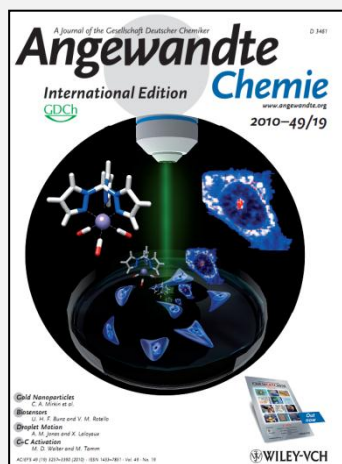


Biological activity and cellular imaging with organometal carbonyl complexes

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Although by many generally assumed as very sensitive to oxygen and water, a significant number of organometal carbonyl compounds have now been demonstrated to be stable for an extended period of time under physiological conditions and are even utilized by nature in some enzyme active sites. Besides these natural systems, synthetic metal-carbonyl complexes are now also widely explored for their potential therapeutic applications in human medicine. This steadily growing interest is mostly, but not exclusively, fueled by the recent identification of carbon monoxide as an endogenous signalling molecule in higher organisms, including humans, and the promise of utilizing its bioactivity in novel chemotherapeutic approaches.

A particularly promising feature of metal-carbonyl complexes is the presence of intense $M(C\equiv O)$ stretching vibrations in the 1800-2200 cm^{-1} spectral range, where they can be detected by IR or Raman spectroscopy with very little background signal from the normal constituents of biological systems. In the present lecture, an overview will be given on bioactive organometal carbonyl compounds as CO-releasing molecules (CORMs) to study the cellular action of this gasotransmitter and vibrational spectroscopy methods to detect both surface-immobilized as well as dissolved carbonyl complexes using confocal Raman microscopy and scattering scanning near-field infrared microscopy.

- [1] H.W. Peindy N'Dongo, I. Neundorf, K. Merz, U. Schatzschneider, Synthesis, characterization, and X-ray crystallography of cymantrene keto carboxylic acids for IR labelling of bioactive peptides on a solid support, *J. Inorg. Biochem.* 2008, 102, 2114-2119; [2] K. Meister, J. Niesel, U. Schatzschneider, D. Schmidt, N. Metzler-Nolte, M. Havenith, Metal-carbonyl complexes as a new modality for label-free live cell imaging by Raman microspectroscopy, *Angew. Chem. Int. Ed.* 2010, 49, 3310-3312; [3] U. Schatzschneider, PhotoCORMs: light-triggered release of carbon monoxide from the coordination sphere of transition metal complexes for biological applications, *Inorg. Chim. Acta* 2011, 374, 19-23; [4] I. Kopf, H.W. Peindy N'Dongo, F. Ballout, U. Schatzschneider, E. Bründermann, M. Havenith, Introducing cymantrene labels into scattering scanning near-field infrared microscopy, *Analyst* 2012, 137, 4995-5001.

CURRICULUM VITAE

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born October 5th 1971 in Berlin, married

Education and professional positions

since 09/2010	Associate Professor of Bioinorganic Chemistry (W2) at the University of Würzburg
12/2010	Habilitation in Inorganic Chemistry at the Ruhr-Universität Bochum, title of thesis "Bioorganometallic chemistry with carbonyl complexes: from small molecules and bioconjugates to nanoscale carriers"
10/2009 - 08/2010	Temporary Professorship (W2, Vertretungsprofessur) in Inorganic Chemistry at the University of Hamburg
08/2009 - 07/2010	Member of the <i>Global Young Faculty</i> 09/11 of the Institute for Advanced Study in Essen
07/2009 - 08/2010	Junior Principal Investigator in the Research Department Interfacial Systems Chemistry (RD-IFSC) of the Ruhr-Universität Bochum
04/2006 - 08/2010	independent research group leader within DFG research group FOR 630 "Biological function of organometallic compounds" at the Lehrstuhl für Anorganische Chemie I of the Ruhr-Universität Bochum
04/2004 - 03/2006	research group leader at the Institute of Pharmacy and Molecular Biotechnology of the University of Heidelberg and the Institute for Inorganic and Analytical Chemistry of the University of Mainz
04/2002 - 03/2004	postdoc in the group of Prof. Dr. J.K. Barton, Division of Chemistry and Chemical Engineering, California Institute of Technology, Pasadena, USA supported by a DFG fellowship
11/2001 - 03/2002	postdoc at the MPI for Bioinorganic Chemistry in Mülheim an der Ruhr, completion of work from the PhD project

Additional functions

since 10/2011	Chairman of the Examinations Committee (Prüfungsausschuß) of the Faculty of Chemistry and Pharmacy of the University of Würzburg
since 2012	member of COST action CM1105 " Functional metal complexes that bind to biomolecules"
since 2011	management committee member of COST action TD1004 "Theragnostics imaging and therapy: An action to develop novel nanosized systems for imaging-guided drug delivery"
since 2011	member of COST action BM1005 "Gasotransmitters: from basic science to therapeutic applications (ENOG: European Network on Gasotransmitters)"

- member of the organizing committee of the 6th International Symposium on Bioorganometallic Chemistry ISBOMC '12, Toronto, July 2012
- member of the organizing committee of the symposium on "Chemical interactions of metal-related therapeutic drugs" at the 243rd American Chemical Society Meeting, San Diego, March 2012

- member of the organizing committee of the 5th International Symposium on Bioorganometallic Chemistry ISBOMC'10, Bochum, July 2010
- reviewer for the Deutsche Forschungsgemeinschaft (DFG), the Swiss National Science Foundation (SNSF), the Fonds zur Förderung der wissenschaftlichen Forschung (FWF, Austria), and the Czech Science Foundation (GAČR)
- well over 200 reviews for leading international journals like *Angew. Chem.*, *Chem. Eur. J.*, *Chem. Commun.*, *Inorg. Chem.*, *Dalton Trans.*, *J. Inorg. Biochem.* and many more
- author of about 45 original papers in leading international peer-reviewed journals
- author of a laboratory textbook on experiments in bioinorganic chemistry: N. Metzler-Nolte, U. Schatzschneider, *Bioinorganic Chemistry - A Practical Course*, de Gruyter, Berlin 2009 (ISBN 978-3110209549)
- author of chapter on bioinorganic chemistry for the latest edition of the well-established general inorganic chemistry textbook: J.E. Huheey, E.A. Keiter, R.L. Keiter, R. Steudel, *Anorganische Chemie*, 4. Aufl., de Gruyter, Berlin 2012 (ISBN 978-3110249088)

Five most important publications 2009-2013

1. G. Dördelmann, T. Meinhardt, T. Sowik, A. Krüger, **U. Schatzschneider**, CuAAC click functionalization of azide-modified nanodiamond with a photoactivatable CO-releasing molecule (PhotoCORM) based on $[\text{Mn}(\text{CO})_3(\text{tpm})]^+$, *Chem. Commun.* **2012**, *48*, 11528-11530.
2. I. Kopf, H.W. Peindy N'Dongo, F. Ballout, **U. Schatzschneider**, E. Bründermann, M. Havenith, Introducing cymantrene labels into scattering scanning near-field infrared microscopy, *Analyst* **2012**, *137*, 4995-5001.
3. **U. Schatzschneider**, Photoactivated biological activity of transition metal complexes, *Eur. J. Inorg. Chem.* **2010**, 1451-1467 (invited microreview, cover picture of issue 10/2010).
4. K. Meister, J. Niesel, **U. Schatzschneider**, D. Schmidt, N. Metzler-Nolte, M. Havenith-Newen, Label-free imaging of metal-carbonyl complexes in live cells by Raman microspectroscopy, *Angew. Chem. Int. Ed.* **2010**, *49*, 3310-3312; *Angew. Chem.* **2010**, *122*, 3382-3384 (selected as a very important paper, cover picture of issue 19/2010).
5. H. Pfeiffer, A. Rojas, J. Niesel, **U. Schatzschneider**, Sonogashira and "Click" reactions in the N-terminal and side chain functionalization of peptides with $[\text{Mn}(\text{CO})_3(\text{tpm})]^+$ -based CO releasing molecules (tpm = tris(pyrazolyl)methane), *Dalton Trans.* **2009**, 4292-4298 (selected as a hot article).