INTERNATIONAL SOLVAY INSTITUTES BRUSSELS

Solvay Colloquium

Professor Stefan Matile

University of Geneva, Switzerland

Functional Supramolecular Chemistry

This lecture will focus on functional systems that emphasize conceptual innovation, integrate unorthodox interactions,[1] and address lessons from and challenges in nature.

Catalysis with anion-π interactions[2] and chalcogen bonds[3] will be introduced as recent examples for "exotic" interactions at work. Anion-π catalysts for asymmetric enolate, enamine, iminium and transamination chemistry, the first anion-π enzyme,[4] and remote control by electric fields will be presented. The more delocalized nature of anion-π interactions suggests that the stabilization of long-distance charge displacements in cascade reactions on π-acidic aromatic surfaces deserves particular attention.[5] This is almost complementary to the highly localized transition-state stabilization in the focal point of two or more chalcogen bond donors. To realize this noncovalent catalysis with chalcogen bonds, benzodiselenazoles and dithienothiophenes will be introduced as a privileged scaffold reminiscent of classics such as bipyridines or bipyrroles.[2]

A twisted dimer of same dithienothiophenes will be introduced as the first fluorescent probes that can image membrane tension in cells (unpublished). The fluorescent imaging of forces in biological systems in general is one of the central current challenges that are waiting for solutions from chemistry. Our contribution to solve this problem focuses on mechanosensitive "flipper" probes that change color like lobsters during cooking, that is by a combination of polarization and planarization of the mechanophore in the ground state.[6]

Another central, most persistent challenge in current biology concerns the question how to move across lipid bilayer membranes. To find new ways to enter cells, dynamic covalent disulfide exchange chemistry on their surface is particularly attractive. Coming from counterion-mediated uptake with cell-penetrating peptides, attention is gradually shifting over hybrid mechanisms with cell-penetrating poly(disulfide)s (CPDs) toward strain-promoted thiol-mediated uptake with asparagusic acid[7] and, most recently, epidithiodiketopiperazines (ETPs)[8] and diselenolanes (unpublished). With a CSSC dihedral angle near zero, ring tension with ETPs and diselenolanes is at the maximum, their uptake efficiency is correspondingly powerful.

Tuesday 28 November 2017 at 4.00 P.M.

COFFEE AND TEA WILL BE SERVED AT 3.45 P.M. IN FRONT OF THE SOLVAY ROOM

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