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Newsletter

Stratingh Institute for Chemistry

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May 2017

Ben Feringa wins prestigious Royal Society of Chemistry prize

Ben Feringa is the Royal Society of Chemistry Centenary Prize winner for 2017. The Centenary Prize is awarded to outstanding chemists from outside the United Kingdom – those who are also exceptional communicators – to give lectures in the British Isles. Professor Feringa receives £5,000, a medal and a certificate.

The Royal Society of Chemistry (RSC) is a leading chemistry community, advancing excellence in the chemical sciences. With over 50,000 members and 175 years of history, it is the UK's professional non-profit body for chemical scientists over the world.

Professor Feringa: "I am greatly honoured by this prestigious Royal Society of Chemistry award and it is fantastic to be on this list of distinguished chemists that were winners of the Centenary Prizes in the past decades. I am looking forward to visit several UK universities and discuss the frontiers of our field with colleagues and students."

Centenary prize winners are evaluated for the originality and impact of their research, as well as the quality of the results, which can be shown in publications, patents, or even software. An illustrious list of 50 previous winners of the Royal Society of Chemistry's awards have gone on to win Nobel Prizes for their pioneering work, including Ben Feringa himself, who shared the 2016 Nobel Prize with fellow Centenary Prize winners Jean-Pierre Sauvage and Fraser Stoddart.

Harutyunyan wins prestigious Royal Society of Chemistry award

Syuzanna Harutyunyan, professor of Synthetic Organic Chemistry, is the Royal Society of Chemistry Homogeneous Catalysis Award winner for 2017. Her work focuses on developing new methods to synthesise molecules that are useful in the pharmaceutical, fine-chemical or agrochemical industries. Professor Harutyunyan receives £2000, a medal and a certificate.

"Many commonly used methods are very inefficient and produce much more waste than the desired product," Syuzanna explains. "Our new strategies are not only aimed at making compounds that were not available before, but also at providing better and more sustainable alternatives to existing methodologies. In this way my research contributes to a future with better drugs and a cleaner environment."

On receiving the award, she said: "I am delighted to receive this award. It is an honour to have been selected out of so many excellent scientists that work in this field, and a great recognition of the work my group and I have done. I'm looking forward to sharing and discussing the latest results of our research during the lecture tour."

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

- Lewis acids are well-known and find numerous applications. Many chemical elements can serve as the central atom, but nitrogen is usually associated with Lewis bases. Now, however, Gandelman, with three coworkers at the Technion, in Haifa, Israel, published the first examples of Lewis acids centered on the nitrogen atom that formed stable and well-characterized adducts with Lewis bases. Based on the reactivity of these materials they could obtain, for the first time, cyclic triazanes, a novel class of cyclic compounds sequentially bearing three all-saturated nitrogen atoms (a N-N-N motif). These unusual compounds are now further studied in detail. *Pogoreltsev, A., Tulchinsky, Y., Fridman, N., Gandelman, M., J.Am.Chem.Soc. 2017, DOI 10.1021/jacs.6b12360.*

- Another highly unexpected result in the same area, obtained by Mooibroek (van 't Hoff Institute, Amsterdam and University of Bristol, UK) and two coworkers (from the Universty of Palma, Spain). It is, of course, almost a dogma that the nitrate anion is an electron donor and a Lewis base. But now it was found by computational studies that, in special cases, the anion can also function as a Lewis acid and participate in donor-acceptor interactions. This can occur when the charge on the nitrate is resonating over a larger area than normally, resulting in possibilities for "π-hole" bonding to nitrogen in complexes with some electron-rich organic salts and a protein (3EZH). In the protein the nitrate is structure-determining and can bind to four moieties: two arginines (via hydrogen-bonds) and two glycines (via the π-hole). The authors argue that the nitrate anion has some properties that make its unusual bonding possible: NO3- is fairly polarized and further polarizable, not very charge-dense and is flat (which makes the π-hole sterically accessible). *Bauzá, A., Frontera, A., Mooibroek, T.J., Nature Comm. 2017, DOI 10.1038/ncomms14522.*

- Three staff-members of the University of Birmingham (UK) with two coworkers wrote a review on vesicles in nature, concentrated on their biological properties and on the preparation of increasingly complex vesicles. Our knowledge about the origin and different roles of natural vesicles has recently strongly increased. This also applies for our understanding of membrane chemistry and physics. We can now often control membrane asymmetry, binding and fusion properties as well as vesicle compartmentalization. In addition, insights into the behavior of synthetic vesicles can now be employed to increase our understanding of natural systems. This field of research has been reviewed in some detail, with particular emphasis, among others, on vesicle compartmentalization, chemical nanoreactors and artificial minimal cells. *Fernandez-Trillo, F., Grover, L.M., Stephenson-Brown, A., Harrison, P., Mendes, P.M., Angew.Chem.Int.Ed., 2016, DOI 10.1002/anie.201607825.*

- Carreira and two scientists from the ETH, Zürich, have reported enantioselective additions of functionalized terminal alkynes to α,α-dichlorinated aldehydes using Zn(OTf)2/NME. Herein NME is (-)-N-methylephedrine. For fourteen reactions the yields are satisfactory to high and the enantioselectivities are in all cases at least 86 percent. These results are promising for the application of the new procedure in the synthesis of a variety of chlorinated natural products. *Molina, Y.S., Ruchti, J., Carreira, E.M., Org.Lett., 2017, DOI 10.1021/acs.orglett.6b03692.*

- In the past many attempts have been made to obtain single-layer graphene in a liquid in bulk quantities, but without success. But now, in a joint project of the Universities of Bordeaux, Montpellier and Bologna, a homogeneous and stable dispersion of single-layer graphene (SLG) has been obtained by mixing a negatively charged graphene (graphenide) solution in tetrahydrofuran with degassed water followed by evaporation of the THF. The graphene 2D structure of SLG was proven by three spectroscopic methods. The authors suggest a number of potential applications such as its use as drug carrier.A brief review by Vincent with two scientists from two institutes of the University of Manchester already summarizes the first results with graphene materials as 2D non-viral gene transfer vector platforms. *Bepete, G., Anglaret, E., Ortolani, L., Morandi, V., Huang, K., Pénicaud, A., Drummond, C., Nature Chem., 2017, DOI 10.1038/NCHEM.2669. Vincent, M., de Lázaro, I., Kostarelos, K., Gene Therapy, 2017, DOI 10.1038/gt.2016.79.*

- Seven scientists from two Chinese and one Swedish University claim that they have obtained the, so far, highest power conversion efficiency (PCE, 17.1 %) for a perovskite solar cell using a solution-processable copper phthalocyanine as a hole-transporting material. The latter cost-effective materials can be relatively facilely synthesized from commercially available materials via two simple steps and they are promising systems to be further explored in mesoscopic perovskite solar cells. *Jiang, X., Yu, Z., Lai, J., Zhang, Y., Lei, N., Wang, D., Sun, L., Science China, Chemistry, 2017, DOI 10.1007/s11426-016-0393-5.*

- Herbert Waldmann (Max Planck Inst. of Mol.Physiology and Tech. University of Dortmund) published, with five coworkers, a novel approach to chiral Cp ligands that possess a wide applicability and a possibility for rapid structural variation. These chiral JasCp ligands can be easily prepared from commercially available starting materials and their structures and configurations can be easily adjusted by means of flexible enantioselective [6+3] cycloaddition reactions. These chiral ligands were employed in three enantioselective RhIII-catalyzed C-H activation reactions, including one unprecedented transformation. For one optimized catalyst the solvent had no obvious effect on the ee, but significantly influenced the reactivity. As expected, the ee values increased upon lowering the temperature. The obtained results will stimulate further research on effective chiral Cp ligands for other enantioselective transformations. *Jia, Z-J., Merten, C., Gontia, R., Daniliuc, C.G., Antonchick, A.P., Waldmann, H., Angew.Chem.Int.Ed., 2017 DOI 10.1002/anie.201611981.*

- The final item I like to mention this month is an extremely important experimental observation: time crystals. They form a regular pattern in time but not in space, thereby allowing the crystal to be in perpetual motion.Their existence has been predicted by Frank Wilczek in 2012 but his proposal was criticized by many theoreticians, particularly on the basis of thermodynamics. However there is now convincing evidence that time crystals do not produce work as it rotates in its ground state, that they do not spontaneously convert thermal energy into mechanical work and that they cannot serve as perpetual stores of work. Two groups, one at the University of Maryland (C. Monroe et al.) and one at Harvard University (Lukin et al.) have now created a time crystal, and their results have been described by Elizabeth Gibney in Nature. I strongly recommend to look up this paper! There are also suggestions that time crystals may provide a deeper understanding of the theory of time. *Gibney, E., Nature 2016, 543, 164-166.*

Jan Engberts

PhD Defences

Friday, May 12th

@ 11:00 Sandeep Kumar Padamati will defend his PhD thesis. Title: **"Mechanisms in iron, nickel, and manganese, catalysis with small molecule oxidants".** Promotor: Prof. dr. W.R. Browne

@ 12:45 Arjan Geersing will defend his PhD thesis. Title: **"Redox-active N4Py-metal complexes in human cell cultures".** Promotores: Prof. dr. J.G. Roelfes and Prof. dr. M.G. Rots

Monday, May 22nd

@ 12:45 Elio Mattia will defend his PhD thesis. Title: **"Enabling Darwinian evolution in chemical replicators".** Promotor: Prof. dr. S. Otto

Werkbespreking: Thursday morning 8.30 hrs, room 5111.0080

May 4th— Guillermo Monreal Santiago (PhD Otto) - "Next steps in peptide based self-replicators: Compartmentalization, metabolism, or cell culture?"

May 11th— Pablo Ortiz (PhD Harutyunyan) - "Catalytic asymmetric alkylation of enolizable ketimines using Grignard reagents"

May 18th—Friederike Reessing (PhD Szymanski) - "Development of light-responsive MRI contrast agents"

May 25th— Ascension Day

Jun 1st— Meniz Tezcan (PhD Otto) - "Title to be announced"

Jun 8th— Xinkai Qiu (PhD Chiechi) - "Dye-sensitized solar cell comprising cofabricated microfluidic channels and high-surface electrode"

June 15th— Henrieke Heideman (PhD Feringa) - "Directional Movement of Light-Driven Molecular Motors on Surfaces"

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