M., Dizhoor, A.M. Recoverin immunoreactivity in mammalian cone bipolar cells. **Visual Neurosci.** 9, 10, 1-12 (1993)

Dizhoor, A.M., Chen, Ch.-K., Olshevskaya, E., Sinelnikova, V.V., Philippov, P.P., Hurley, J.B. Role of the acylated amino - terminus of recoverin in Ca²⁺ - dependent membrane interaction. **Science** 259, 829-832 (1993)

Dizhoor, A.M., Lowe, D.G., Olshevskaya, E.V., Laura, R.P., Hurley, J.B. The human photoreceptor membrane guanylyl cyclase, RetGC, is present in outer segments and is regulated by calcium and a soluble activator **Neuron** 12, 1345-1352 (1994)

Lowe, D.G., Dizhoor, A.M., Liu, K., Gu, O., Spencer, M., Laura, R., Lu, L., Hurley, J.B. Cloning and expression of a second photoreceptor - specific membrane guanylyl cyclase (RetGC), RetGC-2. **Proc. Natl. Acad. Sci. U.S.A.** 92, 5535-5539 (1995)

Dizhoor, A.M., Olshevskaya, E.V., Henzel, W.J., Wong, S., Stults, J.T., Ankoudinova, I., Hurley, J.B. Cloning, sequencing and expression of a 24 kDa Ca^{2+} -binding protein activating photoreceptor guanylyl cyclase. *J. Biol. Chem.* **270**, 25200-25206 (1995)

Laura, R.P., Dizhoor, A.M., Hurley, J.B. The membrane guanylyl cyclase, RetGC-1, is activated through its intracellular domain. *J. Biol. Chem.* **271**, 11646-11651 (1996)

Dizhoor, A.M., and Hurley, J.B. Inactivation of EF-hands makes GCAP-2 (p24) a constitutive activator of photoreceptor guanylyl cyclase by preventing a Ca^{2+} -induced "activator-to-inhibitor" transition. *J. Biol. Chem.* **271**, 19346-19350 (1996)

Olshevskaya, E.V., Hughes, R.E., Hurley, J.B., Dizhoor, A.M. Calcium binding, but not a calcium-myristoyl switch, controls the ability of guanylyl cyclase activating protein GCAP-2 to regulate photoreceptor guanylyl cyclase. *J. Biol. Chem.* **272**, 14327-14333 (1997).

Dizhoor A.M., Boikov, S.G., Olshevskaya, E.V. Constitutive Activation of Photoreceptor Guanylate Cyclase By Y99C Mutant of GCAP-1: Possible Role In Causing Human Autosomal Dominant Cone Degeneration. *J. Biol. Chem.* **273**, 17311-17314 (1998).

Hughes, R.E., Brzovic, P.S., Dizhoor, A.M., Klevit, R.E., Hurley, J. B. Ca^{2+} -dependent conformational changes in bovine GCAP-2. *Protein Science*. **7**, 2675-2680 (1998).

kaya, E., Yamazaki, A., Miyake, Y., Wakabayashi, T., Dizhoor, A.,
Usukura, J. Detailed localization of photoreceptor guanylate cyclase activating protein-1 and -2 in mammalian retinas using light and electron microscopy. *Exp. Eye. Res.* **68**, 465-473 (1999)

Olshevskaya, E.V., Boikov, S., Ermilov, A., Krylov, D., Hurley, J.B., Dizhoor A.M. Mapping functional domains of the guanylate cyclase regulator protein, GCAP-2. *J. Biol. Chem.* **274**, 10823-10832 (1999).

Krylov, D.M., Niemi, G., Dizhoor, A.M., Hurley, J.B. Mapping Sites in GCAP-1 Required for Regulation of Photoreceptor Membrane Guanylyl Cyclases. *J. Biol. Chem.* **274**, 10833-10839 (1999).

Yu, H., Olshevskaya, E., Duda, T., Seno, K., Hayashi, F. Sharma, R.K., Dizhoor, A.M., Yamazaki, A. Activation of retinal guanylyl cyclase-1 by Ca^{2+} binding proteins involves its dimerization. *J. Biol. Chem.* **274**, 15547-15555 (1999).

Ames, J.B., Dizhoor, A.M., Ikura, M., Palczewski, K., Stryer, L. Three-dimensional structure of GCAP-2, a calcium sensitive modulator of photoreceptor guanylyl cyclases. *J. Biol. Chem.* **274**, 19329-19337 (1999).

Olshevskaya, E.V., Ermilov, A.N., Dizhoor A.M. Dimerization of Guanylyl cyclase-activating protein and a mechanism of photoreceptor guanylyl cyclase activation. **J. Biol. Chem.** 274, 10823-10832 (1999).

Hurley, J.B. & Dizhoor, A.M. Heterologous expression and assay of photoreceptor guanylyl cyclases and guanylyl cyclase activator proteins. **in: Vertebrate Phototransduction and the Visual Cycle, Methods in Enzymology** 315, 708-718 (2000) .

Mendez, A., Burns, M.E., Sokal, I., Dizhoor, A.M., Baehr, W., Palczewski, K., Baylor, D.A., Chen, J. Guanylate Cyclase Activating Proteins (GCAPs) set the flash sensitivity of rod photoreceptors. **Proc. Natl. Acad. Sci. U.S.A.** 98, 9948-53 (2001).

Ermilov AN, Olshevskaya EV, Dizhoor AM. Instead of binding calcium, one of the EF-hand structures in guanylyl cyclase activating protein-2 is required for targeting photoreceptor guanylyl cyclase. **J Biol Chem.** 276(51):48143-8 (2001)

Olshevskaya, E.V., Ermilov, A.N. , and Dizhoor, A.M . Factors That Affect Regulation Of cGMP Synthesis In Vertebrate Photoreceptors And Their Genetic Link To Human Retinal Degeneration. **Molecular and Cellular Biochemistry** 230, 139-147 (2002).

Dizhoor, A. Site-directed and natural mutations in studying functional domains in guanylyl cyclase activating proteins (GCAPs). **Adv Exp Med Biol.** 514:291-301 (2002).

Peshenko, I.V., Dizhoor, A.M. Guanylyl Cyclase Activating Proteins (GCAPs) Are $\text{Ca}^{2+}/\text{Mg}^{2+}$ -Sensors: Implications for Photoreceptor Guanylyl Cyclase (RetGC) Regulation *in vitro* and *in vivo*. **J Biol Chem.** 279: 16903-16906 (2004)

Olshevskaya, E.V., Calvert P.D., Woodruff, M.L., Peshenko I.V., Savchenko A.B., Makino C.L., Ho Y-S., Fain G.L., Dizhoor, A.M. The Y99C mutation in guanylyl cyclase activating protein 1 (GCAP1) increases intracellular Ca^{2+} and causes photoreceptor degeneration in transgenic mice. **J. Neuroscience** 24, 6078-6085 (2004)

Peshenko, I.V., Moyiseev, G.P, Olshevskaya, E.V., Dizhoor, A.M. Factors that determine Ca^{2+} -sensitivity of photoreceptor guanylyl cyclase. Kinetic Analysis of the Interaction between the Ca^{2+} -Bound and the Ca^{2+} -Free Guanylyl Cyclase Activating Proteins (GCAPs) and Recombinant Photoreceptor Guanylyl Cyclase 1 (RetGC-1). **Biochemistry**, 13796-13804 (2004)

Peshenko, I.V., Olshevskaya, E.V., Dizhoor, A.M. Ca^{2+} -dependent conformational changes in guanylyl cyclase activating protein 2 (GCAP-2) revealed by site-specific phosphorylation and partial proteolysis. **J. Biol. Chem.** 279, 50342-50349 (2004)