

Sven Timo Stripp

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Personal Information

Born 1980 in Wesel, Germany

Married, two children (*2009 and *2012)

Education and Background

2010 – today

Freie Universität Berlin

Postdoctoral scientist

Vibrational spectroscopy on gas-processing metalloenzymes.

Department of Physics, Experimental Molecular Biophysics (Prof. Dr. J. Heberle)

2007 – 2010

Ruhr-Universität Bochum

Dissertation in Biology, degree: Dr. rer. nat. (summa cum laude)

“Molecular Background of Oxygen Sensitivity in [FeFe] hydrogenases.”

Faculty of Biology and Biotechnology, Photobiotechnology.

Prof. Dr. T. Happe and Prof. Dr. E. Hofmann

Research stays in Hamburg (Deutsches Elektronen-Synchrotron, Dr. M. Haumann), Uppsala SWE (Ångström Laboratory), and Oxford UK (Inorganic Chemistry, Prof. Dr. F. Armstrong)

2001 – 2007

Ruhr-Universität Bochum

Studies of Chemistry and Biology, degree: diploma (1.7)

“Optimierung der Expression eines Proteins aus *C. reinhardtii* in *C. acetobutylicum*.”

Faculty of Biology and Biotechnology, Photobiotechnology.

Prof. Dr. T. Happe and Prof. Dr. K. Störtkuhl

Top Ten Publications

Protonation and Reduction Dynamics at the Hydrogen-forming Cofactor of [FeFe]-Hydrogenases. Senger, M.; Mebs, S.; Duan, J.; Shulenina, O.; Laun, K.; Kertess, L.; Wittkamp, F.; Apfel, U.-P.; Happe, T.; Winkler, M.*; Haumann, M.*; Stripp, S. T.* *Phys. Chem. Chem. Phys.* **2017**, 10.1039/c7cp04757f.

Bridging Hydride at Reduced H-Cluster Species in [FeFe]-Hydrogenases Revealed by Infrared Spectroscopy, Isotope Editing, and Quantum Chemistry. Mebs, S.*; Senger, M.; Duan, J.; Wittkamp, F.; Apfel, U.-P.; Happe, T.; Winkler, M.; Stripp, S. T.*; Haumann, M.* *J. Am. Chem. Soc.* **2017**, 10.1021/jacs.7b07548.

Accumulating the Hydride State in the Catalytic Cycle of [FeFe]-Hydrogenases. Winkler, M.; Senger, M.; Duan, J.; Esselborn, J.; Wittkamp, F.; Hofmann, E.; Apfel, U.-P.; Stripp, S.T.*; Happe, T.* *Nat. Comm.* **2017**, 8, 16115.

Proteolytic Cleavage Orchestrates Cofactor Insertion and Protein Assembly in [NiFe]-hydrogenase Biosynthesis. Senger, M.; Stripp, S.T.; Soboh, B.* *J. Biol. Chem.* **2017**, 292(28), 11670.

Stepwise Isotope Editing of [FeFe]-Hydrogenases Exposes Cofactor Dynamics. Senger M., Mebs S., Duan J., Wittkamp F., Apfel U.-P., Heberle J., Haumann M., Stripp S.T.* *Proc. Natl. Acad. Sci.* **2016**, 113(30), 8454.

Identification of an Isothiocyanate on the HypEF Complex Suggests a Route for Efficient Cyanyl-Group Channeling during [NiFe]-Hydrogenase Cofactor Generation. Stripp S.T.*, Lindenstrauss U., Sawers R.G., Soboh B. *PLoS One.* **2015**, 10(7), e0133118.

The influence of oxygen on [NiFe]-hydrogenase cofactor biosynthesis and how ligation of carbon monoxide precedes cyanation. Stripp S.T.*, Lindenstrauss U., Granich C., Sawers R.G., Soboh B. *PLoS One.* **2014**, 9(9), e107488.

Surface-enhanced infrared absorption spectroscopy (SEIRAS) to probe monolayers of membrane proteins. Ataka K., Stripp S.T., Heberle J.* *BBA – Biomembr.* **2013**, 1828(10), 2283.

How algae produce hydrogen - news from the photosynthetic hydrogenase. Stripp S.T., Happe T.* *Dalton Trans.* **2009**, 45, 9960.

How oxygen attacks [FeFe]-hydrogenases from photosynthetic organisms. Stripp S.T., Goldet G., Brandmayr C., Sanganas O., Vincent K.A., Haumann M., Armstrong F.A., Happe T.* *Proc. Natl. Acad. Sci.* **2009**, 106(41), 17331.

* Corresponding author

Teaching

Lectures, seminars, and lab courses for M.sc.

WS/SS 2012 – 2017 (with Prof. J. Heberle)

“Advanced Laboratory Course in Biophysics” (seminar, lab course, and admin)

“Advanced Biophysics” (lecture, seminar, and admin)

“Photobiophysics and Photosynthesis” (lecture, seminar, and admin)

Lectures, seminars, and lab courses for B.sc.

WS/SS 2014 – 2017 Physik f. d. Grundschule (lecture and seminar; with J. Fahndrich)

WS 12/13 – 16/17 Biophysik (lecture, seminar, and admin; with Prof. J. Heberle)

WS/SS 2012 – 2014 Physikalisches Grundpraktikum (lab course)

Research seminars and outreach

WS/SS 2012 – 2017 “Function and Dynamics of Photoreceptors” & “Metalloenzymes”

SS 2012 – 2017 “Lange Nacht der Wissenschaft“

SS 2012 – 2017 “inFU:tage“

External Funding

German-Russian Interdisciplinary Science Center (G-RISC)

Research stay (to Iuliia Baranova, 2016):

“Towards an Accurate Description of the Reduced States of [FeFe]-hydrogenases”

Research stay (to Olga Shulenina, 2015):

“Kinetic analysis of the influence of H₂ on the catalytic cycle of [FeFe]-hydrogenases”

Focus area Functional Materials at the Nanoscale (NanoScale)

Project support (2015): “Studying Proton-coupled Electron Transfer in Hydrogenases”

Project support (2013): “Protein-assisted in-vitro Generation of a H₂-forming, Bio-inorganic Cofactor Monitored by LASER-powered Surface-enhanced IR Absorption Spectroscopy”

International Max Plank Research School (IMPRS on Multiscale Bio-Systems)

Ph.D. Fellowship (to Moritz Senger, 2013):

“Vibrational Spectroscopy of Light-activated Membrane Proteins”

Conferences

ECSBM 17 (2017, Amsterdam, NL): “Proton-coupled Electron Transfer

at the Catalytic Cofactor of Hydrogenases” (talk)

GRC Cell Biology of Metals (2017, Mt. Snow, USA): “Proton-coupled Electron Transfer

at the Catalytic Cofactor of Hydrogenases” (poster)

Hydrogenase 11 (2016, Marseilles, FR): “Stepwise Isotope Editing of [FeFe] Hydrogenases” (talk)

EuroBIC 13 (2016, Budapest, HU): “Unraveling Enzymatic Hydrogen Turnover” (poster)

ECSBM 16 (2015, Bochum): “Proton-coupled Electron Transfer in Hydrogenases” (poster)

ISF1 (2015, Uppsala, SWE): “The Yin and Yang of Hydrogen Turnover” (talk)

NanoScale Tag (2015, Berlin): “Studying PCET in Hydrogenases by ATR FT-IR” (talk)

IMPRS (2015, Berlin): “Turnover with [FeFe] Hydrogenases involves a terminal Hydride” (talk)

PCET (2014 Skokloster, SWE): “[NiFe] Hydrogenase Maturation Probed by ATR FTIR” (poster)

Joint Meeting of the British and German Biophysical Society (2013 Hünfeld):

“[NiFe] Hydrogenase Maturation Probed by Infrared Spectroscopy” (poster)

ECSBM 15 (2013, Oxford, GB): “Maturation of [NiFe] Hydrogenases” (talk)

BMBF (2012, Bielefeld): “Time-resolved FT-IR Spectroscopy on [FeFe] Hydrogenases” (talk)

BMBF (2011, Berlin): “Light-driven Hydrogen Production by [FeFe] Hydrogenases” (talk)

Research Profile

Main research interests include

- proton-coupled electron transfer (PCET) in enzymes
- photo- and redoxchemistry of bioinorganic cofactors
- enzymatic activation of small molecules (H₂, CO, O₂)
- interplay of protein fold and cofactor catalysis
- biogenesis of cofactors *in vivo* and *in vitro* ('maturation')

Investigated enzymes

- [FeFe]-, [NiFe]-, and [Fe]-only hydrogenases
- formate- and CO dehydrogenases
- cytochrom c oxidase and photosystem I

Collaboration partners

- Prof. T. Happe (Ruhr-Universität Bochum)
- Dr. M. Haumann (Freie Universität Berlin)
- Prof. G. Sawers (Martin Luther Universität, Halle)
- Dr. U.-P. Apfel (Ruhr-Universität Bochum)
- Prof. G. Knoer (Johannes Kepler Universität Linz, AU)
- Dr. S. Shima (MPI for Terrestrial Microbiology, Marburg)
- Prof. J. Hirst (University of Cambridge, UK)
- Dr. A. Parkin (University of York, UK)
- Dr. O. Lenz (Technische Universität Berlin)
- Dr. W. Shaw (PNNL, Richland WA, USA)

Spectroscopic expertise

- attenuated total reflection Fourier-transform IR spectroscopy (ATR FTIR) with focus on novel techniques for *in situ* modification of sample matter
- ATR FTIR spectro-electrochemistry on bulk protein
- surface-enhanced IR absorption spectroscopy (SEIRAS) on protein thin films

Further experience

- rapid-scan quantum cascade laser (QCL) IR spectroscopy
- rapid-scan and step-scan FTIR spectroscopy
- resonance Raman spectroscopy (RR) and surface-enhanced Raman spectroscopy (SERS)
- steady-state and flash photolysis UV/vis spectroscopy
- quantum mechanical (QM) and molecular mechanical (MM) simulations with Gaussian
- molecular biology (e.g. PCR, transformation, cell growth, protein isolation, etc.)

Publications

1. Optimized over-expression of [FeFe] hydrogenases with high specific activity in *Clostridium acetobutylicum*.
von Abendroth G, **Stripp ST**, Silakov A, Croux C, Soucaille P, Girbal L, Happe T*. *Int J Hydrogen Energy*, Volume 33, Issue 21, November 2008, Pages 6076-6081
2. The structure of the active site H-cluster of [FeFe] hydrogenase from the green alga *Chlamydomonas reinhardtii* studied by X-ray absorption spectroscopy.
Stripp ST, Sanganas O, Happe T, Haumann M*. *Biochemistry*. 2009 Jun ;48(22):5042-9.
3. Immobilization of the [FeFe]-hydrogenase CrHydA1 on a gold electrode: design of a catalytic surface for the production of molecular hydrogen.
Krassen H & **Stripp ST**, von Abendroth G, Ataka K, Happe T, Heberle J*. *J Biotechnol*. 2009 Jun 1;142(1):3-9.
4. How oxygen attacks [FeFe] hydrogenases from photosynthetic organisms.
Stripp ST, Goldet G, Brandmayr C, Sanganas O, Vincent KA, Haumann M, Armstrong FA, Happe T*. *Proc Natl Acad Sci U S A*. 2009 Oct 13;106(41):17331-6.
5. Electrochemical kinetic investigations of the reactions of [FeFe]-hydrogenases with CO and O₂: comparing the importance of gas tunnels and active-site electronic/redox effects. Goldet G, Brandmayr C, **Stripp ST**, Happe T, Cavazza C, Fontecilla-Camps JC, Armstrong FA*. *J Am Chem Soc*. 2009 Oct 21;131(41):14979-89.
6. How algae produce hydrogen - news from the photosynthetic hydrogenase.
Stripp ST, Happe T*. *Dalton Trans*. 2009 Dec 7;(45):9960-9.
7. Multiple ferredoxin isoforms in *Chlamydomonas reinhardtii* – Their role under stress conditions and biotechnological implications.
Winkler M, Hemschemeier A, Jacobs J, **Stripp ST**, Happe T*. *Eur J Cell Biol*. 2010 Dec;89(12):998-1004.
8. Molecular Background of Oxygen Sensitivity in [FeFe]-hydrogenases.
Sven ST*. 2011. Saarbrücken: Südwestdeutscher Verlag für Hochschulschriften.
9. The [FeFe]-hydrogenase maturation protein HydF contains a H-cluster like [4Fe4S]-2Fe site. Czech I, **Stripp ST**, Sanganas O, Leidel N, Happe T, Haumann M*. *FEBS Lett*. 2011 Jan 3;585(1):225-30.
10. Tailor-Made Modification of a Gold Surface for the Chemical Binding of a High-Activity [FeFe] Hydrogenase.
Krassen H, **Stripp ST**, Böhm N, Berkessel A, Happe T, Ataka K, Heberle J*. *Eur. J. Inorg. Chem.*, 2011: 1138–1146.
11. Formaldehyde - a rapid and reversible inhibitor of hydrogen production by [FeFe]-hydrogenases.
Wait AF, Brandmayr C, **Stripp ST**, Cavazza C, Fontecilla-Camps JC, Happe T, Armstrong FA*. *J Am Chem Soc*. 2011 Feb 9; 133(5): 1282-5.

12. [NiFe]-hydrogenase maturation: isolation of a HypC-HypD complex carrying diatomic CO and CN-ligands.
Soboh B & **Stripp ST**, Muhr E, Granich C, Brausemann M, Herzberg M, Heberle J, Gary Sawers R*. FEBS Lett. 2012 Nov 2; 586(21): 3882-7.
13. Surface-enhanced infrared absorption spectroscopy (SEIRAS) to probe monolayers of membrane proteins.
Ataka K, **Stripp ST**, Heberle J*. Biochim Biophys Acta. 2013 Oct; 1828(10): 2283-93.
14. The [NiFe]-hydrogenase accessory chaperones HypC and HybG of Escherichia coli are iron- and carbon dioxide-binding proteins.
Soboh B & **Stripp ST**, Bielak C, Lindenstrauß U, Brausemann M, Javaid M, Hallensleben M, Granich C, Herzberg M, Heberle J, Sawers RG*. FEBS Lett. 2013 Aug 19; 587(16): 2512-6.
15. HypD is the scaffold protein for Fe-(CN)₂CO cofactor assembly in [NiFe]-hydrogenase maturation.
Stripp ST, Soboh B, Lindenstrauß U, Brausemann M, Herzberg M, Nies DH, Sawers RG, Heberle J*. Biochemistry. 2013 May 14; 52(19): 3289-96.
16. [NiFe]-hydrogenase maturation in vitro: analysis of the roles of the HybG and HypD accessory proteins.
Soboh B*, Lindenstrauß U, Granich C, Javed M, Herzberg M, Thomas C, **Stripp ST**. Biochem J. 2014 Dec 1; 464(2): 169-77.
17. The influence of oxygen on [NiFe]-hydrogenase cofactor biosynthesis and how ligation of carbon monoxide precedes cyanation.
Stripp ST*, Lindenstrauß U, Granich C, Sawers RG, Soboh B. PLoS One. 2014 Sep 11; 9(9): e107488.
18. Photosynthesis and hydrogen metabolism revisited. On the potential of light-driven hydrogen production in vitro.
Stripp ST, Heberle J*. Biohydrogen 2015 (pp. 211-238). Berlin, Boston: DE GRUYTER.
19. Identification of an Isothiocyanate on the HypEF Complex Suggests a Route for Efficient Cyanyl-Group Channeling during [NiFe]-Hydrogenase Cofactor Generation.
Stripp ST*, Lindenstrauß U, Sawers RG, Soboh B. PLoS One. 2015 Jul 17; 10(7): e0133118.
20. Stepwise Isotope Editing of [FeFe]-Hydrogenases Exposes Cofactor Dynamics.
Senger M, Mebs S, Duan J, Wittkamp F, Apfel UP, Heberle J, Haumann M, **Stripp ST***. Proc Natl Acad Sci U S A. 2016 June 10; 113(30): 8454-59.
21. Wasserstoffkatalyse in Mikroalgen.
Senger M and **Stripp ST***. 2017 Nachrichten aus der Chemie. 2017, 65, 123.
22. Accumulating the Hydride State in the Catalytic Cycle of [FeFe]-Hydrogenases.
Winkler M, Senger M, Duan J, Esselborn J, Wittkamp F, Hofmann E, Apfel UP, **Stripp ST***, Happe T* Nat. Comm. 2017, 8, 16115.

23. Bridging Hydride at Reduced H-Cluster Species in [FeFe]-Hydrogenases Revealed by Infrared Spectroscopy, Isotope Editing, and Quantum Chemistry.
Mebs S*, Senger M, Duan J, Wittkamp F, Apfel UP, Happe T, Winkler M, **Stripp ST***, Haumann M*. J. Am. Chem. Soc. 2017, 10.1021/jacs.7b07548.
24. Protonation and Reduction Dynamics at the Hydrogen-forming Cofactor of [FeFe]-Hydrogenases.
Senger M, Mebs S, Duan J, Shulenina O, Laun K, Kertess L, Wittkamp F, Apfel UP, Happe T, Winkler M*, Haumann M*, **Stripp ST***. Phys. Chem. Chem. Phys. 2017, 10.1039/c7cp04757f.