



Molecular Motors, powering dynamic functional molecular systems



Professor Ben Feringa is awarded the second ERC advanced grant.

Ben received his first ERC Advanced Grant (Molecular Motors) in 2008 and is now awarded a second one for 2,5 million euros.

In this second program the unique properties of unidirectional light driven molecular rotary motors will be built upon to achieve dynamic control of function and develop responsive systems with a particular focus on systems in water. Light-driven molecular rotary motors are distinct from the majority of molecular switches, as they allow sequential access to multiple functional states in a responsive system through non-invasive stimulation. Importantly, continuous irradiation induces continuous rotary motion which provides a unique opportunity to design dynamic systems and responsive materials that can be driven out-of-equilibrium.

The proposed research program is highly challenging but provides the comprehensive effort required to achieve control of complex nanomechanical systems and will opening a bright future for applications ranging from stimuli responsive materials to spatio-temporal control of biomolecular systems.

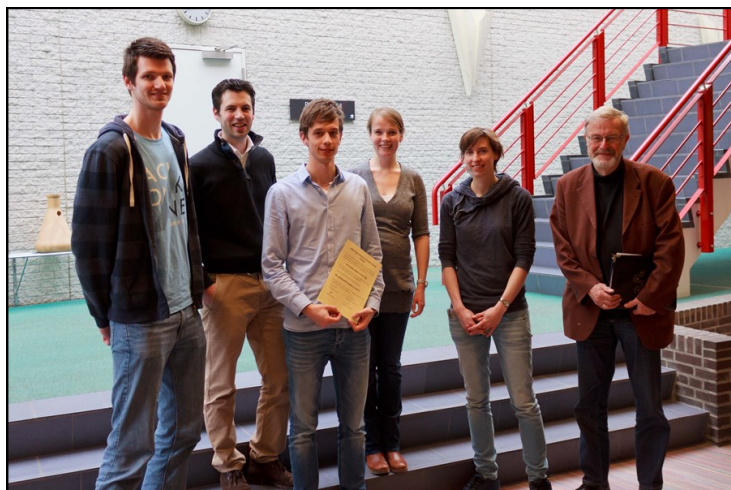
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KNCV Backer Prize for Massimo Giannerini

Massimo Giannerini, former group member in the Feringa Group, has been awarded the KNCV Backer prize for best thesis Organic Chemistry 2015.

After careful reflection and consideration of 45 dissertations the thesis of Dr. Massimo Giannerini was considered the best to receive the KNCV Backer price. The study was conducted in the Netherlands under the guidance of Prof Ben Feringa. The committee was very impressed by the neat way in which the experiments are described and some innovative steps in the synthesis but also the substantive discussions in the various chapters. In short, the overall quality of the thesis was considered excellent.

Stratingh Award 2015



On Thursday March 24th, the winner of the Stratingh Award for the best-written colloquium of 2015 was announced. After an introduction on the history of this prestigious prize by Prof Jan Engberts, the three nominees that were selected by the selection committee were announced. The committee consisting of 2 staff members (Martin Witte and Marthe Walvoort) and 2 PhD students (Dowine de Bruijn and Luuk Kortekaas) ranked the colloquia on criteria like critical analysis and clarity of writing.

The prize for the third place went to Federico Lancia with his colloquium entitled

"Droplets of liquid crystals as building blocks for soft photonics". His colloquium described in detail the current advances in this field. The runner up of this year Stratingh Award was Giedrius Zolubas, who described in his collo-

quium *"Meta C-H functionalization using base-templated approach"* the innovative methods that are being developed for meta-functionalization of monosubstituted arenes. The winner of this years Stratingh Award, Ramon van der Vlag, described in his colloquium the upcoming field of gold(III) catalysis. The most important advances and problems that need to be tackled by the field as well as future application were presented in attractive and very clear manner. The title of the winning colloquium by Ramon van der Vlag is: *"The organometallic chemistry of Au(III)"*. The award ceremony was followed by coffee and cake for the members of the Stratingh Institute and a lunch for the members of H.J. Backer foundation, the selection committee and of course the winner of the Stratingh prize.

Graduate School Sounding Board

The Graduate School of Science has a sounding board that comprises PhD students from all research institutes at the Faculty of Mathematics and Natural Sciences. The PhD sounding board gives sought and unsolicited advice to the PhD council and the Graduate School of Science in PhD-related issues. If you are interested in becoming Stratingh Institute representative in the GS sounding board please contact Cristina (m.c.darrigo@rug.nl or 4233).

Highlights by Prof. dr. Jan B.F.N.Engberts

- In a joint project of IBM, Zürich, and the University of Santiago de Compostela, on-surface generation and imaging of arynes was accomplished using atomic force microscopy. Individual polycyclic arynes were generated on an ultrathin insulating film by means of low-temperature scanning tunnelling microscopy and atomic force microscopy. Aryne reactivity is preserved at cryogenic temperatures and a cumulene resonance structure is dominant as suggested by bond-order analysis. In a molecule consisting of a chain of three carbon rings a carbon-carbon bond was cleaved, thereby converting two of the rings into one large one. Using another pulse, the large ring was converted back into two rings. Overall the results gave useful insights into the chemical properties of the elusive intermediates and also suggest potential applications in the field of on-surface synthesis. Pavlicek, N., Schuler, B., Collazos, S., Moll, N., Pérez, D., Guitián, E., Meyer, G., Pena, D., Gross, L., *Nature Chemistry*, 2015, 7, 623-628. Reviewed by Phil Ball, *Chemistryworld*, January 25, 2016. See also *Nature Chemistry*, 2016, 8, 220-224.
- Synthetic chemists from two research institutes in Bombay and from Monash University in Victoria, Australia published the first metal-free nitrogenation of terminal alkynes, using tert-butyl nitrite as the nitrogenating reagent, to give aryl nitriles under mild conditions. The synthetic protocol allows the use of a large variety of functional groups. Because no hazardous materials are employed, potential applications in both industry and academia can be considered. Dutta, U., Lupton, D.W., Maiti, D., *Org.Lett.* 2016, 18, 860-863.
- Sybren Otto and three of his coworkers at our Stratingh Institute published recent work that marks an important step towards achieving Darwinian evolution using a system of fully synthetic self-replicating molecules and towards the synthesis of life. They monitored in real time and at a molecular level the diversification of self-replicating species into two distinct sets, competing for two different building blocks (to be considered as "food") and thereby capturing an important aspect of the process by which species may arise. The second

replicator set is a descendant of the first. Both sets are kinetic products opposing the thermodynamic preference of the system. The sets occupy related but complementary food niches. A timescale of weeks is required for diversification into sets which can be studied at the molecular level. Interestingly, this work provides novel opportunities for experimentally investigating the process through which species arise in real time and with enhanced detail. *Sadownik, J.W., Mattia, E., Nowak, P., Otto, S., Nature Chemistry, 2016, 8, 264-269.*

- Aragones (University of Barcelona) and seven colleagues from Spanish and Australian Universities accomplished electrostatic catalysis of a Diels-Alder reaction. So far, this technique was believed to be only possible for redox reactions. But now it was shown that the formation of carbon-carbon bonds can also be accelerated by an electric field, properly aligned to favor electron flow from the dienophile to the diene. A scanning tunneling microscopy break-junction (STM-BJ) technique was employed to create a sufficiently strong electric field. A 5-fold increase of the reaction rate was observed by increasing the strength of the applied electric field 15-fold. Much further work is necessary before the electrostatic catalysis can be used on an industrial scale, but the STM-BJ approach is a highly interesting novel way to study and control chemical reactions at the single-molecule level. The paper has been reviewed by Xiang and Tao. *Aragones, A.C., Haworth, N.L., Darwish, N., Ciampi, S., Bloomfield, N.J., Wallace, G.G., Diez-Perez, I., Coote, M.L., Nature, 2016, 531, 88-89; Xiang, L., Tao, N.J., Nature, 2016, 531, 38-39.*
- Two chemists from a University in Moscow and one from Baku University in Azerbaijan wrote an extensive review (133 references!) about recent advances in the bromination of aromatic and heteroaromatic compounds. Aromatic bromo derivatives are useful intermediates in organic synthesis and possess importance in medicinal chemistry. Special attention is given to procedures with inherent regioselectivity and to green syntheses using conveniently accessible and safe reagents. The authors argue that the bromination of aromatics will get increasing importance in future chemistry. *Voskressensky, L.G., Golantsov, N., Maharramov, A., Synthesis, 2016, 48(05), 615-643.*
- Perhaps not a highlight, but nevertheless an important paper. Chemists from three research institutes in Belgium argued that the environmental impact of metal halide perovskite solar cells (OHPs) is an important issue. In recent years these solar cells found great interest as efficient light harvesters, and also as light-emitting diodes, lasers and photodetectors. These properties emerged from their favorable intrinsic properties such as ambipolarity, efficient charge-carrier mobilities, high diffusion lengths and high absorption coefficients. For their environmental friendliness in large-scale applications, particular attention should be paid to the Pb and Sn components of the OHPs, since at the moment there is only an incomplete knowledge of their toxicology. It is argued that perhaps replacement of Pb and Sn by Bi could be considered. An interplay of theoretical simulations and experimental discoveries may be a useful approach. *Babayigit, A., Ethirajan, A., Muller, M., Conings, B., Nature Materials, 2016, 15, 247-251.*
- Finally I like to call your attention to two challenging discussions about the progress of science. Of course, we like to build our work on important and experimentally reliable work carried out previously. But Seeman and Cantrill argue that on rare occasions, a wrong interpretation of experimental data can induce the development of an entire new field of science. An example is the structure of the dicyclopentadienyl iron, initially reported in *Nature* (1951) and cited 953 times in the period of 1951-2015. The correct structure was reported a year later and the topic induced a whole field of new chemistry. Other examples are discussed. An editorial in *Nature Methods* provides a discussion of "the power of disagreement". Examples are shown that disagreement can prompt a closer look at the available data which can lead to novel and sometimes unexpected insights. My conclusion: scientific research remains an adventure and it is a privilege to participate in it! *Seeman, J.L., Nature Chemistry, 2016, 8, 193-200. Editorial Nature Methods, 2016, 13, 185.*

Jan Engberts

New Appointments



Michael Wegener

As of 1/3/2016

Visiting Scientist

Group Feringa

Werkbespreking: Thursday morning 8.30 hrs, room 5111.0080

7th April— Hugo van Oosterhout (PhD Roelfes): "DNA-Templated Oligomerization of Pore-Forming Peptides"

14th April—Sambika Varatharajan (PhD Roelfes): "Title to be announced"

19th April—Master Symposium

- **Hans Kasper (Msc Browne)**
"On-line Reaction Monitoring of Catalytic Oxidations in Simple Continuous Flow Mesoscale Tubular Reactors by Raman Spectroscopy"
- **Jana Volaric (Msc Feringa)**
"Synthesis and catalytic ability studies of two bithiourea first generation motor catalysts"
- **Brian Corbet (Msc Feringa)**
"The functionalisation of geminal dichlorides"
- **Michael Boom (Msc Feringa)**
"Towards the in-situ racemization of acetoxyprolinone and its application as a chiral synthon in Diels-Alder reactions"

21st April—Wen-Hao Chen (PhD Feringa): "Dynamic control of chirality in phosphine ligands for enantioselective catalysis"

28th April—Marco Carlotti (Phd Chiechi): "Conjugated molecules in large area molecular junctions"

5th May—Liberation day and Acenscion day

12th May—Luuk Kortekaas (PhD Browne): "Title to be announced"

If you have items for the next issue of this Newsletter, please send an e mail to the Stratingh Institute office: Stratingh@rug.nl