university of groningen

Newsletter

Stratingh Institute for Chemistry

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November 2015

Introducing Marzia Nuzzolo

Marzia Nuzzolo acquired her Bachelor's degree in Environmental Sciences at Northern Arizona University in the US. She moved to Scotland to do a PhD in the group of Prof. Paul Kamer on the synthesis of modified oligonucleotides as ligands for asymmetric catalysis. After her PhD she worked in Cambridge as head of an oligonucleotide synthesis lab for a diagnosis company. She joined the Stratingh Institute in September as a research assistant and is here as a lab manager for the organic chemistry groups. She will be working 1 ½ days in CVL and 2 ½ days in Nijenborgh.

Introducing Marthe Walvoort

As of November 2015, Dr. Marthe Walvoort has joined the Stratingh faculty as assistant professor on a Rosalind Franklin fellowship, embedded in the Chemical Biology division headed by Prof. Adri Minnaard. After obtaining her MSc degree in Chemistry at the Leiden University, she did a research internship in the glycoscience group of Prof. Ben Davis at the University of Oxford. Intrigued by the complex world of carbohydrates, she returned to Leiden University for her PhD studies with Prof. Hermen Overkleeft and Prof. Gijs van der Marel in the field of carbohydrate chemistry. After obtaining the PhD degree *cum laude*, she joined the glycobiology lab of Prof. Barbara Imperiali at the Massachusetts Institute of Technology (Cambridge, USA) as a postdoc associate. There she led the development of phosphoglycosyl transferase inhibitors inspired by nucleoside antibiotics, and was involved in a collaborative effort to link a bacterial infection to biomarkers in multiple sclerosis by producing *N*-linked glycoproteins. At the RUG, her focus will be on the synthesis of complex oligosaccharides and glycoconjugates from human and bacterial origin using chemistry and biology.

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

- Recently, an interesting brief paper appeared in Nature, entitled "March of the Machines". Mark Peplow argued that over the past 25 years, often inspired by biology, quite a large number of molecular switches, motors and ratchets has been prepared, but that it is now time to do something useful with them. Ben Feringa is cited: "We have made 50 or 60 different motors, but now I am less interested in making another motor than actually using it". The potential of this emerging field is fascinating and several useful developments are suggested in two major directions (Stoddart): machines for molecular-scale jobs and for macro-scale applications. Regarding the latter field, it is suggested that trillions of molecular machines could work together and change the properties of materials in the macroscopic world. *Peplow, M., Nature 525, 18-21, 2015.*
- Carbohydrates play a highly important role in many biological processes. However, they

are more difficult to characterize than peptides and oligonucleotides owing to their branched structures and the presence of stereogenic centres at each glycosidic linkage between monomers. It has now been found by scientists from four research institutes in Berlin and Potsdam, that ion mobility-mass spectrometry is able to unambiguously identify carbohydrate linkage-isomers and stereoisomers. The data show that even coexisting carbohydrate isomers can be identified and that relative concentrations of the minor isomer as low as 0.1% can be detected. The analysis is rapid and needs no derivatization and only small amounts of the sample. *Hofmann, J., Hahm, H.S., Seeberger, P.H., Pagel, K., Nature,2015, DOI 10.1038/nature15388.*

- In the past few decades it has been shown that biology and chemistry are coming closer together and sometimes even merging into one discipline. A fascinating development, that has contributed to a better understanding of living systems, both from a thermodynamic and kinetic viewpoint. A collection of chemical biologists has been asked: "What do you value most about being part of the chemical biology community? " Their replies, published in Nature Chemical Biology, demonstrate the inspiration obtained from research in a field where two important disciplines meet each other. *Nature Chem.Biol.,2015,11,752-753.*

- Chemists from Mumbai, China and Saudi Arabia wrote an interesting review about the application of metal nanopore catalysts in organic synthesis. Reducing the size of bulk metals to nanometer scale can lead to the display of remarkable physical and chemical properties. Typical examples are metal nanoparticles (MNPs), prepared from metal atoms or metal salts. Particular attention is given to NMPs obtained from converting bulk metal to nanosized metal. Alloy M1M2 is frabricated from M1 and metal M2, and then dealloying of M2 leads to a nanoporous framework of metal M1. The catalytic properties of these materials are compared with those of other representative catalytic reactions. *Takale, B.S., Bao, M., Yamamoto, Y., Almansour, A.I., Arumugam, N., Kumar, R.S., Synlett.2015, DOI 10.1055/s-0034-1380867.*

- A communication from the Universities of Princeton and California, Irvine, reports the use of simple oxalate salts of tertiary alcohols as new, bench-stable, alcohol-activating groups for the generation of radicals under visible light photoredox conditions. The employed heteroleptic photocatalyst is Ir[dF(CF3)ppy]2(dtbbpy)PF6 (see the paper for this structure!).With these precursors, it was possible to achieve the first net redox-neutral coupling of secondary and tertiary alcohols with electron-deficient alkenes in good to excellent yields. *Nawrat, C.C., Jamison, C.R., Slutskyy, Y., MacMillan, D.W.C., Overman, L.E., J.Am.Chem.Soc. 2015, DOI 10.1021/jacs.5b07678.*

- A study, performed at Osaka University, describes the nickel-catalyzed cross-coupling of methoxyarenes with Grignard reagents to give alkylarenes via cleavage of the C(aryl)-OMe bond. Using 1,3-dicyclohexylimidazol-2-ylidene as a ligand allows the introduction of a number of alkyl groups, including Me, Me3SiCH2, ArCH2, ArCH2, adamantly, and cyclopropyl. This novel alkylation method can be used for the late stage elaboration of complex aryl ethers. *Tobisu, M., Takahira, T., Chatani, N., Org.Lett., 2015, DOI 10.1021/acs.orglett.5b02200.*

- Chemists at the Universities of Hong Kong, Beijing (China), and Houston (USA) were successful in the fabrication of efficient planar heterojunction perovskite solar cells employing a one-step chemical vapor deposition method, with a solar power conversion efficiency of up to 11.1%. High quality films of CH3NH3PbI3, and CH3NH3PbI3-xClx could be obtained. Physical techniques indicated that the films have a large grain size of more than 1 micrometer, and carrier life-times of , respectively, 10 ns and 120 ns for the films mentioned above. The authors suggest that further developments are possible. *Tavakoli, M.M., Gu, L., Gao, Y., Reckmeier, C., He, J., Rogach, A.L., Yao, Y., Fan, Z., Nature,2015, DOI 10.1038/srep14083.*

- (-)-Incarviatone A is a natural product hybrid which shows an important potential for the treatment of depression, Alzheimer disease, and other neurological disorders. It is poorly accessible from plants (4.1 mg can be obtained out of 17 kg dried plants) and therefore asking for a total synthesis. This was now accomplished in 14 steps by chemists from three Chinese Universities. Starting from phenylacetic acid, the early stage of the procedure rests on a scalable and sequential C-H functionalization to assemble the indanyl dialdehyde framework. A further biomimetic cascade strategy afforded the desired compound in a one-pot operation. Attention was also given to mechanistic aspects. *Hong, B., Li, C., Wang, Z., Chen, J., Li, H., Lei, X., J.Am.Chem.Soc.,2015,137,11946-11949.*

- The group of David MacMillan at Princeton University (our Backer Lecturer this year) published the first general use of alcohols as simple alkylating agents. The novel procedure enables rapid late-stage derivatization of medicinally relevant molecules. In a bio-inspired stategy, a dual catalytic alkylation of heteroarenes was developed, using (unactivated) alcohols as mild alkylating reagents, via a merger of photoredox and thiol hy-

drogen atom transfer organocatalysis. The chemical process mimics the key step in the enzyme-catalyzed DNA biosynthesis via a new spin-centre shift elimination of water to generate radical intermediates from simple alcohols. *Jin, J., MacMillan, D.W.C., Nature 2015,525,87-90.*

- Finally I like to draw your attention this month to an interesting news feature in Nature entitled "Why interdisciplinary research matters", written by several authors. It is argued that scientists and social scientists should work together to solve the challenges facing society – energy, water, climate, food, health -, but also great scientific problems. But in practice this cooperation may be associated with a number of problems and there is sometimes a significant resistance to crossing borders. Nevertheless it is shown that interdisciplinary research is on the rise and, if you like to focus on big problems, you need to work interdisciplinary. *Nature 2015,525,305-311. DOI 10.1038/525305a.*

Jan Engberts

De scheikundige – Toneel overdag (Hek van de Dam)

"Toneel Overdag" van St.Theaterwerkplaats "het Hek "speelt "de Scheikundige" van Chrétien Schouteten.

Op 22 april 1915 werd bij Ieper voor het eerst in de 1e wereldoorlog op grote schaal gifgas ingezet . De drijvende kracht hier achter was Fritz Haber (1868 – 1934), een Duitse Chemicus. Die zelfde Fritz Haber ontving echter in 1920 de Nobelprijs voor scheikunde vanwege de synthese van ammoniak met behulp van stikstof uit de lucht die hem in 1909 gelukt was. Deze vinding maakte de grootschalige productie van kunstmest mogelijk. Hoe kon Fritz Haber na zijn inzet voor de ontwikkeling van kunstmest zijn werk met gifgassen verantwoorden ? Wat was hij voor een man ? Hoe reageerde zijn gezin ? In het toneelstuk "de Scheikundige" van de chemicus/schrijver Chrétien Schouteten gaat theatergroep "Toneel Overdag" van Theaterwerkplaats "het Hek" op deze vragen in.

Optreden in Zuidhorn, November 13.

Stratingh Lectures

H.J. Backer Lecture 2015

David W.C. MacMillan
Merck Center for Catalysis, Princeton University, USA
Title: The Application of Photoredox Catalysis to New Transformations in Chemical Synthesis.
Day: Tuesday, November 10th, 2015
Time: 16.00 hrs.
Place: 5111.0022
Drinks will be served after the lecture

Prof. István T. Horváth
Department of Biology and Chemistry, City University of Hong Kong
Title: Sustainable Conversion of Biomass to Chemicals: Cooking or Art or Science?
Day: Tuesday, November 17th, 2015
Room: 5111.0080
Time: 16:00

Guillermo Monreal Santiago

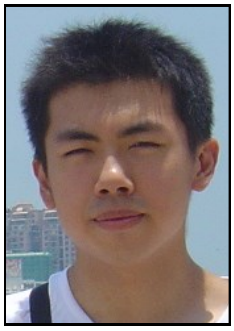
As of 1/10/2015

PhD—Group Otto

Ieng Chim (Steven) Wan

As of 1/10/2015

PhD—Group Minnaard



Xinkai Qiu

As of 1/10/2015

PhD—Group Chiechi

Cora Gutierrez de Souza

As of 1/10/2015

PhD—Group Roelfes

New appointments

Werkbespreking: Thursday morning 8.30 hrs, room 5111.0080

November 12th—Steven Yun Liu (PhD Hirsch): "Title to be announced"

November 19th—Ivana Drienovska (PhD Roelfes): "Novel artificial metalloenzymes by in vivo incorporation of metal-binding unnatural amino acids"

November 26th—Johnny Rong (PhD Harutyunyan): "Asymmetric alkylation of α-silylimines and mechanistic studies"

December 3rd—Tilde Pelligrini (PhD Harutyunyan): "Towards autocatalytic and autoinductive reactions"

December 10th—Dorus Heijnen (PhD Feringa): "Cross-coupling reactions with organolithium reagents"

Stratingh Borrel

To celebrate emplyment of new staff members, promotions and prestigious personal grants won by our institute staff this year, there will be a borrel for all Stratingh members. This will take place on Thursday November 26th, starting at 16:00 in the take away of Nijenborgh 4.

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