08/06/2004

Vladimir P. Shinkarev

Curriculum Vita

Department of Biochemistry
University of Illinois, 156 Davenport Hall,
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Personal:
Date of Birth: August 6, 1952
Permanent Resident of USA from 1994
Marital Status: Married, two children

Education

1978 Ph.D. Biophysics, The Lomonosov Moscow State University (MSU)
Thesis: "Kinetics of electron transfer in molecular complexes of bacterial photosynthesis"
1977 MS Mathematics, MSU, Russia
1975 MS Biology and Biophysics (with honors), MSU, Russia

Employment

2000 - present Research Associate Professor of Biochemistry, University of Illinois at Urbana-Champaign (UIUC)
1998 - present Research Associate Professor of Biophysics and Plant Biology, UIUC
1994 - 1998 Visiting Associate Professor of Biophysics and Plant Biology, UIUC
1990 - 1994 Visiting Research Associate, Departments of Physiology and Biophysics and Plant Biology, UIUC

1989 - 1994 Senior Scientist, Department of Biophysics, School of Biological Sciences, MSU, Russia (tenured)
1989 - 1990 Badminton Coach, Bauman Moscow State Technical University
1975 - 1989 Scientist, Department of Biophysics, School of Biological Sciences, MSU, Russia

Teaching Interests

- Physical biochemistry (molecular biophysics, molecular bioenergetics);
- Biochemistry;
- Bioinformatics, computational biology, and mathematical modeling.

Teaching Experience

2000-2001	Biophysics 354 (Biological energy conversion; discussions, lectures, and problem solving; UIUC)
2000	Biophysics 332 (Photosynthesis; as part of teaching team; UIUC)
1994 - present	Undergraduate and graduate student training at the College of Liberal Arts and Sciences (UIUC)
1989 - 1990	Badminton coach at the Moscow State Technical University
1986 - 1987	Mathematical statistics (lectures/discussions; MSU)
1984	Co-author of the textbooks "Thermodynamics of Biological Processes" (MSU) and “Electron Transfer in Biological Systems” (Nauka)
1980 - 1989	Stochastic processes in biochemistry and biophysics (lectures/discussions; MSU)

1979 - 1983 Undergraduate biophysics seminar (lectures, discussions and problem solving; MSU)
1978 – 1989 Undergraduate and graduate student advising at the School of Biological Sciences (MSU). Supervised 10 MS. and 3 Ph.D. Students

Research Interests

Our current research includes several interdisciplinary topics originated from our continuing interest in multienzyme membrane complexes involved in energy transduction during photosynthesis and respiration:

- Molecular mechanisms of electron and proton transfer in biological systems;
- The structure and function of membrane-bound multienzyme complexes;
- Biophysical chemistry of protein-cofactor and protein-protein molecular recognition;
- Biochemical and biophysical properties of photosynthetic reaction centers;
- Light-induced hydrogen production;
- Molecular mechanisms of quinone processing sites;
- Mathematical modeling and analysis of electron transfer and coupled processes in biological systems;
- Imaging of membranes and membrane proteins using AFM and NSOM.

Grant Support:

Grant Support - Active

National Institutes of Health, "Charge transfer reactions of the cytochrome bc_1 complex" 2R01GM053508, (competitive renewal of previous NIH grant), 2001-2005, $750,000 (dc)

- Colin A. Wraight, Principal Investigator
- Vladimir P. Shinkarev, Co-Principal Investigator

Grant Support - Past

United States Department of Agriculture, Photosynthesis/Respiration program of the National Research Initiative Competitive Grants Program (USDA/NRICGO AG94-37306-0343) 1994-1997, $130,000:

- Vladimir P. Shinkarev, Principal Investigator
- Colin A. Wraight, Co-Principal Investigator

National Institutes of Health, "Charge transfer reactions of the cytochrome bc_1 complex", (1R01GM053508, 1996-2000, $630,000 (dc):

- Colin A. Wraight, Principal Investigator
- Vladimir P. Shinkarev, Co-Principal Investigator

Honors

1986 Award of Moscow Scientific Society (founded in 1805) for the best work in Natural Sciences
1989, 1990 First and second prizes in the competition of best scientific works in the A.N. Belozersky Institute of Physico-Chemical Biology (MSU)
1993, 2002 Second and third places at the UIUC Badminton Club open tournaments

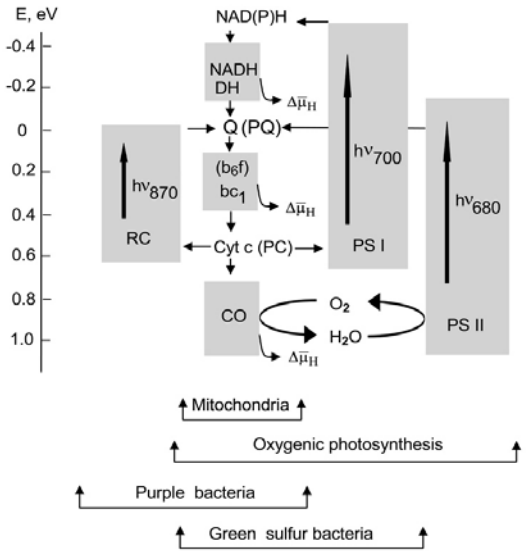
Professional Activities

- Referee of scientific manuscripts for the following journals:
  - *Biochemistry*
  - *Biochimica et Biophysica Acta, Bioenergetics*
  - *Biophysical Journal*
  - *FEBS Letters*
  - *EMBO Journal*
- Peer reviewer of grant proposals for:
  - United States Department of Agriculture (1994-present)
- Reviewer of Institute of Scientific and Technical Information (Moscow, Russia) on:
  - Bioenergetics, (1980 – 1990)
  - Theoretical and Mathematical Biophysics (1980 – 1990)

- Photosynthesis (1980 – 1990)

♦ Editor of Institute of Scientific and Technical Information on Bioenergetics (Moscow, Russia, 1989 – 1990)

Research Accomplishments



Kinetic and thermodynamic analysis of electron transfer in multienzyme complexes

- ♦ Development and application of the quantitative analysis of electron transfer in multienzyme complexes of respiration and photosynthesis (1975-present);
- ♦ Mathematical model of the flash-induced binary oscillations of ubisemiquinone in primary reactions of photosynthesis (1981);
- ♦ Kinetic and thermodynamic analysis of the interaction between cytochrome and reaction center (1982);
- ♦ General analytical model of charge accumulation at the donor and acceptor sides of the reaction center (2003).

Some of these results are reviewed in:

Rubin A.B. and Shinkarev V.P. (1984) Electron Transfer in Biological Systems. Nauka. Moscow, 320 pp.

Shinkarev V.P. (1998) The general kinetic model of electron transfer in photosynthetic reaction centers activated by multiple flashes. *Photochem. Photobiol.* 67, 683 - 699.

Electron transfer and coupled reactions in photosynthetic reaction centers

- ♦ Characterization of electron transfer and coupled electrogenic reactions of Q10 (ubiquinone) in membranes of phototrophic bacteria;
- ♦ First direct measurements of flash-induced binary oscillations of electric potential (by electrodes) in chromatophores of purple bacteria (1980);
- ♦ First direct electrometric measurements (by electrodes) of the electrogenic events in the bc_1 complexes. Correlation analysis of the Q_BH_2 generation in reaction center and electrogenic reactions of bc_1 complex (1987-1989);
- ♦ Discovery that lipophilic cations effectively screen the electric potential of Q_B^- at alkaline pH (1986);
- ♦ The role of histidine residues in binding of cofactors and electron transfer. Determination of pK of histidines, responsible for quinone binding (1988);
- ♦ First experimental indication that the proton channel is inhibited by specifically bound cations (1993). This observation was confirmed by subsequent works in this field;
- ♦ Phase II of carotenoid band shift is mainly due to the electrogenic protonation of the secondary acceptor quinone (1988; during 1971-1988 it was mostly attributed to the reaction between cytochrome c_2 and P870);
- ♦ Direct (with glass electrode) measurements of the flash-induced proton uptake by reaction centers at alkaline conditions in reaction centers from purple bacteria. Proton uptake by reaction centers at alkaline pH was attributed to single amino acid, and distance between quinone and this amino acid residue was estimated (1988). This prediction was confirmed by subsequent works in this field;
- ♦ Analysis of the flash-induced proton uptake by reaction centers in wild and mutant RCs of purple bacteria (1991- present);
- ♦ First direct measurements of intraprotein proton transfer in RCs (1990).

Some of these results are reviewed in:

Shinkarev V.P. (1990) Function of Quinones in Phototrophic Bacteria. Advances in Science and Technology, Biophysics Series (VINITI), Vol. 35, Moscow, 206 pp.

Shinkarev V.P. and Wraight C.A. (1993) Electron and proton transfer in the acceptor quinone complex of reaction centers of phototrophic bacteria. In: *The Photosynthetic Reaction Center* (J. Deisenhofer and J. Norris, eds.), Vol 1, Academic Press, New York pp. 193-255.

Oxygen evolution, electron transfer and energy transduction in Photosystem II

- ♦ Discovery of two parallel cycles of oxygen evolution in oxygenic photosynthesis (1993);
- ♦ Analysis of interaction between different quenchers of chlorophyll (Chl) *a* fluorescence in green plants (1993);
- ♦ Discovery of electrogenic nature of electron transfer between Y_Z and P680 in Photosystem II (1994);
- ♦ New method of analysis of kinetics of oxygen evolution in plants based on measurements of Chl *a* fluorescence (1995-1998);

- Complete analytical solution for the Kok model of oxygen evolution in photosynthesis (2003, solution for a 30-year old problem!);
- Quantitative description of the effects of intrathylakoid pH and xanthophyll cycle pigments on Chl *a* fluorescence lifetime distributions and intensity in thylakoids (1996-2000);
- Development of general *dynamic* model of oxygen evolution in plants which takes into account the kinetic and thermodynamic properties of electron transfer at the donor and acceptor sides of the PS II (1993-present);
- Quantitative analysis of the Kok model of oxygen evolution (2003-present).

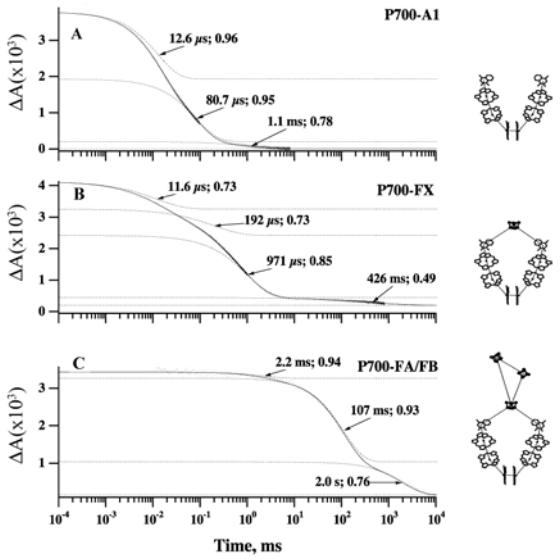
Some of these results are reviewed in:

Shinkarev V.P. (2004) The Photosystem II: Oxygen evolution and chlorophyll *a* fluorescence during multiple flash activation. In: *Chlorophyll Fluorescence: A Signature of Photosynthesis* (G.C. Papageorgiou and Govindjee, eds.), Chapter 8. Kluwer Academic Publishers, Dordrecht (*invited review, in print*).

Shinkarev V.P. (2004) Kinetics of O_2 Evolution. In: *Photosystem II: The Water/Plastoquinone Oxido-Reductase in Photosynthesis* (Wydrzynski T. and Satoh, K., eds), Chapter 22. Kluwer Academic Publishers, Dordrecht (*invited review, in print*).

Functional characteristics of electron transfer in Photosystem I

- A kinetic assessment of the sequence of electron transfer between iron-sulfur proteins in Photosystem I as $F_X \rightarrow F_A \rightarrow F_B$ (later confirmed by X-ray structural analysis; 1997-2000);
- Quantitative analysis of electron transfer and redox equilibrium between the iron-sulfur clusters in photosystem I (1997- present);
- Mathematical model of the flash-induced electron transfer in wild type and mutant Photosystem I complexes with phylloquinone and plastoquinone-9 in the A_1 site (2001- present).



Some of these results are reviewed in:

Shinkarev V.P. (2005) Functional Modeling of Electron Transfer in Photosynthetic Reaction Centers. In: *Photosystem I: The Plastocyanin: Ferredoxyn Oxidoreductase in Photosynthesis* (Golbeck J.H., editor).

Ubiquinone: cytochrome c oxidoreductase

- Functional characterization of the kinetics of the electron transfer and coupled processes in cytochrome bc_1 complex from purple bacteria (1987- present);
- First direct electrometric measurements of electrogenic phases of the bc_1 complex (1989-1993)
- First measurements of the kinetics of electron transfer between low and high-potential hemes in cytochrome bc_1 complex.
- Model of the modulation of the midpoint potential of the [2Fe-2S] Rieske iron sulfur protein by Q_o occupants in the bc_1 complex (2002-present)

Instrumentation

The following computer-controlled instruments were designed, constructed or modified:

- Multichannel spectrophotometer for high-throughput spectral analysis of multicomponent systems (1998-2001);
- Single-beam differential spectrophotometer with microsecond time resolution (1984-1985; 1994-1995);
- Instruments for fast measurements of electric potential and pH (1990; 1996);
- Instrument for measurements of fast flash-induced oxygen evolution (1994-1996);
- Pulse and probe fluorimeter (1994-1995).

Molecular mechanisms of quinone processing sites

- First determination of thermodynamic characteristics of acceptor quinones in the reaction centers of purple bacteria at *room temperature* (1983);
- Determination of rates of exchange of pool quinones with specific binding site at the reaction center protein (1985);
- Kinetic analysis of flash-induced binary oscillations of ubisemiquinone state in primary reactions of bacterial photosynthesis (1981-1998);
- Development of a new quantitative model of the interaction between RC protein, detergent, and quinone molecules (1995-1997);

- Kinetic characteristics of phylloquinone and plastoquinone-9 in the A_1 site of Photosystem I (2000-2002);
- Discovery of the main role of the Born energy in the kinetic stabilization of the semiquinone (2001-present)

Some of these results are reviewed in:

Shinkarev V.P. (1990) "Function of Quinones in Phototrophic Bacteria." Advances in Science and Technology, Biophysics Series (VINITI), Vol. 35, Moscow, 206 pp.

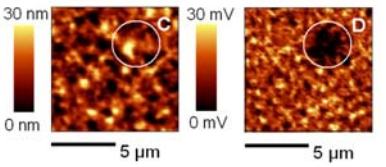
Shinkarev V.P. and Wraight C.A. (1993) Electron and proton transfer in the acceptor quinone complex of reaction centers of phototrophic bacteria. In: *The Photosynthetic Reaction Center* (J. Deisenhofer and J. Norris, eds.), Vol 1, Academic Press, New York pp. 193-255.

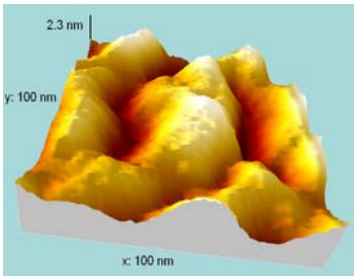
Shinkarev V.P. (2004) The Photosystem II: Oxygen evolution and chlorophyll *a* fluorescence during multiple flash activation. In: *Chlorophyll Fluorescence: A Signature of Photosynthesis* (G.C. Papageorgiou and Govindjee, eds.), Chapter 8. Kluwer Academic Publishers, Dordrecht (*invited review, in print*).

Analysis of bc_1 complex reactions by Fourier transform infrared (FTIR), ATR FTIR and step-scan FTIR

- First characterization of interaction of specific inhibitors with isolated bc_1 complex.

Imaging (scanning probe microscopy)





- Use of near field scanning optical microscopy (NSOM) for characterization of structures formed after fusion of membrane vesicles (chromatophores) from the purple bacterium *Rhodobacter sphaeroides* with phospholipid layers supported on artificial films (1998-present)
- The application of near-field scanning optical microscopy (NSOM) for analysis of the structures of typical photosynthetic membrane objects such as chloroplasts and thylakoids from spinach and chromatophores from purple bacteria. To our knowledge, this is the first application of NSOM for imaging chromatophores from photosynthetic bacteria and intact thylakoids from higher plants (1998-present)
- Use of the atomic force microscopy (AFM) to characterize supercomplexes of bacterial membranes (1998 – present)

Some of these results are reviewed in:
Shinkarev V.P., Brunner R. and Wraight C.A. (1999) Application of near-field scanning optical microscopy in photosynthesis research. *Photosynth. Res.* 61, 181-191

Recent Invited Lectures

- "The cytochrome bc_1 complex: Structure, mechanisms and modeling" - Rice University, April 2001;
- "Multienzyme complexes in photosynthesis" - University of Nebraska at Lincoln, May 2001;
- "Modeling of energy transduction in multienzyme complexes" - Virginia Bioinformatics Institute, January 2002;
- "Multienzyme complexes of energy transducing biomembranes: Structure, mechanisms, regulation, modeling and evolution" - University of Denver, June 2002.

Other Activities

- Tutor for students at MSU and UIUC (biophysics, calculus, differential equations, complex variables, probability, stochastic processes, statistics, linear algebra, etc.);
- Consultant (biophysics, mathematical modeling and computational biology, instrumentation, scanning probe microscopy);
- Professional badminton. Member of the University of Illinois Badminton Club for over 12 years.
- Mountains hiking.

Publications

Books:

Rubin A.B. and Shinkarev V.P. (1984) *Electron Transfer in Biological Systems*. Nauka. Moscow, 320 pp.

Shinkarev V.P. (1990) *Function of Quinones in Bacterial Photosynthesis*. Advances in Science and Technology, Biophysics Series (VINITI), Vol. 35, Moscow, 206 pp.

Selected publications (out of 100+)

Drachev L.A., Kaurov B.S., Mamedov M.D., Mulkidjanian A.Ja., Semenov A.Yu., Shinkarev V.P., Skulachev V.P. and Verkhovsky M.I. (1989) Flash-induced electrogenic events in the photosynthetic reaction center and bc_1 complexes of *Rhodobacter sphaeroides* chromatophores. *Biochim. Biophys. Acta*, 973, 189-197.

Shinkarev V.P., Drachev A.L. and Dracheva S.M. (1990) The thermodynamic characteristics of four-heme cytochrome c in *Rhodopseudomonas viridis* reaction centers, as derived from a quantitative analysis of the differential absorption spectra in α - domain. *FEBS Lett*. 261, 11-13.

Drachev L.A., Mamedov M.D., Mulkidjanian A.Ja., Semenov A.Yu., Shinkarev V.P. and Verkhovsky M.I. (1990) Electrogenesis associated with proton transfer in the reaction center protein of purple bacteria *Rhodobacter sphaeroides. FEBS Lett.* 259, 324-326.

Shinkarev V.P., Verkhovsky M.I., Sabo Ja., Zakharova N.I., Seyfullina N.Kh. and Kononenko A.A. (1990) Characterization of quinone reactions in reaction center preparations from *Chromatium minutissimum*. *Biol. Membranes* (Moscow) 7, 368 - 381.

Shinkarev V.P., Drachev A.L., Drachev L.A., Mamedov M.D., Mulkidjanian A.Ja., Semenov A.Yu. and Verkhovsky M.I. (1990) Electron transfer and electrogenic reactions in *bc* complex of purple bacteria. In: *Molecular Biology of Membrane-Bound Complexes in Phototrophic Bacteria* (Eds. G. Drews and E.A. Daves). Plenum Press, New York, pp. 393-400.

Mulkidjanian A.Y., Mamedov M.D., Semenov A.Y., Shinkarev V.P., Verkhovsky M.I., and Drachev L.A. (1990) Partial reversion of the electrogenic reaction in the ubiquinol- cytochrome c_2 oxidoreductase of *Rhodobacter sphaeroides* chromatophores under neutral and alkaline conditions. *FEBS Lett.* 277, 127-130.

Semenov A.Yu., Mamedov M.D., Shinkarev V.P., Verkhovsky M.I. and Zakharova N.I. (1990) The electrogenic events associated with the reduction of secondary quinone acceptor in *Rhodobacter sphaeroides* reaction centers. In: *Molecular Biology of Membrane-Bound Complexes in Phototrophic Bacteria* (Eds. G. Drews and E.A. Daves). Plenum Press, New York, pp. 329-335.

Mamedov M.D., Shinkarev V.P., Verkhovsky M.I. and Semenov A.Yu. (1990) Protonation of secondary quinone in proteoliposomes with reaction centers of *Rhodobacter sphaeroides*. *Biol. Membranes* (Moscow) 7,730-735.

Shinkarev V.P., Verkhovsky M.I., Sabo Ja., Zakharova N.I. and Kononenko A.A. (1991) Properties of photosynthetic reaction centers isolated from chromatophores of *Chromatium minutissimum*. *Biochim. Biophys. Acta. Bioenergetics* 1098, 117-126.

Kutuzov M.A., Mamedov M.D., Semenov A.Y., Shinkarev V.P., Verkhovsky M.I., Abdulaev N.G. and Drachev L.A. (1991) Functioning of quinone acceptors in the reaction center of the green photosynthetic bacterium *Chloroflexus aurantiacus*. *FEBS Lett*. 289, 179-182.

Shinkarev V.P., Drachev L.A., Mamedov M.D., Mulkidjanian A.Ja., Semenov A.Yu. and Verkhovsky M.I. (1993) Effect of pH and ionic strength on kinetics of generation of electric potential in chromatophores of *Rhodobacter sphaeroides*. *Biochim. Biophys. Acta. Bioenergetics* 1144, 285-294.

Shinkarev V.P. and Wraight C.A. (1993) Electron and proton transfer in the acceptor quinone complex of reaction centers of phototrophic bacteria. In: *The Photosynthetic Reaction Center* (J. Deisenhofer and J. Norris, eds.), Vol 1, Academic Press, New York pp. 193-255.

Shinkarev V.P. and Wraight C.A. (1993) Oxygen evolution in photosynthesis. From unicycle to bicycle. *Proc. Natl. Acad. Sci. USA*, 90, 1834-1838.

Shinkarev V.P., Takahashi E. and Wraight C.A. (1993) Flash-induced electric potential generation in wild type and L212EQ mutant chromatophores of *Rhodobacter sphaeroides*: QH_2 is not released from L212EQ mutant reaction centers. *Biochim. Biophys. Acta. Bioenergetics* 1142, 214-216.

Shinkarev V.P. and Wraight C.A. (1993) Kinetic factors in the bicycle model of oxygen evolution by Photosystem II. *Photosynth. Res.* 38, 315-321.

Shinkarev V.P., Takahashi E. and Wraight C.A. (1993) Electrostatic interactions and flash-induced proton uptake in reaction centers from *Rb. sphaeroides*. In: *The Photosynthetic Bacterial Reaction Center II. Structure, Spectroscopy, and Dynamics* (J. Breton and A. Vermeglio, eds), Plenum Press, New York, pp. 375-387.

Shinkarev V.P. and Govindjee (1993) A new insight into the relationship of chlorophyll a fluorescence yield to the concentration of its natural quenchers in plant photosynthesis. *Proc. Natl. Acad. Sci. USA*, 90, 7466-7469.

Mamedov M.D. Lovyagina E.R., Verkhovsky M.I., Semenov A.Yu., Cherepanov D.A. and Shinkarev V.P. (1994) Generation of electric potential difference by Photosystem II from thermophilic cyanobacteria. *Biochemistry* (Moscow) 59, 685-689.

Shinkarev V.P. (1996) Binary oscillations in the Kok model of oxygen evolution in oxygenic photosynthesis. *Photosynth. Res.* 48, 411-417.

Shinkarev V.P., Xu C., Govindjee and Wraight C.A. (1997) Kinetics of the oxygen evolution step in plants determined from flash-induced chlorophyll a fluorescence. *Photosynth. Res*. 51, 43-49.

Shinkarev V.P. and Wraight C.A. (1997) The interaction of quinone and detergent with reaction centers of purple bacteria. I. Slow quinone exchange between reaction center micelles and pure detergent micelles. *Biophys. J*. 72, 2304-2319.

Shinkarev V.P. (1998) The general kinetic model of electron transfer in photosynthetic reaction centers activated by multiple flashes. *Photochem. Photobiol*. 67, 683 - 699.

Gilmore A.M., Shinkarev V.P., Hazlett T.L. and Govindjee (1998) Quantitative analysis of the effects of intrathylakoid pH and xanthophylls cycle pigments on chlorophyll *a* fluorescence lifetime distributions and intensity in thylakoids. *Biochemistry* 37, 13582-13593.

Vassiliev, I.R., Shinkarev V.P., and Golbeck J.H. (1999) Electron transfer and redox equilibrium between the iron-sulfur clusters in photosystem I: F_B is the terminal acceptor. In: *Photosynthesis: Mechanisms and Effects*, Vol. I, (G. Garab, ed.), pp. 655-658, Kluwer, Dordrecht, Netherlands.

Shinkarev V.P., Brunner R., White J.O. and Wraight C.A. (1999) The structure of chromatophores from purple photosynthetic bacteria fused with lipid-impregnated collodion films determined by near-field scanning optical microscopy. *FEBS Lett.* 452, 223-227.

Shinkarev V.P., Brunner R. and Wraight C.A. (1999) Application of near-field scanning optical microscopy in photosynthesis research. *Photosynth. Res.* 61, 181-191.

Shinkarev V.P., Vassiliev I.R. and Golbeck J.H. (2000) A Kinetic assessment of the sequence of electron transfer from F_X to F_A and further to F_B in Photosystem I. The value of the equilibrium constant between F_X and F_A. *Biophys. J.* 78, 363–372.

Shinkarev V.P., Ugulava N.B., Takahashi E., Crofts A.R. and Wraight C.A. (2000) Aspartate-187 of cytochrome b is not needed for DCCD inhibition of ubiquinol: cytochrome c oxidoreductase in *Rhodobacter sphaeroides* chromatophores. *Biochemistry* 39, 14232-14237.

Shinkarev V.P., Ugulava N.B., Crofts A.R. and Wraight C.A. (2000) DCCD inhibits the reactions of the iron-sulfur protein in *Rhodobacter sphaeroides* chromatophores. *Biochemistry* 39, 16206-16212.

Shinkarev V.P., Crofts A.R. and Wraight C.A. (2001) The electric field generated by photosynthetic reaction center induces rapid oxidation of the high potential heme in the bc_1 complex. *Biochemistry 40,* 12584-12590.

Shinkarev V.P., Zybailov B., Vassiliev I.R., and Golbeck J.H. (2002) Modeling of the $P700^+$ charge recombination kinetics with phylloquinone and plastoquinone-9 in the A_1 site of Photosystem I. *Biophys. J. 83*, 2885–2897.

Crofts A.R., Shinkarev V.P., Dikanov S., Samoilova R., and Kolling D. (2002) Interactions of quinone with the iron-sulfur protein of the bc_1 complex: Is the mechanism spring-loaded? *Biochim. Biophys. Acta. Bioenergetics* 1555, 48-53.

Shinkarev V.P., Kolling D., Miller T.J., and Crofts A.R. (2002) Modulation of the midpoint potential of the [2Fe-2S] Rieske iron sulfur center by Q_o occupants in the bc_1 complex *Biochemistry 41*, 14372-14382.

Shinkarev V.P. (2003) Oxygen evolution in photosynthesis: Simple analytical solution for the Kok model. *Biophys. J. 85***,** 435–441.

Crofts A.R., Shinkarev V.P., Kolling D.R.J. and Hong S.J. (2003) The modified Q-cycle explains the apparent mismatch between the kinetics of reduction of cytochromes c_1 and b_H in the bc_1 complex. *J. Biol. Chem.* 278, 36191 - 36201.

Shinkarev V.P. (2004) The Photosystem II: Oxygen evolution and chlorophyll *a* fluorescence during multiple flash activation. In: *Chlorophyll Fluorescence: A Signature of Photosynthesis* (G.C. Papageorgiou and Govindjee, eds.), Chapter 8, pp. 197-229. Kluwer Academic Publishers, Dordrecht.

Shinkarev V.P. (2004) Kinetics of O_2 Evolution. In: *Photosystem II: The Water/Plastoquinone Oxido-Reductase in Photosynthesis* (Wydrzynski T. and Satoh, K., eds), Chapter 22. Kluwer Academic Publishers, Dordrecht (*in print*).

Shinkarev V.P. (2005) Functional Modeling of Electron Transfer in Photosynthetic Reaction Centers. In: *Photosystem I: The Plastocyanin: Ferredoxin Oxidoreductase in Photosynthesis* (Golbeck J.H., editor) Chapter 35. Kluwer Academic Publishers, Dordrecht.

Manuscripts under review or in preparation:

Kokhan O., Shinkarev V.P. and Wraight C.A. The activity of the bc_1 complex isolated with Ni-NTA metal-affinity chromatography is inhibited by residual Ni (to be submitted to *FEBS Lett.*).

Shinkarev V.P. and Crofts A.R. Intermonomer electron transfer in dimer of bc_1 complex (to be submitted to *J. Biol. Chem.*).

Shinkarev V.P. and Wraight C.A. Global probing of dielectric structure of photosynthetic reaction center (to be submitted to *Biophys. J.*)

Shinkarev V.P. Factors controlling stabilization of coenzyme Q10 semiquinone at the binding site of enzyme (to be submitted to PNAS).

Shinkarev V.P. Flash-induced oxygen evolution in photosynthesis. Simple solution for the extended S-state model that includes misses, double hits, inactivation and backward transitions (submitted to *Biophys. J*)

Shinkarev V.P., Crofts A.R., Fernandez-Velasco J. G. and Wraight C.A. Antimycin A titration of the pre-steady-state kinetics of cytochromes in bc_1 complex (to be submitted to *J. Biol. Chem.*).

Takahashi E., Wraight C.A. and Shinkarev V.P. A partial model for the secondary acceptor quinone binding site of Photosystem II. Site-directed mutations Glu^{L-212}→His and Asp^{L-213}→His in the purple bacteria reaction center (to be submitted to Biochemistry).

Wells T.A., Shinkarev V.P., Crofts A.R. and Wraight C.A. FTIR characterization of antimycin binding site in isolated cytochrome $\underline{bc}_1$ complex from *Rhodobacter sphaeroides* (to be submitted to *FEBS Lett.*).

May 30, 2004

VLADIMIR P. SHINKAREV

LIST OF MAIN PUBLICATIONS
(Includes refereed papers, proceedings, books and book chapters)

1. Shinkarev V.P. and Venediktov P.S. (1977) Probability description of the processes of electron transfer in the molecular complexes. *Biophysics (Moscow)* 22, 413 - 417.
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Manuscripts under review or in preparation:

Kokhan O., Shinkarev V.P. and Wraight C.A. The activity of the bc_1 complex isolated with Ni-NTA metal-affinity chromatography is inhibited by residual Ni (to be submitted to *FEBS Lett.*).

Shinkarev V.P. and Crofts A.R. Intermonomer electron transfer in dimer of bc_1 complex (to be submitted to *J. Biol. Chem.*).

Shinkarev V.P. and Wraight C.A. Global probing of dielectric structure of photosynthetic reaction center (to be submitted to *Biophys. J.*)

Shinkarev V.P. Factors controlling stabilization of coenzyme Q10 semiquinone at the binding site of enzyme (to be submitted to PNAS).

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