

BIOGRAPHICAL SKETCH

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NAME Heinrich Roder, Ph.D.		POSITION TITLE Senior Member, Adjunct Professor	
eRA COMMONS USER NAME			
EDUCATION/TRAINING (<i>Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.</i>)			
INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Eidgenössische Technische Hochschule (ETH), Zürich, Switzerland	Diploma	1978	Physics
Eidgenössische Technische Hochschule (ETH), Zürich, Switzerland (Advisor: Kurt Wüthrich)	Ph.D.	1981	Biophysics

A. POSITIONS

Research Associate, Department of Physics, University of Illinois at Urbana-Champaign, Urbana, IL (with H. Frauenfelder)	1981-1984
Research Assistant Professor, Department of Biochemistry and Biophysics, University of Pennsylvania, Philadelphia, PA	1984-1987
Assistant Professor, Department of Biochemistry and Biophysics, University of Pennsylvania, Philadelphia, PA	1987-1990
Associate Professor (with tenure), Department of Biochemistry and Biophysics, University of Pennsylvania, Philadelphia, PA	1990-1991
Member (with tenure), Institute for Cancer Research, Fox Chase Cancer Center, Philadelphia, PA	1991-1998
Adjunct Associate Professor/Adjunct Professor, Department of Biochemistry and Biophysics, University of Pennsylvania, Philadelphia, PA	1991/1994 -date
NIH Molecular and Cellular Biophysics Study Section	1994
NIH Site Visit, Yale University, New Haven, CT	1995
Senior Member, Institute for Cancer Research, Fox Chase Cancer Center, Philadelphia, PA	1998-date
NSF Molecular Biophysics Panel	2001-2005
NIH Center for Scientific Review, Special Emphasis Panels (8 meetings)	1997-date
Program Leader, Biomolecular Structure and Function Program, Fox Chase Cancer Center	2002-date
Editorial Board Member, Protein Engineering, Design and Selection	2004-date
Editorial Board Member, Experimental Biology and Medicine	2006-date
Editorial Board Member, Biophysical Journal	2007-date
NIH Intramural Site Visit, NHLBI Board of Scientific Counselors	2008
NIH Molecular Structure & Function B Study Section	2008

B. PEER-REVIEWED PUBLICATIONS (selected)

- Roder, H.**, Berendzen, J., Bowne, S.F., Frauenfelder, H., Sauke, T.B., Shyamsunder, E., Weissman, M.B. Comparison of the magnetic properties of deoxy- and photodissociated myoglobin. *Proc. Natl. Acad. Sci. U.S.A.* **81**:2359-2363, 1984.
- Roder, H.**, Wagner, G., Wüthrich, K. Amide proton exchange in proteins by EX₁ kinetics: Studies of the basic pancreatic trypsin inhibitor at variable p²H and temperature. *Biochemistry* **24**:7396-7407, 1985.
- Roder, H.**, Wüthrich, K. Protein folding kinetics by combined use of rapid mixing techniques and NMR observation of individual amide protons. *Proteins: Struct. Funct. Genet.* **1**:34-42, 1986.
- Roder, H.**, Elöve, G.A., Englander, S.W. Structural characterization of folding intermediates in cytochrome c by H-exchange labeling and proton NMR. *Nature* **335**:700-704, 1988.
- Jeng, M.-F., Englander, S.W., Elöve, G.A., Wand, A.J., **Roder, H.** Structural description of acid-denatured cytochrome c by hydrogen exchange and 2D NMR. *Biochemistry* **29**:10433-10437, 1990.

- Paterson, Y., Englander, S.W., **Roder, H.** Definition of antibody binding sites on protein antigens by hydrogen exchange and two-dimensional NMR. *Science* **249**:755-759, 1990.
- Baldwin, R.L., **Roder, H.** Characterizing protein folding intermediates. *Current Biol.* **1**:218-220, 1991.
- Briggs, M.S., **Roder, H.** Early hydrogen-bonding events in the folding reaction of ubiquitin. *Proc. Natl. Acad. Sci. U.S.A* **89**:2017-2021, 1992.
- Elöve, G.A., Chaffotte, A.F., **Roder, H.**, Goldberg, M.E. Early steps in cytochrome c folding probed by time-resolved circular dichroism and fluorescence spectroscopy. *Biochemistry* **31**:6876-6883, 1992.
- Jones, C.M., Henry, E.R., Hu, Y., Chan, C.-K., Luck, S.D., Bhuyan, A., **Roder, H.**, Hofrichter, J., Eaton, W.A. Fast events in protein folding initiated by nanosecond laser photolysis. *Proc. Natl. Acad. Sci. U.S.A* **90**:11860-11864, 1993.
- Khorasanizadeh, S., Peters, I.D., Butt, T.R., **Roder, H.** Folding and stability of a tryptophan-containing mutant of ubiquitin. *Biochemistry* **32**:7054-7063, 1993.
- Moore, K.S., Wehrli, S., **Roder, H.**, Rogers, M., Forrest, J.N., Mc Crimmon, D., Zasloff, M. Squalamine An Aminosterol antibiotic from the shark. *Proc. Natl. Acad. Sci. U.S.A* **90**:1354-1358, 1993.
- Elöve, G.A., Bhuyan, A.K., **Roder, H.** Kinetic mechanism of cytochrome c folding: involvement of the heme and its ligands. *Biochemistry* **33**:6925-6935, 1994.
- Gochin, M., **Roder, H.** Protein structure refinement based on paramagnetic NMR shifts: applications to wild-type and mutant forms of cytochrome c. *Protein Sci.* **4**:296-305, 1995.
- Roder, H.** Watching protein folding unfold. *Nature Struct. Biol.* **2**:817-820, 1995.
- Zhang, Y.-Z., Paterson, Y., **Roder, H.** Rapid amide proton exchange rates in peptides and proteins measured by solvent quenching and two-dimensional NMR. *Protein Sci.* **4**:804-814, 1995.
- Khorasanizadeh, S., Peters, I.D., **Roder, H.** Evidence for a 3-state model of protein folding from kinetic analysis of ubiquitin variants with altered core residues. *Nature Struct. Biol.* **3**:193-205, 1996.
- Colón, W., Elöve, G.A., Wakem, L.P., Sherman, F., **Roder, H.** Side chain packing of the N- and C-terminal helices plays a critical role in the kinetics of cytochrome c folding. *Biochemistry* **35**:5538-5549, 1996.
- Colón, W., **Roder, H.** Kinetic intermediates in the formation of the cytochrome c molten globule. *Nature Struct. Biol.* **3**:1019-1025, 1996
- Sauder, J.M., MacKenzie, N.E., **Roder, H.** Kinetic mechanism of folding and unfolding of *Rhodobacter capsulatus* cytochrome c₂. *Biochemistry* **35**:16852-16862, 1996.
- Colón, W., Wakem, L.P., Sherman, F., **Roder, H.** Identification of the predominant non-native histidine ligand in unfolded cytochrome c. *Biochemistry* **36**:12535-12541, 1997.
- Park, S.-H., O'Neil, K.T., **Roder, H.** An early intermediate in the folding reaction of the B1 domain of protein G contains a native-like core. *Biochemistry* **36**:14277-14283, 1997.
- Pinheiro, T.J.T., Elöve, G.A., Watts, A., **Roder, H.** Structural and kinetic description of cytochrome c unfolding induced by the interaction with lipid vesicles. *Biochemistry* **36**:13122-13132, 1997.
- Roder, H.**, Colón, W. Kinetic role of early intermediates in protein folding. *Curr. Opin. Struct. Biol.* **7**:15-28, 1997.
- Walkenhorst, W.F., Green, S.M., **Roder, H.** Kinetic evidence for folding and unfolding intermediates in staphylococcal nuclease. *Biochemistry* **63**:5795-5805, 1997.
- Houry, W.A., Sauder, J.M., **Roder, H.**, Scheraga, H.A. Definition of amide protection factors for early kinetic intermediates in protein folding. *Proc. Natl. Acad. Sci. U.S.A* **95**:4299-4302, 1998.
- Sauder, J.M., **Roder, H.** Amide protection in an early folding intermediate of cytochrome c. *Folding & Design* **3**:293-301, 1998.
- Shastry, M.C.R., Luck, S.D., **Roder, H.** A continuous-flow capillary mixer to monitor reactions on the microsecond time scale. *Biophys. J.* **74**:2714-2721, 1998.
- Shastry, M.C.R., **Roder, H.** Evidence for barrier-limited protein folding kinetics on the microsecond time scale. *Nature Struct. Biol.* **5**:385-392, 1998.
- Shastry, M.C.R., Sauder, J.M., **Roder, H.** Kinetic and structural analysis of submillisecond folding events in cytochrome c. *Acct. Chem. Res.* **31**:717-725, 1998.
- Walsh, S.T.R., Cheng, H., Bryson, J.W., **Roder, H.**, DeGrado, W.F. Solution structure and dynamics of a *de novo* designed three helix bundle protein. *Proc. Natl. Acad. Sci. U.S.A.* **96**:5486-5491, 1999.
- Park, S.-H., Shastry, M.C.R., **Roder, H.** Folding dynamics of the B1 domain of protein G explored by ultrarapid mixing. *Nature Struct. Biol.* **6**:943-947, 1999.

- Roder, H.**, Shastry, M.C.R. Methods for exploring early events in protein folding. *Curr. Opin. Struct. Biol.* **9**:620-626, 1999.
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- Talaga, D.S., Lau, W.L., **Roder, H.**, Tang, J., Jia, Y., Degrado, W.F., Hochstrasser, R.M. Dynamics and folding of single two-stranded coiled-coil peptides studied by fluorescent energy transfer confocal microscopy. *Proc. Natl. Acad. Sci. U.S.A.* **97**:13021-13026, 2000.
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- Cheng, R.P., Suich, D.J., Cheng, H., **Roder, H.**, DeGrado, W.F. Template-constrained somatostatin analogues: a biphenyl linker induces a type-V' turn. *J. Amer. Chem. Soc.* **123**:12710-12711, 2001.
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- Abdullaev, Z., Bodrova, M. E., Chernyak, B. V., Dolgikh, D. A., Kluck, R. M., Pereverzev, M. O., Arseniev, A. S., Efremov, R. G., Kirpichnikov, M. P., Mokhova, E. N., Newmeyer, D. D., **Roder, H.** & Skulachev, V.P.A cytochrome *c* mutant with high electron transfer and antioxidant activities but devoid of apoptogenic effect. *Biochem. J.* **362**:749-54, 2002.
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- Roder, H.** Stepwise helix formation and chain compaction during protein folding. *Proc. Natl. Acad. Sci. U.S.A.* **101**:1793-1794, 2004.
- Maki, K., Cheng, H., Dolgikh, D.A., Shastry, M.C.R., **Roder, H.** Early events during folding of wild-type staphylococcal nuclease and a single-tryptophan variant studied by ultrarapid mixing. *J. Mol. Biol.* **338**:383-400, 2004.
- Roder, H.**, Maki, K., Cheng, H., Shastry, M.C.R. Rapid mixing methods for exploring the kinetics of protein folding. *Methods* **34**:15-27, 2004.
- Pabit, S.A., **Roder, H.**, Hagen, S.J. Internal friction controls the speed of protein folding from a compact configuration. *Biochemistry* **43**:12532-12538, 2004.
- Welker, E., Maki, K., Shastry, M.C.R., Juminaga, D., Bhat, R., Scheraga, H.A., **Roder, H.** Ultrarapid mixing experiments shed new light on the characteristics of the initial conformational ensemble during the folding of ribonuclease A. *Proc. Natl. Acad. Sci. USA* **101**:17681-17686, 2004.
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- Kurchan, E., **Roder, H.**, Bowler, B.E. Kinetics of loop formation and breakage in the denatured state of iso-1-cytochrome *c*. *J. Mol. Biol.* **353**:730-743, 2005.

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- Apetri, A. C., Maki, K., **Roder, H.** Surewicz, W.K. Early intermediate in human prion protein folding as evidenced by ultrarapid mixing experiments. *J. Am. Chem. Soc.* **128**:11673-8, 2006.
- Riley, P. W., Cheng, H., Samuel, D., **Roder, H.** Walsh, P. N. Dimer Dissociation and Unfolding Mechanism of Coagulation Factor XI Apple 4 Domain: Spectroscopic and Mutational Analysis. *J. Mol. Biol.* **367**:558-573, 2007.
- Maki, K., Cheng, H., Dolgikh, D. A, **Roder, H.** Folding kinetics of staphylococcal nuclease studied by tryptophan engineering and rapid mixing methods. *J. Mol. Biol.* **268**:244-255, 2007.
- Abel, C.J., Goldbeck, R.A., Latypov, R.F., **Roder, H.**, Kliger, D.S. Conformational equilibration time of unfolded protein chains and the folding speed limit. *Biochemistry*, **46**:4090-4099, 2007.
- Bender, G.M., Lehmann, A., Zou, H., Cheng, H., Fry, H.C., Engel, D., Therien, M.J., Blasie, J.K., **Roder, H.**, Saven, J.G., and Degrado, W.F. De Novo Design of a Single-Chain Diphenylporphyrin Metalloprotein. *J. Am. Chem. Soc.* **129**:10732-10740, 2007.
- Samuel, D., Cheng, H., Riley, P.W., Canutescu, A.A., Nagaswami, C., Weisel, J.W., Bu, Z., Walsh, P.N., and **Roder, H.** Solution structure of the A4 domain of factor XI sheds light on the mechanism of zymogen activation. *Proc. Natl. Acad. Sci. U. S. A.* **104**:15693-15698, 2007.
- Srimathi, T., Robbins, S.L., Dubas, R.L., Chang, H., Cheng, H., **Roder, H.** Park, Y.C. Mapping of POP1-binding site on pyrin domain of ASC. *J. Biol. Chem.* **283**:15390-8, 2008.
- Latypov, R., Maki, K. Cheng, H., Luck, S.D., **Roder, H.** Folding mechanism of reduced cytochrome *c*: Equilibrium and kinetic properties in the presence of carbon monoxide. *J. Mol. Biol.*, **383**, 437-453, 2008. NIHMSID#73591
- Tzul, F. O., Kurchan, E., Roder, H. & Bowler, B. E. Competition between reversible aggregation and loop formation in denatured iso-1-cytochrome *c*. *Biochemistry* **48**:481-91, 2009. NIHMSID # 86751

C. RESEARCH SUPPORT

Ongoing Research Support

R01 GM056250 (PI: Roder)

05/01/2006 – 04/30/2010

NIH

Role: Principal Investigator

Kinetics of Early Events in Protein Folding

The major goals of this project are: To monitor rapid formation of specific tertiary interactions during folding of staphylococcal nuclease and cytochrome *c*; to characterize early intermediates during folding by ultrafast quenched-flow H/D exchange and NMR; to explore the conformational properties of equilibrium intermediates and denatured states.

P30 CA06927 (PI: Seiden)

09/10/2005 – 06/30/2010

NIH

Role: Program Leader

Comprehensive Cancer Center Program at Fox Chase

This Cancer Center Support Grant provides salary support to Dr. Roder as Facility Director of the Spectroscopy Support Facility and Program Leader. Role: Program Leader and Facility Director

R01 HL046213 (Subcontract; PI: Walsh, Temple University)

09/01/2007 – 08/31/2012

NIH

Role: Principal Investigator

Molecular Interactions of Factor XI

Major aims include: To determine the mechanism and physiological importance of factor XI dimer formation; to characterize conformational changes associated with factor XI zymogen activation.

MCB 0744607 (PI: Roder)

03/15/2008 – 3/14/2011

NSF

Role: Principal Investigator

Early Stages of Apomyoglobin Folding.

This project is aimed at elucidating early conformational events during folding of apomyoglobin by combining rapid mixing methods with optical spectroscopy, NMR and site-directed mutagenesis.