JUSTUS-LIEBIG-
UNIVERSITÄT
GIESSEN

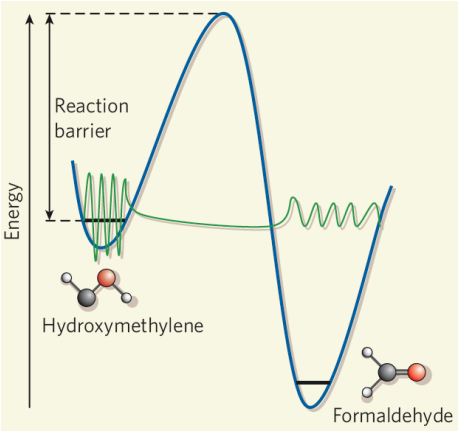
Institute for Organic Chemistry
prs • group

Bachelor's and Master's Theses

in

Hydroxycarbene Chemistry

Key words: Hydroxycarbenes, sugar formation, origins of life, tunneling, organic spectroscopy, ab initio computations, molecular dynamics



Singlet carbenes incorporating a divalent carbon atom (R–C–R') have grown from laboratory curiosities and theoreticians' pet peeves into reagents in the growing field of stable carbene chemistry. Still, the experimental characterization of many simple yet fundamentally important carbenes (e.g., hydroxycarbenes, alkyl carbenes, etc.) is hampered by their high reactivity or lack of precursors. Hydroxycarbenes have been an unknown class of compounds until 2008, when our group reported the synthesis and characterization of hydroxymethylene (H–C–OH, **1**), whose preparation has been challenging organic chemists for more than 80 years. The reaction of **1** with formaldehyde would be a source of simple sugars (the so-called "*formose* reaction" in the origin of life theory). Considerable efforts are ongoing to understand the formation and distribution of simple organics in extraterrestrial environments, and the examination of the structures and reactivities of prototypes such as **1** may also provide glimpses of the prebiotic earth.

Your B. Sc. or M. Sc. work would focus on the preparation and identification of new carbenes and their reactions. In particular, we are interested in the topics below. You will be part of an international team working at the forefront of understanding reactive intermediates.

Topics:

1. Preparation and characterization of novel hydroxycarbenes
2. Elucidating hydroxycarbene tunneling behavior
3. Preparative applications of hydroxycarbenes
4. High-level computational studies (with W. D. Allen and A. G. Csaszar groups in the US and Budapest)

Interested? Talk to us: labs on the 5th–7th floor, OC wing

Prof. Dr. Peter R. Schreiner
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Selected papers:

[1] *Capture of Elusive Hydroxymethylene, a Tunnelling Marvel Precluded from Sugar Formation in Space*. P. R. Schreiner, H. P. Reisenauer, F. Pickard, A. C. Simmonett, W. D. Allen, E. Mátyus, and A. G. Császár *Nature* **2008**, *453*, 906. **Highlights**: a) Cool it, baby. M. Räsanen *Nature* **2008**, *453*, 862–863. b) Houdini molecule escapes energy trap. S. Hadlington *Chemistry World* **2008**, June 11, p. 23. c) Hydroxymethylene Captured. B. Halford *Chem. Eng. News* **2008**, *86*(24), 15. d) Leben eines Organischen Moleküls verlängert. U. Bilow *FAZ*, August 6, 2008, *182*, p. N1. e) Watching a Molecular Mole at Work. G. Bucher *Angew. Chem. Int. Ed.* **2008**, *47*, 6957–6958. f) Aus der Traum vom Weltraum? S. Feil *Chem. Unserer Zeit* **2008**, *42*, 252.

[2] Spectroscopic Characterization of Dihydroxycarbene. Peter R. Schreiner and Hans Peter Reisenauer *Angew. Chem. Int. Ed.* **2008**, *47*, 7071–7074. *Angew. Chem.* **2008**, *120*, 7179–7182.