CURRICULUM VITAE

Yulia Pushkar

University of California, Berkeley
Lawrence Berkeley National Laboratory, 1 Cyclotron road, Berkeley, CA 94720
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Education

Ph.D. (summa cum laude) Physical Chemistry / Biophysics, 2003
Institut für Experimentalphysik, Freie Universität Berlin, Germany
Thesis: "How do proteins control cofactor function? A Multifrequency Time Resolved ESR study of modified Photosystem I complexes." Advisor: Prof. D. Stehlik.

M.S. (with honor) Physical Chemistry, 1999
Moscow State University, Russia
Thesis: "Structure and Lewis acid properties of surface of Ga_2O_3-ZrO_2 and Ga_2O_3-Al_2O_3 catalysts." Advisor: Prof. Lunina E.V.

Research Experience

Post Doctoral Fellow 2004-present
University of California, Berkeley & Lawrence Berkeley National Laboratory
Biochemical and Biophysical studies of photosynthetic light-driven oxygen evolution. Development of biomimetic catalysts for the light-induced oxidation of water. Advisors Dr. V. K. Yachandra.
Techniques used: X-ray Absorption Spectroscopy, Resonant Inelastic X-ray Scattering, X-ray imaging, emission spectroscopy, Electron Paramagnetic Resonance (EPR).

Post Doctoral Fellow 2003-2004
Institut für Experimentalphysik, **Freie Universität Berlin**, Germany
Study of the protein-cofactor interactions critical for the asymmetric light-induced electron transfer in the Photosystem I protein complex. Advisor: Prof. D. Stehlik.
Techniques used: Time Resolved-EPR, Electron Nuclear Double Resonance, Electron Spin Echo Envelop Modulation, High field EPR, selective isotope labelling and biochemical modification of the protein complexes.

Research assistant 4/2000-10/2000
Chemistry Department, **Lund University**, Sweden
Inorganic synthesis, NMR, IR, catalysis

Research assistant 1994 - 1999
Laboratory of Catalysis, **Moscow State University**, Russia
Techniques used: EPR, IR, Raman, solid state NMR, catalysis.

Awards

Young Investigator Award, Gordon Research Conference on Photosynthesis 2006

Postdoctoral Richard Malkin Award for research in the field of Photosynthesis 2005

Chevron Corporation Award for Research in Ecologically Friendly Catalysis 1998

Teaching Experience

Teaching assistant 2001 – 2004
Physics for medical major, Freie Universität Berlin.

Teaching assistant 1997 - 1998
Chemistry, International Soros Science Education program. Moscow.

Independent tutor 2000 – 2004
Taught chemistry individually to students with special needs

Grants

The German Academic Exchange Service (DAAD) grant for graduate study 10/2000-4/2001

Halder-Topsoe Graduate Student Research Grant 1999

Open Society Institute and Soros Foundation Undergraduate Research Grants 1994-1999

Summary

- Ten years of experimental experience in EPR spectroscopy (including time resolved and pulsed EPR) as applied in catalysis; protein studies; studies of the electron transfer process in proteins, protein-cofactor interactions. Experience in spin labels and paramagnetic probe molecules techniques.

- Four years of experimental experience in application of Synchrotron X-ray absorption, emission and diffraction methods for analysis of molecular structures; crystal structures; structure and function of active sites in metalloproteins; electronic structures of organic/inorganic compounds.

- Ten years of experience in international collaboration, including project planning, follow-up on projects, samples and data exchange, joint discussions and publication of results.

- Nine years of experience in supervision of undergraduate and graduate students. Examples of MS theses done under my supervision: Irina Karyagina “Investigation of Photosystem I complex isolated from the double mutant *menB/rubA* by multifrequency Time Resolved EPR”; Andrew Haritonkin “A density functional theory study of the quinone anione-radical interaction with protein environment, prediction of the magnetic-resonance parameters”.

- Several years of experience in community outreach through interaction with high school teachers and pupils in the frame of the International Soros Science Education program, Russia.

References

Prof. Kenneth Sauer
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Dr. Vittal Yachandra
Senior Staff Scientis, Physical Bioscience Division, Lawrence Berkeley National Lab.
Berkeley, CA 94720-5230
Tel: 1 510 486 4963 Fax: 1 510 486 4995
e-mail: YKYachandra@lbl.gov

Prof. Dr. John H. Golbeck
Professor of Biochemistry and Biophysics
Professor of Chemistry
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Prof. Dr. Wolfgang Lubitz
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Publications

2008

1. "Structural changes in the Mn_4Ca cluster and the mechanism of photosynthetic water splitting"

   Yulia Pushkar, Junko Yano, Kenneth Sauer, Alain Boussac, Vittal Yachandra ***Proceedings of the National Academy of Science*** 2008, V. 105, N. 6, 1879-1884.

2. "High-resolution structure of the photosynthetic Mn_4Ca catalyst from X-ray spectroscopy"

   Junko Yano, Jan Kern, Yulia Pushkar, Kenneth Sauer, Pieter Glatzel, Uwe Bergmann, Johannes Messinger, Athina Zouni, Vittal K. Yachandra ***Philosophical Transactions of the Royal Society B*** 2008, V. 363, N. 1494, 1139-1147.

3. "Focusing the view on Natures's water splitting catalyst"

   Samir Zein, Leonid V. Kulik, Junko Yano, Jan Kern, Yulia Pushkar, Athina Zouni, Vittal K. Yachandra, Wolfgang Lubitz, Frank Neese, Johannes Messinger ***Philosophical Transactions of the Royal Society B*** 2008, V. 363, N. 1494, 1167-1177.

4. "Visible Light-Induced Electron Transfer from a Di-μ-oxo Bridged Mn Dinuclear Complex to Cr Centers in Silica Nanopores"

   Walter W. Weare, Yulia Pushkar, Vittal K. Yachandra, and Heinz Frei ***Journal of the American Chemical Society*****,** submitted

5. "Electronic structure and oxidation state changes in the Mn4Ca cluster of Photosystem II"

   Junko Yano, Yulia Pushkar, Johannes Messinger, Uwe Bergmann, Pieter Glatzel, Vittal Yachandra ***Photosynthesis: Energy from the Sun*** Springer, chapter 41 (in press)

2007

6. "Structure and orientation of the Mn_4Ca cluster in plant Photosystem II membranes studied by polarized range-extended X-ray absorption spectroscopy"

   Yulia Pushkar, Junko Yano, Pieter Glatzel, Johannes Messinger, Azul Lewis, Kenneth Sauer, Uwe Bergmann, Vittal K. Yachandra ***Journal of Biological Chemistry*** 2007, V. 282, N. 10, 7198-7208.

   This paper was selected as a paper of the week by Journal of Biological Chemistry and featured on the journal cover

7. "Polarized X-ray Absorption Spectroscopy of Single-Crystal Mn(V) Complexes Relevant to the Oxygen Evolving Complex of Photosystem II"

   Junko Yano, John Robblee, Yulia Pushkar, Matthew A. Marcus, Jesper Bendix, Josè M. Workman, Terrence J. Collins, Edward I. Solomon, Serena DeBeer George, Vittal Yachandra ***Journal of the American Chemical Society*** 2007, 129(43), 12989-13000.

8. "Contributions of the Protein Environment to the Midpoint Potentials of the A_1 Phylloquinones and the F_X Iron-Sulfur Cluster in Photosystem I"

   Irina Karyagina, Yulia Pushkar, Dietmar Stehlik, Art van der Est, Hiroshi Ishikita, Ernst-Walter Knapp, Bharat Jagannathan, Rufat Agalarov, and John H. Golbeck ***Biochemistry*** 2007, 46(38), 10804-10816.

9. "Hetero nuclear Mn-Ca/Sr Complexes, and Ca/Sr EXAFS Spectral Comparisons with the Oxygen-Evolving Complex of Photosystem II"

   Abhudaya Mishra, Junko Yano, Yulia Pushkar, Vittal K. Yachandra, Khalil A. Abboud, George

Christou ***Chemical Communications*** 2007, V. 15, 1538-1540.

2006

10. ”Where Water is Oxidized to Oxygen: Structure of the Photosynthetic Mn_4Ca Cluster”

    Junko Yano, Jan Kern, Kenneth Sauer, Matthew J. Latimer, Yulia Pushkar, Jacek Biesiadka, Bernhard Loll, Wolfram Saenger, Johannes Messinger, Athina Zouni, Vittal K. Yachandra ***Science*** 2006, V.314; 821-825

2005

11. “High-Resolution Mn EXAFS of the Oxygen-Evolving Complex in Photosystem II: Structural Implications for the Mn_4Ca Cluster”

    Junko Yano, Yulia Pushkar, Pieter Glatzel, Azul Lewis, Kenneth Sauer, Johannes Messinger, Uwe Bergmann, Vittal Yachandra ***Journal of the American Chemical Society (Communication)*** 2005, V. 127, N. 43, 14974-14975.

12. “X-ray Damage to the Mn4Ca Complex in Single-Crystals of Photosystem II: A Case Study for Metallo-Protein Crystallography”

    Junko Yano, Jan Kern, Klaus-Dieter Irrgang, Matthew J. Latimer, Uwe Bergmann, Pieter Glatzel, Yulia Pushkar, Jacek Biesiadka, Bernhard Loll, Kenneth Sauer, Johannes Messinger, Athina Zouni, Vittal K. Yachandra ***Proceedings of the National Academy of Science*** 2005, V. 102, N 34, 12047-12052.

13. “Recruitment of a Foreign Quinone into the A_1 site of Photosystem I. Consecutive Forward Electron Transfer from A_0 to A_1 to F_X with Anthraquinone in the A_1 Site as studied by transient EPR”

    Yulia Pushkar, Irina Karyagina, Dietmar Stehlik, Sarah Brown, Art van der Est ***Journal of Biological Chemistry*** 2005, V. 280, N13, 12382-12390.

14. “Recruitment of a Foreign Quinone into the A_1 site of Photosystem I. Characterization of a *menB rubA* double deletion mutant in *Synechococcus SP.* PCC 7002 devoid of F_X, F_A and F_B and containing Plastoquinone or exchanged 9,10-Anthroquinone”

    Yumiko Sakuragi, Boris Zybailov, Gaozhong Shen, Donald A. Bryant, John H. Golbeck, Bruce A. Diner , Irina Karygina, Yulia Pushkar, and Dietmar Stehlik ***Journal of Biological Chemistry*** 2005, V. 280, N13, 12371-12381.

15. “Transient and pulsed EPR study of ^{17}O substituted methyl-naphthoquinone as radical anion in the A_1 binding site of Photosystem I and in frozen solution”

    Yulia Pushkar, Oleg Ayzatulin, Dietmar Stehlik ***Applied Magnetic Resonance*** 2005, **V**. 28, 195-211

2004

16. “Asymmetric hydrogen-bonding of the quinone cofactor in Photosystem I probed by ^{13}C labeled naphthoquinones”

    Yulia Pushkar, Herbert Zimmermann, John H. Golbeck, Dietmar Stehlik ***Journal of Physical Chemistry B*** 2004, 108 (27) 9439-9448.

    This paper was featured on the journal cover.

17. "An EPR/ENDOR study of the asymmetric hydrogen bond between the quinone electron acceptor and the protein backbone in Photosystem I"

    Yulia Pushkar, Dietmar Stehlik, Maurice van Gastel, Wolfgang Lubitz ***Journal of Molecular Structure*** 2004, V. 700, 1-3, 233-241.

18. "Evidence for Asymmetric Electron Transfer in Cyanobacterial Photosystem I: Analysis of a Methionine to Leucine Mutation of the Ligand to the Primary Electron Acceptor A_0"

    Wu Xu, Parag Chitnis, Alfia Valieva, Art van der Est, Yulia Pushkar, Dietmar Stehlik, Rachel Cohen, Gaozhong Shen, and John H. Golbeck ***Biochemistry*** 2004, *43*(16); 4741-4754.

19. "Paramagnetic complexes of anthraquinone on the surface of Al_2O_3 and ZrO_2 according to the 3-mm wave band EPR spectra"

    Fionov A.V., Pushkar Y., Lunina E.V. ***Russian Journal of Physical Chemistry*** 2004, 78(9), 1408-1412.

20. "Reactivity of palladium(II) methyl complexes towards CO2: formation of carbonate complexes"

    Yulia Pushkar, Ola F. Wendt ***Inorganica Chimica Acta*** 2004, 357, 1295-1298.

2003

21. "Interpretation of multifrequency transient EPR spectra of the $P_{700}^{+}A_0Q_K^{-}$ state in Photosystem I complexes with a sequential correlated radical pair model: wild type versus A0 mutants"

    Kev M. Salikhov, Yulia Pushkar, John H. Golbeck, Dietmar Stehlik ***Applied Magnetic Resonance*** 2003, 24, 467-482.

22. "Electron Transfer in Cyanobacterial Photosystem I. **I.** Physiological and Spectral Characterization of Site-Directed Mutants in a Putative Electron Transfer Pathway from A_0 through A_1 to F_X"

    Wu Xu, Parag Chitnis, Yulia Pushkar, Christian Teutloff, Stephan G. Zech, Robert Bittl, Dietmar Stehlik, Alfia Valieva, Art van der Est, Boris Zybailov, Gaozhong Shen, and John H. Golbeck ***Journal of Biological Chemistry*** 2003, 278, 30, 27864-27875.

23. "Electron Transfer in Cyanobacterial Photosystem I. **II.** Determination of Forward Electron Transfer Rates of Site-Directed Mutants in a Putative Electron Transfer Pathway from A_0 through A_1 to F_X"

    Klaus Brettel, Parag R. Chitnis, Art van der Est, John H. Golbeck, Mariana Guergova-Kuras, Yulia Pushkar, Gaozhong Shen, Dietmar Stehlik, Alfia Valieva, Wu Xu, Stephan G. Zech, Boris Zybailov ***Journal of Biological Chemistry*** 2003, 278, 30, 27876-27887.

2002

24. "Orientation and protein-cofactor interactions of monosubstituted n-alkyl naphthoquinones in the A_1 binding site of Photosystem I"

    Yulia Pushkar, Stephan G. Zech, Sarah Brown, Art van der Est, Herbert Zimmermann, Dietmar Stehlik ***Journal of Physical Chemistry B*** 2002, *106*(46); 12052-12058.

2000

25. "Structure and Lewis acid properties of Gallia-alumina catalysts"

    Y. Pushkar, O.O. Parenago, A. Sinitsky, A.N. Kharlanov, E.V. Lunina ***Applied Surface Science*** 2000, 67, p. 69-78.

26. "Coordination of nitroxyl radical probes to the Lewis acid sites on the surface of gallium oxide: a quantum-chemical analysis"

    A.M. Tokmachev, Y. Pushkar, E.V. Lunina, N.D. Chuvylkin ***Russian Chemical Bulletin*** 2000***,*** *49, 6, p. 991-996.*

1999

27. "Paramagnetic complexes of probe molecules with electron-accepting sites on the surface of M_2O_3-ZrO_2 (M=Al, Ga)."

    Y. Pushkar, O.O. Parenago, A.V. Fionov, E.V. Lunina ***Colloids and Surface A: Physicochemical and Engineering Aspects*** 1999, 158, 1-2 p. 179-187.

1998

28. "Role of the crystalline structure in the formation of Lewis acid sites at the surface of gallium oxide"

    O.O. Parenago, Y. Pushkar, A.O. Turakulova, G.P. Murav'eva, E.V. Lunina ***Kinetic and Catalysis*** 1998, 39, 2 268-273.

Selected Conferences

Type: Contributed Talk
Conference: Gordon research conference, Graduate Research Seminar: Bioinorganic Chemistry
Date and place: January 2007, Ventura, CA
Title: Oxygen Evolving Complex of Photosystem II
Authors: Yulia Pushkar

Type: Posters
Conference: 14th International Congress of Photosynthesis
Date and place: July 2007, Glasgow, Scotland
Title: Electronic and geometric structures of the Mn_4O_xCa cluster in the S_0 and S_2 states of the oxygen-evolving complex of Photosystem II based on pulse ^{55}Mn-ENDOR spectroscopy and DFT calculations.
Authors: Leonid V. Kulik, Boris Epel, Samir Zein, Junko Yano, Jan Kern, Yulia Pushkar, Athina Zouni, Vittal K. Yachandra, Frank Neese, Wolfgang Lubitz, and Johannes Messinger
Title: Structural changes in the oxygen evolving complex of Photosystem II upon $S_2 \rightarrow S_3$ transition.
Authours: Yulia Pushkar, Junko Yano, Alain Boussac, Uwe Bergmann, Ken Sauer, Vittal Yachandra

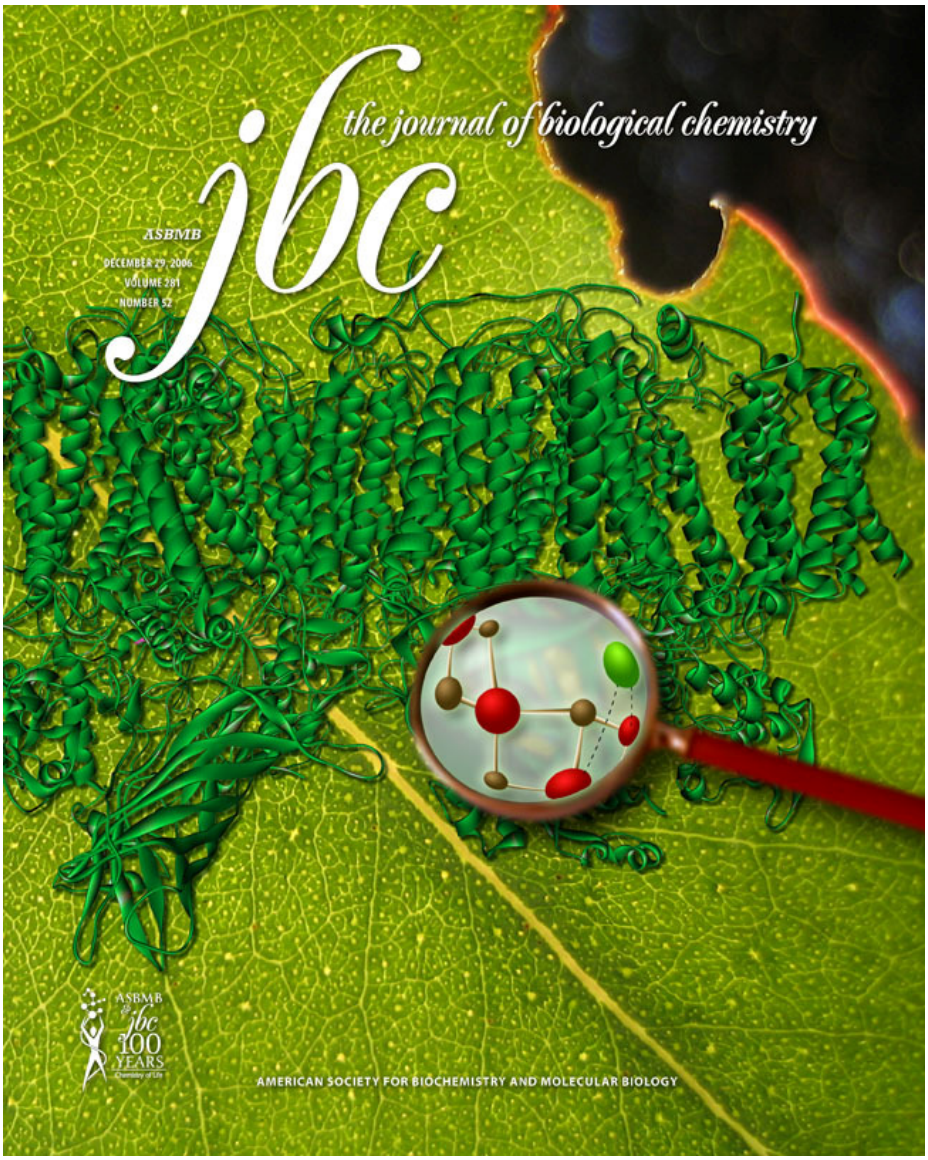
Type: Poster
Conference: Stanford Synchrotron Radiation Laboratory User Meeting
Date and place: October 2007, Menlo Park, CA
Title: Characterization of the binding and function of the Ca^{2+} and Cl^- cofactors of the water oxidation process in Photosystem II
Authors: Yulia Pushkar, Xi Long, Junko Yano, Kenneth Sauer, Alain Boussac, Vittal Yachandra

Type: Poster
Conference: Gordon research conference, Graduate Research Seminar: Bioinorganic Chemistry
Date and place: January 2008, Ventura, CA
Title: Direct interatomic X-ray spectroscopy detection of the Mn ligands in the Oxygen Evolving Complex of Photosystem II
Authors: Yulia Pushkar, Xi Long, Junko Yano, Uwe Bergmann, Vittal Yachandra

Featured on the journal cover:

"Asymmetric hydrogen-bonding of the quinone cofactor in Photosystem I probed by ^{13}C labeled naphthoquinones"

Yulia Pushkar, Herbert Zimmermann, John H. Golbeck, Dietmar Stehlik *J. Phys. Chem. B* **2004** 108 (27) 9439-9448.



Featured on the journal cover:

"Structure and orientation of the Mn_4Ca cluster in plant Photosystem II membranes studied by polarized range-extended X-ray absorption spectroscopy"

Yulia Pushkar, Junko Yano, Pieter Glatzel, Johannes Messinger, Azul Lewis, Kenneth Sauer, Uwe Bergmann, Vittal K. Yachandra *Journal of Biological Chemistry* **2007**, V. 282, N. 10, 7198-7208.