

CURRICULUM VITAE

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Date of Birth: November 18, 1966

Education: 1987, B.S (Physics) American University of Beirut, Beirut, Lebanon
1987-1989, M.Sc. program (not completed), Physics Department,
American University of Beirut, Beirut, Lebanon
1993, PhD, Medical College of Wisconsin, Milwaukee, WI
(National Biomedical ESR center, James S. Hyde, Advisor)

Research experience

1993-1996 Postdoctoral Fellowship, Jules Stein Eye Institute, UCLA (Wayne L. Hubbell, Advisor)
1996-2000 Assistant Professor of Biophysics and Ophthalmology, Medical College of Wisconsin
2000-2002 Assistant Professor, Department of Molecular Physiology and Biophysics, Vanderbilt University
2002-2006 Associate Professor, Department of Molecular Physiology and Biophysics, Vanderbilt University
2006- Professor, Department of Molecular Physiology and Biophysics, Vanderbilt University. Adjunct Professor, Departments of Physics and Chemistry

Honors:

Fellow-American Association for the Advancement of Science
Stanley Cohen Award for Research Bridging Diverse Disciplines
Chancellor Award for Research, Vanderbilt University: 2006
Teacher of the year award 2001

Teaching experience (only substantial teaching commitments are listed):

9/1997 Course director and sole lecturer. *Quantum mechanics for magnetic resonance*. Medical College of Wisconsin.
9/1999 Lecturer. *Nuclear Magnetic resonance*. Medical College of Wisconsin.
9-2001 Lecturer and course director. *Protein structure and function*, Interdisciplinary graduate program (IGP) Bioregulation course. Vanderbilt University

- 9-2002 Lecturer and Course director (24 hours). *Protein structure and function*, IGP Bioregulation course. Vanderbilt University.
- 9-2003 Lecturer and Course director (24 hours). *Protein structure and function*, IGP Bioregulation course. Vanderbilt University.
- 2010- Lecturer. *Introduction to chemical and physical biology* CPB306, Vanderbilt University
- 2013-2015 Course director and lecturer for IGP/CPB module on *advanced membrane protein biology* Vanderbilt University
- 2013- 2016 Course co-director and lecturer for IGP/CPB module on *protein-protein interactions* Vanderbilt University
- 2015- Course director and main lecture for IGP/CPB module “Introduction to membrane protein structure and function”
- 2016- Course Director. *Introduction to chemical and physical biology* CPB306, Vanderbilt University

Undergraduate Student training.

Celia Fung. (1995- 1997). Fellowship Program, UCLA medical school.
 Coryn Carver. (1997-1998). MIT
 Neema Salimi. (2002). University of California, San Francisco.
 Ambalavanan, Madhumitha. (2003) Vanderbilt University.
 Kristin Trone (2011) Stanford University
 Sara Howard (2016-2018) Vanderbilt University

Graduate student training.

Andree Berengian, (1996-1999), Pacific Health Care.
 Jinhui Dong, (2001- 2005). Assistant Professor, Vanderbilt University.
 Sepan Amadi, (2004-2010). Postdoctoral Fellow, University College London
 Derek Claxton, (2005-2010). Postdoctoral Fellow, Vollum Institute, laboratory of Eric Gouaux
 Ezelle McDonald (2005-2011). Postdoctoral Fellow, Saint Jude’s, Memphis TN
 Laurel Hoffman (2006-2011). Scientist, Bristol-Myers Squibb
 Robel Yirdaw (Physics) (2006-2012). Research assistant professor, University of Texas Southwestern
 Kelli Kazmier (2008-2013). Assistant Professor, Hillsdale College
 Sanjay Mishra (2012- 2018)
 Francisco Rodriguez (2011-2016)
 Kevin Jagessar (2012-)

Postdoctoral Trainees.

Hasigae Sathish, 2001-2003, Scientist II, Medimmune.
 Khaled Boddor, 2001- 2002. Associate Professor, University of Amman, Jordan.
 Marco Bortolus (2005-2006). Assistant Professor, University of Padova, Italy.

Smriti Smriti (2006-). Research Instructor, Vanderbilt University
 Ping Zou (2006-2014): Molecular Geneticist at Ovation Fertility (Nashville, TN)
 Ryan Steed (2010-2014). Assistant Professor, University of North Carolina- Asheville.
 Shruti Sharma (2010-2014) Software Engineer, Ingram content group
 Brandy Verhalen (2011-2014). Postdoctoral fellow. University of Alabama, Birmingham.

Doctoral Dissertation Committees.

Candice Klug, Medical College of Wisconsin (1997-1999)
 Marilyn Ritchie, Vanderbilt University (2002-2004)
 Zou Zheng., Vanderbilt University (2003-2006)
 Sue Hansen, Vanderbilt University (2003-2005)
 Susan Saban, Vanderbilt University (2004-2007)
 Will Oldham, Vanderbilt University (2004-2006)
 Ximing Qin, Vanderbilt University (2006-)
 Junkai Xu, Vanderbilt University (2005-2007)
 Brandon Lute, Vanderbilt University (2004-2008)
 Xiaoming Zhou, Vanderbilt University (2006-2009)
 Erica Bowton, Vanderbilt University (2005-2009)
 Patrick Robertson, Vanderbilt University (2006-2010)
 Sonya Dave, Vanderbilt University (2008-2010)
 Julia Koheler, Vanderbilt University (2008-2012)
 Sunghoon Kim, Vanderbilt University (2008-2012)
 Ryan Balbridge, Vanderbilt University (2009-2013)
 Kristopher Burkewitz, Vanderbilt University (2009-2012)
 Peter Hamilton, Vanderbilt University (2010-2014)
 Andrea Bellovich, Vanderbilt University (2013-2016)
 Axel Fisher, Vanderbilt University (2013-2017)
 Brain Bender, Vanderbilt University (2014-2018)
 Cody Seacrest, Vanderbilt University (2016-)
 Jenny Aguilar, Vanderbilt University (2015-)
 Aparna Shekar, Vanderbilt University (2015-)

Research and Training Service

- Member, Graduate education committee, 2001- 2004. Department of Molecular Physiology and Biophysics, Vanderbilt University.
- Member, Computational biology search committee, center for structural biology. 2004
- Director of graduate studies, Department of Molecular Physiology and Biophysics, Vanderbilt University.2004-2007.
- Member, Strategic plan committee, Vanderbilt University medical center. 2009
- Chair, cryoEM faculty search committee, Department of Molecular Physiology and Biophysics. 2012
- Member, Search committee, Chair of Biochemistry. Vanderbilt University. 2012.
- Director of graduate studies, Chemical and Physical Biology Program, Vanderbilt University.2007-2012
- Director, Chemical and Physical Biology Program, Vanderbilt University. 2012-2105
- Director, Quantitative and Chemical Biology admission program, Vanderbilt University. 2014-

- Member, Tenure and Promotion Committee, School of Medicine, Vanderbilt University. 2016-2017.

Scientific Service

Grant Review

- Member of Anterior Eye Diseases study section (2004-2008)
- Member of Biophysics of Neuronal Systems study section (2008-2010)NIH Ad hoc member: MDCN-3, SSB-3, BSCT, BPNS
- Ad Hoc reviewer: National Science Foundation

Conference organization

Organizer, Spin labeling session. 46th rocky mountain conference on analytical chemistry.

Organizer, 2008, 2009 International EPR symposium, rocky mountain conference on analytical chemistry.

Vice-chair, Gordon Research Conference on Mechanisms of Membrane Transport. 2015

Chair, Gordon Research Conference on Mechanisms of Membrane Transport. 2017

Manuscript Editing and Reviewing

Editorial board member: Biophysical Journal (2009-2015); Journal of Biological Chemistry (2010-2015).

Reviewer: Science, Nature, PNAS, Biochemistry, FEBS letters, Journal of Biological Chemistry, Journal of Molecular Biology, Biophysical Journal, EMBO Journal, Journal of Chemical Physics, Structure.

Advisory Panels

Executive Committee, Membrane protein structural dynamics consortium. 2010-2018

Panel member, National Eye Institute's strategic plan 2004-2009 and 2011-2015.

Board of Scientific counselors NHLBI and NINDS, Ad hoc.

Funding:

Current

1- “Molecular Basis of Lens Transparency”

Principal Investigator: HS Mchaourab

Agency: NIH/NEI

R01 EY12018 (Mchaourab, Hassane S PI) 2/1/98-2/28/2019

Renewal Pending

Molecular Basis of Lens Transparency. Goal: The proposed research plan will attempt, for the first time, to challenge mechanistic *in vitro* hypotheses and models of lens protein stability and α -crystallin chaperone function in the intact lens of zebrafish (*Danio rerio*). Aim 1 will continue our productive studies of α -crystallin structure and mechanism. We will test if a structural model of α -crystallin activation, developed in the previous funding period, explains the evolutionary variation in chaperone properties and the loss of binding regulation in mutants of α -crystallin associated with human autosomal dominant hereditary cataracts. Aim 2 proposes to generate transgenic zebrafish

models to determine how α -crystallin chaperone affinity is shaped by the crowded environment of the lens fiber cells and whether cataract phenotypes can be rescued by engineered α -crystallin with designed functional properties.

2- Structural Dynamics of Multidrug Resistance Transporters.

Principal Investigator: HS Mchaourab

Agency: NIH/NIGMS

Type: R01 GM077659 Period: 03/01/2006-02/28/2019.

The long term goal of this proposal is define the conformation motion that transduces energy input to the mechanical work of substrate translocation in MDR transporter superfamilies. The goal of the next funding period is to elucidate the conformational cycle of the recently characterized family of multidrug and toxic compound extrusion (MATE) transporters that have been associated with bacterial resistance to new generation of antibiotics and implicated in disposition for drugs in humans.

3- The Membrane Protein Structural Dynamics Consortium (Vanderbilt Subcontract)

Agency: NIH/NIGMS

Type: U54 GM084757 Period: 07/01/2010 – 09/01/2018

Vanderbilt Subcontract: To use double electron-electron resonance (DEER) spectroscopy to characterize the conformational dynamics of the human multidrug transporter P-glycoprotein and the bacterial homolog of neurotransmitter transporters LeuT. Pending

Subcontracts:

1R01GM1131195-01A1 (Mchaourab) 09/01/2016-05/30/2020 NIGMS

Mechanisms of CLC transporters and channels

Vanderbilt Subcontract from Stanford: To characterize the elusive outward-facing (OF) and inward-facing (IF) states of the CLC transporter by: (1) double electron-electron resonance (DEER) to measure distance changes between pairs of site-directed spin labels on CLC-ec1; (2) electron paramagnetic resonance (EPR) to evaluate changes in the accessibility of spin labels placed in the lumens along the ion translocation pathways.

2R01 DC007664-11A1 (UCSF sub) 02/08/2017-04/30/2021 NIDCD

Structural Studies of Ion Channel Assembly and Signaling Complexes

The major goal of this project is to study the structural biology of potassium channel regulation.

1R01 GM123410 (Mchaourab) 08/01/2017-04/30/2021 NIGMS

New Nitroxide Spin Labels for Distance Measurements in Biological Systems

Tests on various membrane proteins will be carried out in collaborators labs to determine potential usefulness of the labels and their connections to specific biological problems. C-Labels will be employed for in vivo DEER distance measurements; the spin labels will be incorporated in selected proteins via SDSL into MsbA. The samples will be flash frozen for DEER measurements.

1R01 GM063919 (UCLA, Bowie) 07/01/2018-06/30/2023NIH

Membrane Protein Folding

The Mchaourab laboratory will carry out advanced EPR studies on the CLC transporter designed to investigate its structure in lipid bilayers. The feasibility of this approach has been established through previous collaborations and publications in the Mchaourab lab.

1R01 HL144131-01 (Kenworthy) 06/01/2018-04/30/2022

NIH

Structural basis for caveolae assembly and function

The goal of this proposal is to define the atomic-level structure of caveolin-1 (Cav1) complexes that serve as the fundamental building blocks of caveolae. The aims are to 1) define the overall architecture of Cav1 complexes and identify key determinants of their structure and stoichiometry and 2) map the organization of Cav1 within complexes and define structural changes in the protein associated with the monomer to oligomer transition.

Pending:1R01 GM128087-01A1 (Mchaourab) 10/01/2018-83/31/2022 Fundable score**Structural dynamics of peptide-translocating ABC transporters**

NIH

The long term goal of this application is to illuminate the conformational dynamics of peptidase-containing ABC transporters (PCATs) which contain a cysteine protease domain that cleaves the signal sequence of the cargo peptide prior to export. The aims are designed to address outstanding questions in the field including the structural basis of alternating access powered by ATP turnover, the determinants of cargo protein specificity, and the structure and environment of the cargo protein as it transitions through the transporter. The significance of the proposed research stems from a molecular target at the junction of antibacterial peptide transport, bacterial immunity and represents a fundamental biochemical process by which proteins are exported across lipid bilayers.

2R01 EY012018-21 (Mchaourab) 04/01/2019-03/31/2024

NIH (NEI) \$383,830

Molecular Basis for Lens Transparency

Goal: The long term goals of this research program is to illuminate the mechanistic principles that describe small heat-shock proteins (sHSP) chaperone activity, reveal the sequence and structural elements underlying their oligomer dynamics and polydispersity, and define their physiological roles in the context of the proteostasis network. Premised on a detailed mechanistic model and grounded in discoveries in the previous funding period, this renewal will test two hypotheses describing the physiological roles of α -crystallins. Aims 1 and 2 will use zebrafish lines genetically engineered with compromised oxidative response, reduced chaperone capacity or expressing truncated crystallins to experimentally test the long-standing paradigm in the field that α -crystallins bind and sequester aggregation-prone proteins *in vivo*. Aim 3 will follow up on our recent discovery that α B-crystallin is critical for survival of zebrafish under stress.

Role: PI

1R01 UNIV (OHSU, Mchaourab) 04/01/2019-03/31/2024

Structure and Function of Neurotransmitter Transporters

NIH

Goal: The Mchaourab group at Vanderbilt University will be conducting electron paramagnetic resonance (EPR) experiments to map ligand-dependent conformational changes of SERT and DAT. Specifically, we will determine distance distributions between pairs of spin labels using Double Electron Electron Resonance (DEER).

1R35 GM (Mchaourab) 05/01/2019-04/30/2024

Structural Dynamics of Active Transporters

NIH \$448,228

Goal: This MIRA proposal will continue support of two long-standing, productive research programs focused on addressing these questions for multiple families of transporters. Our approach capitalizes on the tool kit of EPR spectroscopy in the context of high resolution structures, is informed by functional studies, and is contextualized through collaborative molecular modeling efforts. Project 1, motivated and grounded in the contribution of the PI's group, seeks to decipher ion-substrate coupling, to define conserved elements of alternating access, and to reveal specific transporter-lipids interactions that shape the energy landscape of conformational changes in two families of ion-coupled multidrug resistance (MDR) transporters. Project 2 will expand a long-standing investigation of energy transduction and alternating access of ATP-binding cassette (ABC) efflux transporters to the peptidase-containing ABC transporters (PCATs) subfamily, which specializes in the export of entire protein domains. PCAT structures have only been recently elucidated setting the stage for a detailed interrogation of the conformational dynamics underlying the movement of bacteriocins and quorum sensing peptides across membranes

Publications:

I have published more than 100 peer-reviewed articles. Analysis of my publications using Google Scholar on 8/1/2018 returned a total of 7300 citations (calculated h index of 46). A full publication list can be found at:

<http://www.ncbi.nlm.nih.gov/sites/myncbi/hassane.mchaourab.1/bibliography/40970896/public/?sort=date&direction=ascending>.

1. **Mchaourab HS**, Christidis TC, Froncisz W, Sczaniecki PB, and Hyde JS. Multiple quantum electron-electron double resonance. *J. Magn. Reson.* **92**, 420 (1991).
2. **Mchaourab HS** and Hyde JS. Continuous wave multiquantum EPR spectroscopy. III. Theory of intermodulation sidebands. *J. Chem. Phys.* **98**, 1786 (1993).
3. **Mchaourab HS** and Hyde JS. Dependence of the multiquantum EPR signal on the spin-lattice relaxation time. Effect of oxygen in spin-labeled membranes. *J. Magn. Reson.* **101B**, 1748 (1993).
4. **Mchaourab HS**, Pfenninger S, Antholine WE, Felix CC, Hyde JS, and Kroneck PMH. Multiquantum EPR of the copper mixed valence site in nitrous oxide reductase. *Biophys. J.* **64**, 1576 (1993).
5. **Mchaourab HS**, Christidis TC, and Hyde JS. Continuous wave multiquantum EPR spectroscopy. IV. Multiquantum electron-nuclear double resonance. *J. Chem. Phys.* **99**, 4975 (1993).
6. **Mchaourab HS**, Hyde JS, and Feix JB. Aggregation state of spin-labeled cecropin AD in solution. *Biochemistry* **32**, 11895-11902 (1993).
7. **Mchaourab HS**, Hyde JS, and Feix JB. Binding and state of aggregation of spin-labeled cecropin AD in phospholipid bilayers: effects of surface charge and fatty acyl chain length. *Biochemistry* **33**, 6691-6699 (1994).

8. Strangeway RA, **Mchaourab HS**, Luglio JR, Froncisz W, and Hyde JS. A general multipurpose multiquantum EPR spectrometer. *Rev. Sci. Instrum.* **66**, 4516-4528 (1995).
9. Hyde JS, **Mchaourab HS**, Strangeway RA, and Luglio JR. Multiquantum ESR: physics, technology, and applications to bioradicals. *Magn. Reson. Med.* [Japan] **6**, 16-18 (1995).
10. Hyde JS, Strangeway RA, Luglio J, **Mchaourab HS**, and Froncisz W. Noise in EPR bridges with multiple time-locked microwave frequencies. *Bull. Magn. Reson.* **17**, 54-60 (1995).
11. Singh RJ, Feix JB, **Mchaourab HS**, Hogg N, and Kalyanaraman B. Spin-labeling study of the oxidative damage to low-density lipoprotein. *Arch. Biochem. Biophys.* **320**, 155-161 (1995).
12. Singh RJ, Hogg N, **Mchaourab HS**, and Kalyanaraman B. Physical and chemical interactions between nitric oxide and nitroxides. *Biochim. Biophys. Acta* **1201**, 437 (1995).
13. **Mchaourab HS**, Lietzow MA, Hideg K, and Hubbell WL. Motion of spin-labeled side chains in T4 lysozyme. Correlation with protein structure and dynamics. *Biochemistry* **35**, 7692-7704 (1996).
14. Hubbell WL, **Mchaourab HS**, Altenbach C, and Lietzow M. Watching proteins move using site-directed spin labeling. *Structure* **4**, 779-783 (1996).
15. **Mchaourab HS**, Oh KJ, Fang CJ, and Hubbell WL. The conformation of T4 lysozyme in solution. Hinge bending motion and the substrate-induced conformational transition studied by site-directed spin labeling. *Biochemistry* **36**, 307-316 (1997).
16. Berengian AR, Bova MP, and **Mchaourab HS**. Structure and function of the conserved domain in α A-crystallin. Site-directed spin labeling identifies a β -strand located near a subunit interface. *Biochemistry* **36**, 9951-9957 (1997).
17. **Mchaourab HS**, Berengian A, and Koteiche HA. Site-directed spin-labeling study of the structure and subunit interactions along a conserved sequence in the α -crystallin domain of heat-shock protein 27. Evidence of a conserved subunit interface. *Biochemistry* **36**, 14627-14634 (1997).
18. Hyde JS, **Mchaourab HS**, Camenisch TG, Ratke JJ, Cox RW, and Froncisz W. EPR detection by time-locked sub-sampling. *Rev. Sci. Instrum.* **69**, 2622-2628 (1998).
19. Koteiche HA, Berengian AR, and **Mchaourab HS**. Identification of protein folding patterns using site-directed spin labeling. Structural characterization of a β -sheet and putative substrate binding regions in the conserved domain of α A-crystallin. *Biochemistry* **37**, 126821-12688 (1998).
20. Berengian AR, Parfenova M, and **Mchaourab HS**. Site-directed spin labeling study of subunit interactions in the α -crystallin domain of small heat-shock proteins. Comparison

- of the oligomer symmetry in α A-crystallin, HSP27, and HSP16.3. *J. Biol. Chem.* **274**, 6305-6314 (1999).
21. **Mchaourab HS**, Kálai T, Hideg K, and Hubbell WL. Motion of spin-labeled side chains in T4 lysozyme: effect of side chain structure. *Biochemistry* **38**, 2947-2955 (1999).
 22. Barnes JP, Liang Z, **Mchaourab HS**, Freed JH, and Hubbell WL. A multifrequency electron spin resonance study of T4 lysozyme dynamics. *Biophys. J.* **76**, 3298-3306 (1999).
 23. Mansoor SE, **Mchaourab HS**, and Farrens DL. Determination of protein secondary structure and solvent accessibility using site-directed fluorescence labeling. Studies of T4 lysozyme using the fluorescent probe monobromobimane. *Biochemistry* **38**, 16383-16393 (1999).
 24. Koteiche HA and **Mchaourab HS**. Folding pattern of the α -crystallin domain determined by site-directed spin labeling. *J. Mol. Biol.* **294**, 561-577 (1999).
 25. Bova MP, **Mchaourab HS**, Fung BKK. Subunit exchange of small heat-shock proteins. *J. Biol. Chem.* **275**, 1035-1042 (2000).
 26. Haley DA, Bova MP, Huang QL, **Mchaourab HS**, and Stewart PL. Small heat-shock protein structures reveal a continuum from symmetric to variable assemblies. *J. Mol. Biol.* **298**, 261-272 (2000).
 27. Kaplan RS, Mayor, JA, Kotaria, R, and **Mchaourab HS**. The mitochondrial citrate transport protein. Determination of secondary structure and solvent accessibility of transmembrane domain IV using site-directed spin labeling. *Biochemistry* **39**, 9157-9163 (2000).
 28. Mansoor SE, **Mchaourab HS**, and Farrens DL. Mapping proximity within proteins using fluorescence spectroscopy. A study of T4 lysozyme showing tryptophan residues quench bimane fluorescence. *Biochemistry* **40**, 2475-2484. (2002)
 29. Borbat, PP, **Mchaourab HS**, and Freed JH. Protein structure determination using long-distance constraints from double-quantum coherence ESR: study of T4 Lysozyme. *J. Am. Chem. Soc.* **124**, 5304-5314. (2002)
 30. Koteiche HA, and **Mchaourab HS**. The determinants of Oligomeric structure in small heat-shock proteins. Studies of the role of the N-terminal domain in Hsp 16.5 and Hsp 16.3. *Febs. Letts.* **519**, 16-22. (2002)
 31. **Mchaourab HS**, Dodson K, and Koteiche HA. Mechanism of function of small heat-shock proteins. Two-mode binding of the excited states of T4 lysozyme by α A-crystallin. *J. Biol. Chem.* **277**, 40557-40566 (2002).
 32. Koteiche HA, and **Mchaourab HS**. Mechanism of function of small heat-shock proteins. Phosphorylation-induced activation of two-mode binding in α B-crystallin. *J. Biol. Chem.*

- 278**, 10361-10367. (2003).
33. Koteiche HA, Reeves MD and **Mchaourab HS**. Structure of the substrate binding pocket of the multidrug transporter Emre: Site-directed spin labeling of transmembrane segment 1. *Biochemistry*. **42**, 6099-6199. (2003).
 34. Sathish, H, Stein, RA, Yang, G, and **Mchaourab HS**. Mechanism of chaperone function in small heat-shock proteins. Fluorescence studies of the conformations of T4 lysozyme bound to α B-crystallin. *J. Biol. Chem.* **278**, 44214–44221. (2003)
 35. Sathish, H, Koteiche, HA, and **Mchaourab HS**. Recognition and Binding of β B2-crystallin mutants by α -crystallin. *J. Biol. Chem.* **279**, 16425-16432. (2004)
 36. Shashidharamurthy, R., Koteiche, HA, Dong, J and **Mchaourab HS**. Mechanism of chaperone function in small heat-shock proteins. Dissociation of the Hsp27 oligomer is requires for recognition and binding of destabilized T4 lysozyme. *J. Biol. Chem.* **280**, 5281-5289. (2005).
 37. Dong, J, Yang, G, and **Mchaourab HS**. Structural basis of energy transduction during the functional cycle of Msba. *Science* **308**, 1023-1027. (2005).
 38. Koteiche, HA, Chiu, S, Majdoch, R., Stewart, PL., and **Mchaourab HS**. Atomic Models by Cryo-EM and Site-Directed Spin Labeling: Application to the N-terminal region of Hsp16.5. *Structure* **13**. 1165-1171 (2005).
 39. Altenbach, C., Froncisz, W., Hemker, R., **Mchaourab, HS.**, Hubbell, WL. Accessibility of nitroxide side chains: absolute Heisenberg exchange rates from power saturation EPR. *Biophys. J.* **89**, 2103-2112. (2005).
 40. Koteiche, HA, and **Mchaourab HS**. Mechanism of a hereditary cataract phenotype. Mutations in α A-crystallin activate substrate binding. *J. Biol. Chem.* **281**, 14273-14279. (2006).
 41. Shi J, Koteiche HA, **Mchaourab HS*** and Stewart PL*. Cryoelectron microscopy and EPR analysis of engineered symmetric and polydisperse Hsp16.5 assemblies reveals determinants of polydispersity and substrate binding. *J. Biol. Chem.* **281**, 40420-8 (2006). * corresponding authors.
 42. Zou P, Surendhran, K, **Mchaourab HS**. Distance measurements by fluorescence energy homotransfer. Evaluation in T4 Lysozyme and correlation with dipolar coupling between spin labels. *Biophys. J.* **92**, 27-29 (2007).
 43. Mori T, Williams DR, Byrne MO, Qin X, Egli M, **Mchaourab HS**, Stewart PL, Johnson CH. Elucidating the ticking of an in vitro circadian clockwork. *PLoS Biol.* **e93**.
 44. Koteiche HA, Kumar MS and **Mchaourab HS**. Analysis of β B1-crystallin unfolding equilibrium by spin- and fluorescence labeling. Evidence of a dimeric intermediate. *FEBS Lett.*, **582**, 1933-1938 (2007).

45. **Mchaourab HS**, Koteiche HA and Kumar MS. Specificity of α A-crystallin binding to destabilized mutants of β B1-crystallin. *FEBS Lett.*, **582**, 1939-1943 (2007).
46. Borbat PB, Surendhran K, Bortolus M, Zou, P, Freed, JH, and **Mchaourab HS**. Conformational Motion of the ABC Transporter MsbA Induced by ATP Hydrolysis. *PLoS Biology* . **5**, e271. (2007).
47. Cobb NJ, Sönnichsen FD, **Mchaourab HS**, Surewicz WK. Molecular architecture of human prion protein amyloid: a parallel, in-register beta-structure. *Proc. Natl. Acad. Sci.* **104**. 18946-51. (2007).
48. Claxton DP, Zou P, **Mchaourab HS**. Structure and orientation of T4 lysozyme bound to the small heat shock protein α -crystallin. *J. Mol. Biol.* **375**. 1026-1039. (2008)
49. Alexander N, Bortolus M, Al-Mestarihi A, **Mchaourab HS**, and Meiler J. De Novo High-Resolution Protein Structure Determination from Sparse Spin-Labeling EPR Data. *Structure*. **16**. 181-195 (2008).
50. **Mchaourab HS**, Mishra S, Koteiche HA, Amadi S. Role of Sequence Bias in the Topology of the Multidrug Transporter EmrE. *Biochemistry (Rapid Report)*. **47**, 7980-7982 (2008).
51. Kumar, SM, Koteiche HA, Claxton, DP, **Mchaourab HS**. Disulfide cross-links in the interaction of a cataract-linked α A-crystallin mutant with β B1-crystallin. *FEBS Lett.* **583**:175-9. (2009) PMC journal- In Process.
52. Latham JC, Stein RA, Bornhop DJ, **Mchaourab HS**. Free-Solution Label-Free Detection of alpha-Crystallin Chaperone Interactions by Back-Scattering Interferometry. *Anal Chem.* **81**: 1865–1871. (2009) PMC2787765
53. Smriti, Ping Zou, **Mchaourab HS**. Mapping daunorubicin binding sites in the ABC transporter MsbA using site-specific quenching by spin labels. *J. Biol. Chem* **284**: 13904-12913. (2009) PMID:2679490
54. **Mchaourab HS**, Godar JA, Stewart, PL. Structure and mechanism of protein stability sensors: The chaperone activity of small heat-shock proteins. *Biochemistry*. 2009; 48:3828-3837. PMC2785012
55. Ping Zou and **Mchaourab, HS**. Alternating Access of the Putative Substrate-Binding Chamber in the ABC Transporter MsbA. *J. Mol. Biol.* 2009; 393: 574-585. PMC2760602
56. Zou, P, Bortolus, M., **Mchaourab HS**. Conformational Cycle of the ABC transporter MsbA in Liposomes. Detailed Analysis using Double Electron-Electron Resonance Spectroscopy. *J. Mol. Biol.* 2009; 393:586-597. PMC2760609
57. Zou, P, **Mchaourab HS**. Increased Sensitivity and Extended Range of Distance Measurements in Spin Labeled Membrane Proteins: Q-Band Double Electron Electron Resonance and Nanoscale Bilayers. *Biophys. J.* (2010) **98**, L18-L20. PMC2849076

58. Adelin Gustot, Smriti, Jean-Marie Ruyschaert, **Mchaourab HS** and Cédric Govaerts: Lipid composition regulates the orientation of transmembrane helices in HorA, an ABC multidrug transporter. (2010) *J. Biol. Chem* 285;14144-51
59. Derek P. Claxton, Matthias Quick, Lei Shi, Fernanda Delmondes de Carvalho, Harel Weinstein, Jonathan A. Javitch & **Mchaourab HS**. (2010) Ion/substrate-dependent conformational dynamics of a bacterial homolog of neurotransmitter:sodium symporters. *Nat. Struct. Mol. Biol.* **17**;822-9 (2010) PMC3245867
60. Amadi S, Koteiche HA, Mishra S, **Mchaourab HS**. Structure, dynamics and substrate-induced conformational changes of the multi-drug transporter EmrE in liposomes. *J. Biol. Chem.* **285**; 26710-8 (2010).
61. Qin X, Byrne M, Mori T, Zou P, Williams DR, **Mchaourab HS**, Johnson CH. Intermolecular associations determine the dynamics of the circadian KaiABC oscillator. *Proc. Natl. Acad. Sci. U. S. A.* **107**;14805-10. (2010)
62. Hoffman L, Stein RA, Colbran RJ, **Mchaourab HS**. Conformational Changes Underlying Calcium/Calmodulin-Dependent Protein Kinase II Activation. *EMBO J* **30**;1251-62. (2011) PMC3094114
63. Kazmier K, Alexander NS, Meiler J, **Mchaourab HS**. Algorithm for selection of optimized EPR distance restraints for de novo protein structure determination. *J. Struct. Biol.* **173**; 549-557. (2011) PMC3073550
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101. Mishra S, Wu SY, Fuller AW, Wang Z, Rose KL, Schey KL, **Mchaourab HS**. Loss of α B-crystallin function in zebrafish reveals critical roles in the development of the lens and stress resistance of the heart. *J Biol Chem*. doi: 10.1074/jbc.M117.808634. (2018)
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103. Paz A, Claxton DP, Prakash Kumar J, Kazmier K, Bisignano P, Sharma S, Nolte SA, Liwag TM, Wright EM, Grabe M, **Mchaourab HS***, Abramson J*. Conformational dynamics of the sodium-dependent sugar transporter, vSGLT. *Proc Natl Acad Sci U S A*. 115(12):E2742-E2751. (2018)* Co-corresponding authors.

104. Song X, Jensen MØ, Jogini V, Stein RA, Lee CH, **Mchaourab HS**, Shaw DE, Gouaux E. Mechanism of NMDA receptor channel block by MK-801 and memantine. *Nature* ;556(7702):515-519 (2018).
105. Claxton DP, Jagessar KL, Steed PR, Stein RA, **Mchaourab HS**. (2018) Sodium and proton coupling in the conformational cycle of a MATE antiporter from *Vibrio cholerae*. *Proc Natl Acad Sci USA*. 115(27):E6182-E6190 (2018)
106. Tsukasa K, Claxton DP, Tanaka Y, Maturana AD, Kuroda T, Ishitani R*, **Mchaourab HS***, Nureki* O. (2018). Structural basis of H⁺-dependent conformational change in a bacterial MATE transporter. *Structure* (In press). * Co-corresponding authors
107. Wu SY, Zou P, Mishra S. and **Mchaourab HS**. Transgenic Zebrafish Models Reveal Distinct Molecular Mechanisms for Cataract-linked α A-crystallin Mutants. Under review *PLos One*. Deposited in BioRxiv under doi: <https://doi.org/10.1101/364125>.
108. Hustedt EJ, Marinelli F, SteinRA, Faraldo-Gomez JD, **Mchaourab HS**. Confidence Analysis of DEER Data and its Structural Interpretation with Ensemble-Biased Metadynamics. *Biophys. J.* (In press)
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Book Chapters

1. Hyde JS, **Mchaourab HS**, Strangeway RA, and Luglio JR. Multiquantum ESR. Physics, technology, and applications to bioradicals, in: *Bioradicals Detected by ESR Spectroscopy*, H. Ohya-Nichiguchi and L. Packer, eds. (Birkhauser) pp. 31-47 (1995)
2. **Mchaourab HS**, Perozo E. Determination of protein folds and conformational dynamics using spin-labeling EPR spectroscopy, in: *Biological Magnetic Resonance*, L. Berliner, S Eaton and G Eaton eds. (Kluwer) 185-238 (2000)

Invited presentations:

1995. 2nd Loop-Gap resonator workshop, national biomedical ESR center, Medical College of Wisconsin, Milwaukee, WI.

1996. Seminar, Department of chemistry, Cornell University, Ithaca, New York

1996. 6th UCLA-UCSB workshop on complex fluids.

1997. 7th Chianti workshop on magnetic resonance, Chianti, Italy.

1997. Seminar, Department of molecular physiology and biological physics, University of Virginia, Charlottesville, VA.

1998. Seminar, Department of chemistry, University of Denver, Denver, Co.

1998. EPR symposium, 40th Rocky Mountain International Conference on Analytical Chemistry.

1998. 29th AMPERE-13th ISMAR conference on Magnetic Resonance and related phenomena. Berlin, Germany.

1998. Seminar, Department of Chemistry, Florida State University. Tallahassee, Fl.

1999. EPR symposium, 41st Rocky Mountain International Conference on Analytical Chemistry. Denver, Co.

2000. Workshop on "EPR Methods in Structural Biology". Milwaukee, WI.

2000. EPR symposium, 42nd Rocky Mountain conference on Analytical Chemistry. Denver, Co.

2000. XIX International conference on magnetic resonance in biological system. Florence, Italy.

2000. 6th International symposium on spin trapping. Marseille, France.

2001. National Eye institute, National Institutes of Health. Bethesda, MD.

2002. Department of Biochemistry and Molecular Biology. Oregon Health and Science University. Portland, Or.

2002. Department of Ophthalmology. Vanderbilt University.

2002. Department of Biochemistry and Molecular Biology. University of Arkansas for Medical Sciences. Little Rock, Ar.

2002. Department of Ophthalmology. Washington University. St. Louis. MO.

2003. EPR symposium, 45nd Rocky Mountain conference on Analytical Chemistry. Denver, Co.

2004. Invited talk, International Conference on Fundamentals of Nano-Materials Creation.

Osaka, Japan, January 22-24, 2004.

2004. Seminar, Center of Excellence. Osaka University. Osaka, Japan.

2004.Seminar, Membrane Biology Group. Vanderbilt University. Nashville, TN.

2004. Seminar, Department of Molecular Physiology and Biological physics. University of Virginia. Charlottesville, VA.

2004. Invited talk, XVI international conference on eye research. Sydney, Australia.

2004. Seminar, Molecular biophysics program. Vanderbilt University.

2004. Invited talk, 6th Workshop on EPR applications in biology and medicine. Krakow, Poland.

2005.Seminar, Structure and affinity group. The Scripps research institute.

2005. Invited talk, Association for research in vision and ophthalmology 2005 annual meeting.

2005. Invited talk, 2005 FASEB summer research conference: "New Perspectives in Transport Biology".

2005. Invited talk, 34th Southeastern Magnetic Resonance Conference.

2005. Seminar, National Cancer Institute. Laboratory of Cell Biology.

2005. Seminar, University of Arizona. Department of Biochemistry. Tuscon, AZ.

2006. Platform Presentation. Biophysical society 50th annual meeting.

2006. Seminar, Institute of Biophysical dynamics. University of Chicago.

2006. Seminar, North Caroline State University. Department of Chemistry.

2006. Invited talk, FASEB summer conference. "Molecular Biophysics of Cellular Membranes".

2006. Invited talk, XXII International conference on magnetic resonance in biological systems. Gottingen, Germany.

2006. Seminar, Department of Biochemistry. University of Missouri. Columbia. Missouri.

2006. Seminar, Department of Biochemistry and Biophysics. Iowa State University. Ames Iowa.

2007. Invited talk, Association for research in vision and ophthalmology 2007 annual meeting.

2007. Invited talk, International EPR symposium, Breckinridge, CO.

2007. Invited talk, 36th Southeastern Magnetic Resonance Conference. Tuscaloosa, AL.

2008. Symposium organizer and speaker, Biophysical Society, Symposium on ABC transporters, Long Beach, CA.

2008. Department of Chemistry and Biochemistry. University of California, Santa Cruz.

2008. Seminar, Department of Chemistry, University of Alabama, Huntsville, AL.

2008. Invited Talk, International School of Biophysics. Channels and transporters. Erice Italy.

2008. Invited talk, XVIII International Congress for Eye Research. Beijing China.

2008. Seminar, Department of Chemistry. Michigan State University.

2008. Seminar, Department of Biochemistry. University of North Carolina.

2010. 5th International Conference on Structural Analysis of Supramolecular Assemblies by Hybrid Methods. Lake Tahoe, CA.

2010. Seminar, University of Frankfurt.

2010. Invited talk, Gordon Research Conferences. Ligand recognition and molecular gating. Luca, Italy.

2010. Seminar, University of Leipzig.

2010. Invited talk, FASEB conference on Molecular Biophysics of Cellular Membranes. Saxtons River, VT.

2010. Invited Talk, Gordon Research Conferences. Membrane Transport Proteins. University of new England, ME.

2011. Seminar. Department of Biochemistry. University of Illinois, Urbana.

2011. Seminar. Department of Pharmacology. Yale University.

2011. Seminar. Department of Chemistry. Florida State University.

2011. Invited talk, Association for research in vision and ophthalmology 2011 annual meeting. Florida

2011. Invited Talk, Gordon Research Conferences. Multidrug Efflux Systems. Les Diablerets, Switzerland.

2011. Invited Talk, Gordon Research Conferences. Mechanisms of Membrane Transport. University of New England. Maine.

2012. Invited Talk, Spin Conference, University of Marseilles, Marseilles France.

2012. Invited Talk, FEBS-ABC 2012, Innsbruck, Austria.

2012. Invited talk, Pittcon 2012. Orlando, FL.

2012. Invited talk, International conference on eye research. Berlin Germany.

2013. Invited talk. Department of Chemistry. Technische Universitat, Munchen. Germany.

2013. Plenary talk. 5th Asia-Pacific NMR. Brisbane, Australia.

2013. Invited talk, Gordon Research Conferences. Mechanisms of membrane transport. Mount Holyoke College. MA.

2014. Invited talk, Gordon Research Conferences. Ligand recognition and molecular gating. Ventura, CA.

2014. Platform talk, ARVO annual meeting. Orlando, FL.

2014. Invited Talk. International conference on magnetic resonance in biological systems. Dallas, TX.

2014. Invited talk. International symposium on membrane transport and communication. Frankfurt, Germany.

2014. Invited Seminar. National Institutes of Neurological Disorders and Stroke. NIH. Bethesda, MD.

2015. Invited speaker. Transmembrane transporters in health and disease symposium. Vienna Austria

2016. Invited Speaker. GRC on membrane transporters. Il Ciocco, Italy.

2016. Invited Seminar. Department of Physiology and Biophysics. Case Western Reserve University.

2016. Invited Seminar. University of Texas San Antonio health center. Department of Biochemistry.

2016. Invited Speaker. FASEB research conference on molecular biophysics of membranes. Aspen, CO.

2016. Invited Speaker. 2nd workshop on small heat shock proteins. Bertinoro, Italy.

2017. Invited speaker. 61st annual meeting of the Biophysical Society. New Orleans, LA.

2017. Seminar Speaker. University of California, San Francisco.

