UniSysCat - Colloquium

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Start Time: Wednesday, July 5, 2023 05:15 pm

End Time: Wednesday, July 5, 2023 06:30 pm

C 264
or via Zoom

Hydride and Hydroxide Intermediates in the Catalytic Turnover of Gas-processing Metalloenzymes

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Gas-processing metalloenzymes (GPMs) catalyse challenging reactions exploiting abundant transition metal ions like iron, nickel, or molybdenum. Understanding the structure and molecular mechanism of GPMs inspires the design of synthetic catalysts for H_2 production, N_2 fixation, and the removal of CO_2 from the atmosphere.

Based on insight from structural biology and *in situ* vibrational spectroscopy [(1)], I will discuss GPMs like hydrogenase [(2)] and nitrogenase [(3)]. Both enzymes bind specialised iron-sulphur clusters that catalyse proton-coupled electron transfer (PCET) processes. Second and outer coordination sphere effects critically promote metal-hydride species that are key to H_2 production with zero electric overpotential and N_2 fixation under ambient conditions [(4)] Similar concepts help understanding the enzymatic conversion of CO_2 by carbonic anhydrase that exploits metal-hydroxide species in catalysis(5).

Beyond a microscopic understanding of enzymatic turnover, vibrational spectroscopy on [FeFe]- and [NiFe]-hydrogenase complexes allows demonstrating catalytic coupling with CO_2 reduction [(6)], O_2 reduction [(7)], and electron bifurcation (8).

References

1. S. T. Stripp, *ACS Catal.* **11**, 7845–7862 (2021).

2. H. Tai, S. Hirota, S. T. Stripp, *Acc Chem Res.* **54**, 232–241 (2021).

3. M. Rohde, K. Laun, I. Zebger, S. T. Stripp, O. Einsle, *Sci Adv.* **7**, eabg4474 (2021).

4. S. T. Stripp et *al.*, *Chem Rev.* **122**, 11900–11973 (2022).

5. A. Gomez et *al.*, *ChemRxiv*. 1–15 (2022).

6. H. M. Dietrich et *al.*, *Nature*. **607**, 823–830 (2022).

7. R. Grinter et *al.*, *Nature*. **615**, 541–547 (2023).

8. A. Katsyv et *al.*, *J Am Chem Soc.* **145**, 5696–5709 (2023).

Prof. Dr. Maria-Andrea Mroginski

Organizer