



# 2018 International Solvay Chair in Chemistry Program



Professor Ben Feringa  
U. of Groningen, The Netherlands

**LECTURE 2 : Tuesday 9 April 2019 (10 - 11 A.M., Solvay Room)**

## *Catalytic Asymmetric Catalysis*

The challenge to develop the fully catalytic sustainable organic synthesis of the future sets the stage for a new era in asymmetric catalysis. Besides high levels of activity and selectivity, practicality of the new catalytic methodologies is a key parameter. The design of catalytic toolkits and tandem catalytic conversions are other important aspects. In this lecture new catalytic systems based on monodentate phosphoramidite ligands with a focus on C-C bond formation will be presented. The enantioselective transformations include catalytic conjugate addition reactions of organozinc and Grignard reagents and allylic alkylation of organolithium reagents with absolute levels of stereocontrol. Furthermore approaches towards dynamic control of chirality and supramolecular systems are discussed. The synthetic methodology will be illustrated in the total synthesis of structures demanding remote acyclic stereocontrol.

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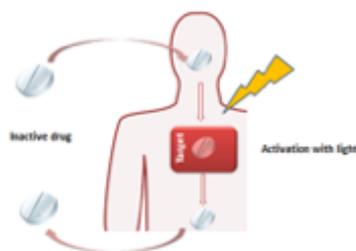
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**LECTURE 3: Tuesday 9 April 2019 ( 3 - 4 P.M. Solvay Room)**

### *Photoresponsive Biomolecular Systems*

The biomolecular machinery that sustains life is a great source of inspiration to design dynamic and responsive functional molecular systems. Can we make smart drugs that can be delivered and activated exclusively at the disease spot? In this lecture I will discuss different approaches currently taken to address some of basic challenges associated with dynamic molecular systems. In particular the use of light offers bright and unconventional opportunities. Light is a non-invasive signal and can be delivered with high precision in space and time. The principles and opportunities of photo-pharmacology will be discussed. Light allows the on-off switching of the activity of a therapeutic agent, as will be illustrated for antibiotics and antitumor drugs. New synthetic methodology towards tracers for molecular imaging is also shown. Other possibilities include potential systems for drug delivery based on self-assembled and light-responsive nano-tubes and vesicles. In the final part of this voyage fundamental principles of autonomous propelling systems are presented that might ultimately form the basis for the roving sensors.



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**LECTURE 4: Thursday 11 April 2019 ( 3 - 4 P.M. Solvay Room)**

### ***Molecular Switches and Motors***

The fascinating molecular motors and machines that sustain life offer a great source of inspiration to the molecular explorer at the nanoscale. Among the major challenges ahead in the design of complex artificial molecular systems is the control over dynamic functions and responsive far-from-equilibrium behaviour. Chemical systems ultimately require integration of structure, organization and function of multi-component dynamic molecular assemblies at different hierarchical levels. A major goal is to achieve and exploit translational and rotary motion. In this presentation the focus is on the dynamics of functional molecular systems as well as triggering and assembly processes. We design switches and motors in which molecular motion is coupled to specific functions. Responsive behaviour will be illustrated in self-assembly, information systems, supramolecular and polymer materials, responsive surface and artificial muscles. The design, synthesis and functioning of rotary molecular motors and machines will be presented with a prospect toward future dynamic molecular systems.

Information on <http://www.benferinga.com>

Molecular Machines: Nature, September 2015

Molecular Switches: Chemistry World, June 2016

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