



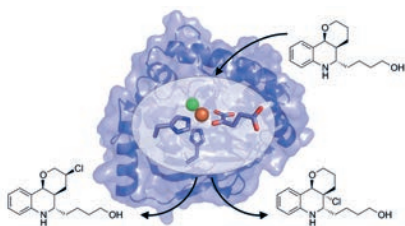
Swiss Science Concentrates

A CHIMIA Column

Short Abstracts of Interesting Recent Publications of Swiss Origin

Evolved Aliphatic Halogenases Enable Regio-complementary C-H Functionalization of an Added-Value Chemical

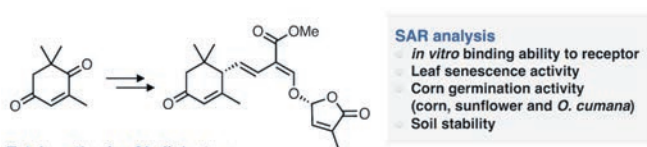
T. Hayashi, M. Ligibel, E. Sager, M. Voss, J. Hunziker, K. Schroer, R. Snajdrova, and R. Buller,* *Angew. Chem. Int. Ed.* **2019**, *58*, 18535. ZHAW and Novartis Institute for BioMedical Research
The selective halogenation of unactivated C(sp³)-H bonds is of high synthetic interest to change the properties of pharmaceuticals and agrochemicals or to install chemical handles for further functionalization. By using structure-guided evolution of the non-heme iron halogenase WelO5*, the authors designed an enzyme that exhibits a more than 290-fold higher turnover number and a 400-fold higher apparent k_{cat} compared to the wild type in the selective chlorination of a martinelline-derived fragment. This is the first example of enzyme engineering that successfully expands the substrate scope of this enzyme family beyond the native indole alkaloid-type substrates.



Total Synthesis and Biological Evaluation of Heliolactone

M. Yoshimura, R. Fonné-Pfister, C. Screpanti, K. Hermann, S. Rendine, M. Dieckmann, P. Quinodoz, and A. De Mesmaeker,* *Helv. Chim. Acta* **2019**, *102*, e1900211. ETH Zurich, Syngenta Crop Protection AG

Strigolactones are a family of phytohormones which are involved in diverse aspects of plant growth and development. Their broad activity makes strigolactones an interesting solution to promote sustainable agriculture. Recently, heliolactone, a non-canonical type of strigolactone, was isolated from the root exudates of sunflower. To assess the biological potential of this molecule, De Mesmaeker and co-workers performed the gram-scale total synthesis of heliolactone, as well as its stereoisomers and analogues. This allowed them to test their biological activities on crops and parasitic weeds and to understand the effect of the stereochemistry and substitution patterns.



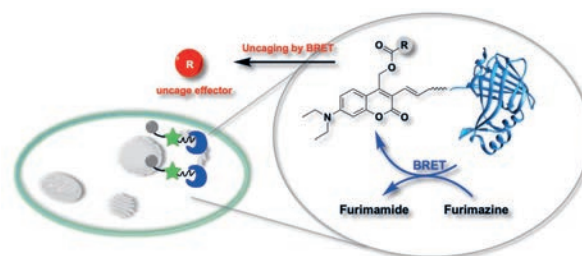
Total synthesis of heliolactone

Strategy A: 9 steps, 17%, racemic synthesis, gram scale synthesis
Strategy B: 11 steps, 8%, synthesis of single enantiomer

Luciferase-Induced Photouncaging: Bioluminescence

D. Chang, E. Lindberg, S. Feng, S. Angerani, H. Riezman, and N. Winssinger,* *Angew. Chem. Int. Ed.* **2019**, *58*, 16033. University of Geneva

Bioluminescence resonance energy transfer (BRET) mediated by luciferase enzymes has been used to report on dynamic processes in biological systems and can also be exploited to turn on some proteins in living systems. Winssinger and co-workers report the first example of direct photouncaging of small molecules in living cells using bioluminescence. This bioorthogonal process, named bioluminescence, effects the release of functional molecules such as kinase inhibitors through efficient BRET from the NanolucHalotag chimera protein to a coumarin-based substrate. This new strategy could enable the easy release of bioactive small molecules with subcellular and tissue specificity.



Synthesis of Organic Super-Electron-Donors by Reaction of Nitrous Oxide with N-Heterocyclic Olefins

L. Y. M. Eymann, P. Varava, A. M. Shved, B. F. E. Curchod, Y. Liu, O. M. Planes, A. Sienkiewicz, R. Scopelliti, F. Fadaei Tirani, and K. Severin,* *J. Am. Chem. Soc.* **2019**, *141*, 17112. EPFL and Durham University

N-heterocyclic olefins (NHOs) are alkylidene derivatives of N-heterocyclic carbenes (NHCs) with a strongly polarized exocyclic C=C double bond and a strong Lewis base character. The authors observed that NHOs are able to activate nitrous oxide ('laughing gas') under mild conditions to form azo-bridged NHO dimers. They demonstrated that these dimers are able to reduce aryl iodides and can hence be considered as organic super-reducing agents. Cyclic voltammetry revealed that their first oxidation potentials are similar to those of tetraazafulvalene derivatives. This suggests that these new super-electron-donors could find applications as potent reducing agents in synthetic chemistry.

