

# Dr. Robert Hein

## Junior Research Group Leader

Organic Chemistry Institute, University of Münster, Corrensstraße 36, 48149 Münster, Germany

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## Research Interests

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My scientific interests are highly interdisciplinary and lie at the interface of molecular nanotechnology, supramolecular, surface- and electrochemistry. This encompasses the synthesis of novel supramolecular host systems for the recognition and subsequent sensing of ions and small molecules, the development of novel analytical techniques and assays as well as the study of supramolecular assemblies and (redox) switches.

## Employment

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07/2024 - to date	<b>University of Münster, Germany</b> Independent Junior Research Group Leader in the Institute of Organic Chemistry Mentor: Prof. Bart Jan Ravoo
09/2022 - 06/2024	<b>University of Groningen, Netherlands</b> Marie Curie Postdoctoral Fellow with Prof. B. L. Feringa Project: Redox-driven molecular switches and motors
07/2020 - 07/2022	<b>University of Oxford, U.K.</b> Postdoctoral Research Associate in Supramolecular Chemistry with Prof. P. D. Beer Project: Development of fluorescent ion sensors

## Education

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10/2016 - 11/2020	<b>University of Oxford, Lady Margaret Hall, U.K.</b> DPhil (PhD) in the Department of Chemistry with Prof. P. D. Beer and Prof. J. J. Davis Thesis: "Electrochemical Anion Sensing in Solution and at Receptive Interfaces"
08/2013 - 06/2016	<b>Jacobs University Bremen, Germany</b> Bachelor of Science in Chemistry, GPA: 1.15 (Scale: 1.00 (best) - 5.00 (failing)) Research group of Prof. W. M. Nau Thesis: "Synthesis of BODIPY Dyes for Supramolecular Reporter Pairs"
08/2015 - 01/2016	<b>Cornell University, USA</b> Exchange Semester at the College of Agriculture and Life Sciences, GPA: 4.03 (Scale: 4.30 (best) - 0.00 (failing))

## Research Stays

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08/2019 - 09/2019	<b>Research Group of Prof. P. R. Bueno, UNESP Araraquara, Brazil</b> Collaboration: Origins of capacitive phenomena at ion-receptive interfaces
08/2015 - 01/2016	<b>Research Group of Prof. G. W. Coates, Cornell University, USA</b> Undergraduate Research: Catalyst development, Dehydrogenation polymerizations
06/2015 - 08/2015	<b>Research Group of Prof. O. A. Scherman, University of Cambridge, U.K.</b> Internship: Synthesis and characterization of biocompatible hydrogels as drug carriers
06/2014 - 08/2014	<b>Fraunhofer Institute for Polymers and Composites PYCO, Germany</b> Internship: Synthesis of ephedrine derivatives

## Publications

12 as first author, 3 as (co)corresponding author; Google Scholar Profile (17.07.2024): Citations: 1279, h-index: 16

† - Equal contribution \* - Corresponding author

24. E. Sidler<sup>†</sup>, **R. Hein**<sup>†</sup>, D. Doellerer, B. L. Feringa\*, "Redox-Switchable Aromaticity in a Helically Extended Indeno[2,1-c]fluorene", *J. Am. Chem. Soc.*, **2024**, *146*, 19168–19176.
23. H. Bagha, **R. Hein**, W. K. Myers, M. R. Sambrook, P. D. Beer\*, "Phosphate selective binding and sensing by halogen bonding tripodal copper (II) metallo-receptors in aqueous media", *Dalton. Trans.*, **2024**, 10.1039/D4DT01585A.
22. A. J. Taylor<sup>†</sup>, **R. Hein**<sup>†\*</sup>, S. C. Patrick, J. J. Davis, P. D. Beer\*, "Redox-Modulated Fluorescent Halogen Bonding and Hydrogen Bonding Anion Sensing", *Angew. Chem.Int. Ed.*, **2024**, *63*, e202315959.
21. H. Bagha, **R. Hein**, J. Y. C. Lim, C. B. Durr, M. R. Sambrook, P. D. Beer\*, "Halogen Bonding Tripodal Metallo-receptors for Phosphate Recognition and Sensing in Aqueous containing Organic Media", *Chem. Eur. J.*, **2023**, *30*, e202302775.
20. M. Sharafeldin, **R. Hein**, J. J. Davis\*, "Catalysed amplification of faradaic shotgun tagging in ultrasensitive electrochemical immunoassays", *Chem. Commun.*, **2022**, *58*, 9472-9475.
19. **R. Hein**, P. D. Beer\*, "Halogen Bonding and Chalcogen Bonding Mediated Sensing", *Chem. Sci.*, **2022**, *13*, 7098-7125.
18. **R. Hein**, A. Docker, J. J. Davis\*, P. D. Beer\*, "Redox-Switchable Chalcogen Bonding for Anion Recognition and Sensing", *J. Am. Chem. Soc.*, **2022**, *144*, 8827-8836.
17. F. N. Tehrani, K. I. Assaf\*, **R. Hein**, T. C. Nugent, W. M. Nau\*, "Supramolecular Catalysis of a Catalysis-Resistant Diels-Alder Reaction: Rapid Dimerization of Cyclopentadiene inside Cucurbit[7]uril", *ACS Cat.*, **2022**, *12*, 2261-2269.
16. **R. Hein**\*, P. D. Beer\*, "Organometallic receptors for charged and neutral guest species", in: *Comprehensive Organometallic Chemistry IV*, Elsevier, **2022**, *14*, 418-462. DOI: 10.1016/B978-0-12-820206-7.00132-3
15. S. C. Patrick<sup>†</sup>, **R. Hein**<sup>†\*</sup>, P. D. Beer\*, J. J. Davis\*, "Continuous and Polarisation-tuned Redox Capacitive Anion Sensing at Electroactive Interfaces", *J. Am. Chem. Soc.*, **2021**, *143*, 19199–19206 (Highlighted as Spotlight)
14. S. C. Patrick<sup>†</sup>, **R. Hein**<sup>†</sup>, M. Sharafeldin, X. Li, P. D. Beer, J. J. Davis\*, "Real-time Voltammetric Anion Sensing Under Flow", *Chem. Eur. J.*, **2021**, *27*, 17700-17706.
13. Y. C. Tse, **R. Hein**, E. J. Mitchell, Z. Zhang, P. D. Beer\*, "Halogen-Bonding Strapped Porphyrin BODIPY Rotaxanes for Dual Optical and Electrochemical Anion Sensing", *Chem. Eur. J.*, **2021**, *27*, 14550-14559. (HOT paper)
12. S. C. Patrick, **R. Hein**, A. Docker, P. D. Beer\*, J. J. Davis\*, "Solvent Effects in Halogen and Hydrogen Bonding Mediated Electrochemical Anion Sensing in Aqueous Solution and at Interfaces", *Chem. Eur. J.*, **2021**, *27*, 10201-10209. (HOT paper)
11. **R. Hein**, X. Li, P. D. Beer\*, J. J. Davis\*, "Enhanced Interfacial Voltammetric Anion Sensing at Halogen and Hydrogen Bonding Ferrocenyl SAMs", *Chem. Sci.*, **2021**, *12*, 2433-2440. (HOT paper)
10. C. Jiang, F. Hopfner, A. Katsikoudi, **R. Hein**, S. Evetts, Y. Huang, H. Wang, J. W. Ryder, G. Kuhlenbäumer, G. Deuschl, A. Padovani, D. Berg, B. Borroni, M. T. Hu, J. J. Davis, G. K. Tofaris\*, " $\alpha$ -Synuclein in serum neuronal exosomes precedes and predicts Parkinson's disease", *J. Neurol. Neurosurg. Psychiatry*, **2020**, *91*, 720-729.
9. C. Jiang<sup>†</sup>, G. Wang<sup>†</sup>, **R. Hein**<sup>†</sup>, N. Liu, X. Luo\*, J. J. Davis\*, "Antifouling Strategies for Selective In Vitro and In Vivo Sensing" *Chem. Rev.*, **2020**, *120*, 3852-3889. (5th Place in "YourFavoriteReview" poll)
8. A. Baradoke, **R. Hein**, X. Li, J. J. Davis\*, "Reagentless Redox Capacitive Assaying of C-Reactive Protein at a Polyaniline Interface", *Anal. Chem.*, **2020**, *92*, 3508-3511.
7. P. R. Bueno\*, **R. Hein**, A. Santos, J. J. Davis\*, "The Nanoscopic Principles of Capacitive Ion Sensing Interfaces", *Phys. Chem. Chem. Phys.*, **2020**, *22*, 3770-3774. (HOT paper)
6. **R. Hein**, P. D. Beer\*, J. J. Davis\*, "Electrochemical Anion Sensing: Supramolecular Approaches", *Chem. Rev.*, **2020**, *120*, 1888-1935.

5. **R. Hein**, A. Borissov, M. D. Smith, P. D. Beer\*, J. J. Davis\*, "A halogen-bonding foldamer molecular film for selective reagentless anion sensing in water", *Chem. Commun.*, **2019**, 55, 4849-4852.
4. J. Piccoli, **R. Hein**, A. H. El-Sagheer, T. Brown, E. M. Cilli, P. R. Bueno\*, J. J. Davis\*, "Redox Capacitive Assaying of CRP at a Peptide Supported Aptamer Interface", *Anal. Chem.*, **2018**, 90, 3005-3008.
3. M. J. Rowland, C. C. Parkins, J. H. McAbee, A. Kolb, **R. Hein**, X. J. Loh, O. A. Scherman\*, "An Adherent Tissue-inspired Hydrogel Delivery Vehicle Utilized in Primary Human Glioma Models", *Biomater.*, **2018**, 179, 199-208.
2. M. A. Alnajjar, J. Bartelmeß, **R. Hein**, P. Ashokkumar, M. Nilam, W. M. Nau, K. Rurack, A. Hennig\*, "Rational design of boron-dipyrromethene (BODIPY) reporter dyes for cucurbit[7]uril", *Beilstein J. Org. Chem.*, **2018**, 14, 1961-1971.
1. **R. Hein**, C. Uzundal, A. Hennig\*, "Simple and rapid quantification of phospholipids for supramolecular membrane transport assays", *Org. Biomol. Chem.*, **2016**, 14, 2182-2185.

## Patents

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1. P. D. Beer, J. J. Davis, **R. Hein**, S. C. Patrick, 2021, "Redox capacitance sensing of particles under flow", WO-2023079269.

## Oral Presentations

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17. **9th EuChemS Chemistry Congress**, Dublin, 07/2024, "Ion-Dependent Conformational Switching of Bisthiocyanthylidenes"
16. **The 5th ERC Grantees Conference**, Edinburgh, 07/2023, "Redox-Switchable Chalcogen Bonding for Anion Recognition and Sensing"
15. **University of Ulm**, 05/2023, Ulm, Germany, "Supramolecular Electrochemistry: Novel Approaches for Sensing and Redox Switching" (*Invited lecture*)
14. **University of Münster**, 05/2023, Münster, Germany, "Supramolecular Electrochemistry: Novel Approaches for Sensing and Redox Switching" (*Invited lecture*)
13. **GDCh-Kolloquium, University of Osnabrück**, 01/2023, Osnabrück, Germany, "Supramolecular Electrochemistry: Novel Approaches for Sensing and Redox Switching" (*Invited lecture*)
12. **SupraChem 2022**, 07/2022, Mainz, Germany, "Redox-Switchable Chalcogen Bonding for Anion Recognition and Sensing"
11. **Matrafured - International Meeting on Chemical Sensors 2022**, 06/2022, Visegrad, Hungary, "Continuous and Polarisation-Tuned Redox Capacitive Ion Sensing at Electroactive Interfaces"
10. **Somerville JRF Symposium 2022**, 05/2022, Oxford, U.K., "Going with the Flow: Development of Sensing Devices for Water Monitoring"
9. **Analytical Research Forum 2021**, Online conference, "Electrochemical Anion Sensing: From Fundamentals to Applications"
8. **Seminar in Chemistry, Mahidol University**, 09/2020 (online), Bangkok, Thailand, "Supramolecular Electrochemistry: Anion Sensing and Fundamental Host-Guest Studies" (*Invited lecture*)
7. **MPLS Graduate Seminar, Lady Margaret Hall 2020**, Oxford, U.K. "Harnessing the Power of Electrochemistry: Sensors and Higher-order Structures"
6. **Sao Paulo State University**, 08/2019, Araraquara, Brazil, "From Supramolecular Anion Recognition to Electrochemical Sensing"
5. **Oxford Electrochemical Society Chapter Symposium 2019**, Oxford, U.K., "Anion Sensing via non-Faradaic Capacitance Spectroscopy"
4. **Inorganic Graduate Symposium 2019**, Oxford, U.K., "Electrochemical Anion Sensing in Solution and at Receptive Interfaces"

3. **Mahidol University**, 02/2019, Bangkok, Thailand, "Electrochemical Anion Sensing" (*Invited lecture*)
2. **Pure and Applied Chemistry International Conference, PACCON 2019**, Bangkok, Thailand, "Non-Faradaic Capacitive Anion Sensing at Anion Receptive Interfaces"
1. **Macrocyclic and Supramolecular Chemistry Meeting 2018**, Lancaster, U.K., "A Halogen-bonding Foldamer Molecular Film for Selective Reagentless Anion Sensing in Water"

Poster presentations: 7 at international conferences

## Teaching and Mentoring

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10/2023	<b>Lecturer for "Photochemistry and Photoredox Catalysis", University of Groningen</b> MSc Course, 2 lectures + 1 tutorial, substitute for Prof. B. L. Feringa,
03/2023 - 05/2023	<b>Supervisor for MSc Student, University of Groningen</b> Project: Chiral Redox Switching in Liquid Crystals
03/2023	<b>Lecturer at Second Dutch selection round for the International Chemistry Olympiad</b> Lecture: Physical-Organic Chemistry
10/2020 - 09/2021	<b>College Advisor, Kellogg College, University of Oxford, U.K.</b> Academic college advisor to nine postgraduate students
09/2019 - 06/2022	<b>Supervisor for three PartII (MChem) Students, University of Oxford</b> Projects: Voltammetric anion and ion-pair sensing, capacitive ion sensing under flow
Michaelmas term 2017	<b>Lab Demonstrator, Physical and Theoretical Chemistry Lab, University of Oxford</b>
Spring term 2016	<b>Teaching Assistant, Jacobs University Bremen:</b> -Advanced Lab Course Physical Chemistry -Organic Chemistry II
Spring term 2015	<b>Teaching Assistant, Jacobs University Bremen:</b> -Advanced Lab Course Physical Chemistry -Organic Chemistry Lab
03/2014 - 2017, 2023	<b>Lecturer at Third German selection round for the International Chemistry Olympiad</b> Seminars: Organic Chemistry I-III, Physical-Organic Chemistry Lectures: Supramolecular Chemistry (2x), Dyes

## Funding and Awards

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**Liebig-Fellowship**, Fonds der Chemischen Industrie, from 07/2024

**Emerging Investigators Bursary**, The 5th ERC Grantees Conference, 07/2023

**Marie Skłodowska-Curie Postdoctoral Fellowship**, EU, 09/2022-08/2024

**Feodor-Lynen Fellowship**, Alexander von Humboldt Foundation, declined

**Fulford Junior Research Fellowship**, Somerville College, University of Oxford, 10/2021 - 07/2022

**Postdoctoral Research Fellowship**, Christ Church, University of Oxford, 2021, declined

**Junior Research Fellowship**, Kellogg College, University of Oxford, 2021, declined

**Research Membership of Common Room**, Kellogg College, University of Oxford, 10/2020-09/2021

**Santander Academic Travel Award**, 2019, for research collaboration in Brazil

**One-year Residential Scholarship**, Lady Margaret Hall, 2016/17

**Fellowship of the Studienstiftung des Deutschen Volkes**, 03/2016 - 09/2017

**Entry on the President's List of Jacobs University Bremen**, 2013 - 2016, Cumulative GPA better than 1.50

**Merit-based scholarship**, Jacobs University Bremen, 2013-2016

**German selection contest for the International Chemistry Olympiad**, 2012: Round 3, Place 26; 2013: Round 3 and 4, Place 5 and 8

**German selection contest for the International Physics Olympiad**, 2013: Round 3, Place 36

**Primus-Prize of the city of Frankfurt (Oder)**, 2013, Prize for outstanding accomplishments in the natural sciences

## **Professional Service and Extracurricular Activities**

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Reviewer	<b>Fulbright Poland (Senior Award), Electrochem. Commun., Mater. Horiz., J. Elecanal. Chem.</b>
07/2019	<b>Mentor for the German National Team at the 51<sup>st</sup> International Chemistry Olympiad, Paris, France</b>
01/2018 - 12/2018	<b>MCR Social Secretary, Lady Margaret Hall, University of Oxford</b>
07/2016	<b>Scientific Observer for the German National Team at the 48<sup>th</sup> International Chemistry Olympiad, Tblisi, Georgia</b>
05/2014 - 06/2016	<b>Chemistry Society, Jacobs University Bremen, President (04/2015 - 05/2016)</b>
06/2012 - 06/2017	<b>Förderverein Chemie-Olympiade e.V. (Friends Of The Chemistry Olympiad e.V.)</b> Organiser of the students chemistry competition "Chemie – die stimmt!" in the states of Lower Saxony and Bremen (03/2014 - 06/2017), Member of the advisory board (2013 - 2016)