

ELECTRON & HYDROGEN TRANSFER IN ORGANIC PHOTOCHEMICAL REACTIONS

Norbert HOFFMANN - CNRS Research Director

CNRS, Université de REIMS
Institut de Chimie Moléculaire de REIMS (UMR7312)
Equipe de Photochimie

Mail - norbert.hoffmann@univ-reims.fr



Photochemical reactions play an important role in the context of organic synthesis. They provide efficient ways to prepare compounds or compound families which are not or difficultly accessible by more conventional methods of organic synthesis. This is explained by the fact that photochemically excited compounds have a completely different electronic configuration when compared to the corresponding ground state molecules.¹ Also electron transfer and hydrogen steps are facilitated when they occur at the electronically excited state.² Often such steps are involved in photoredox catalytic reactions which are currently intensively investigated in connection with organic synthesis.^{3,4,5}

Our research in this domain deals with intramolecular hydrogen transfer of furanones⁶ and imines⁷. We are particularly interested in the stereo- and regioselectivity. Photochemical intra- and intermolecular electron and hydrogen transfer leads to unusual products.⁸ Physicochemical investigations provide a profound understanding of such processes. Further studies deal with trifluoromethylation⁹ and photochemically induced stereo- and regioselective radical addition¹⁰.

References:

- ¹ P. Klán, J. Wirz, *Photochemistry of Organic Compounds*. Wiley, Chichester, 2009. M. Oelgemöller, N. Hoffmann, Studies in organic and physical photochemistry – an interdisciplinary approach. *Org. Biomol. Chem.* **2016**, *14*, 7392
- ² N. Hoffmann, Electron and hydrogen transfer in organic photochemical reactions, *J. Phys. Org. Chem.* **2015**, *28*, 121. N. Hoffmann, Photochemical Electron and Hydrogen Transfer in Organic Synthesis: The Control of Selectivity, *Synthesis* **2016**, *48*, 1782.
- ³ C. R. J. Stephenson, T. P. Yoon, D. W. C. MacMillan, Eds., *Visible Light Photocatalysis in Organic Chemistry*, Wiley VCH, Weinheim, 2018. B. König, Ed. *Photocatalysis*, 2nd Edition, Walter de Gruyter, Berlin, 2020.
- ⁴ C. Michelin, N. Hoffmann, Photosensitization and Photocatalysis – Perspectives in Organic Synthesis, *ACS Catal.* **2018**, *8*, 12046.
- ⁵ M. Latrache, N. Hoffmann, *Chem. Soc. Rev.* **2021**, *50*, 7418-7435
- ⁶ R. Jahjah, A. Gassama, V. Bulach, C. Suzuki, M. Abe, N. Hoffmann, A. Martinez, J.-M. Nuzillard, Stereoselective Triplet-Sensitized Radical Reactions of Furanone Derivatives, *Chem. Eur. J.* **2010**, *16*, 3341.
- ⁷ C. Lefebvre, C. Michelin, T. Martzel, V. D. Mvondo, V. Bulach, M. Abe, N. Hoffmann, Photochemically induced intramolecular radical cyclization reactions with imines, *J. Org. Chem.* **2018**, *83*, 1867.
- ⁸ R. Jahjah, A. Gassama, F. Dumur, S. Marinković, S. Richert, S. Landgraf, A. Lebrun, C. Cadiou, P. Sellès, N. Hoffmann, Photochemical Electron Transfer Mediated Addition of Naphthylamine Derivatives to Electron Deficient Alkenes, *J. Org. Chem.* **2011**, *76*, 7104. M. Fréneau, C. Lefebvre, M. A. Gómez Fernández, C. Richard, N. Hoffmann, Photochemical reactivity of phenyl (methyl-tetrazolyl) ketone- Hydrogen atom transfer vs electron transfer, *New J. Chem.* **2019**, *43*, 17151.
- ⁹ Q. Lefebvre, N. Hoffmann, M. Rueping, Photoorganocatalyse trifluoromethylation of olefins and (hetero)aromatics in batch and flow, *Chem. Commun.* **2016** *52*, 2493.
- ¹⁰ C. Lefebvre, T. Van Gysel, C. Michelin, E. Rousset, D. Djiré, F. Allais, N. Hoffmann, *Eur. J. Org. Chem.* **2022**, e202101298.