

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

- An interesting finding: in the interstellar medium (ISM) the first organic molecule with a branched alkyl chain has been detected. It is iso-propyl cyanide and it has an abundance of 0.4 times that of its straight-chain structural isomer. The formation of both molecules may well occur within or upon dust grain ice mantles through the addition of molecular radicals. The iso-propyl may be formed by addition of a functional group to a nonterminal carbon in the chain. The detection of a branched alkyl molecule suggests a link between interstellar chemistry and the molecular composition of meteorites for which branched α -amino acids are even found to dominate over their straight-chain isomers. *Belloche, A., Garrod, R.T., Müller, H.S.P., Menten, K.M., Science, 2014, 345, 1584-1587.*
- Multifunctional, stimuli-sensitive nanoparticulate systems possess a definite therapeutic potential for a variety of diseases including cancer, cardiovascular diseases and infectious diseases. The development of nanoparticulate pharmaceutical drug delivery systems (NDDSs) to enhance the in vivo effectiveness of drugs is now an active field of current research. These NDDSs may have long circulation times, can target the site of the disease and enhance the intracellular delivery of a drug. Moreover, the NDDSs can also respond to local stimuli that are characteristic of the pathological site. This can occur by, for example, releasing an entrapped drug or shedding a protective coating, thus facilitating the interaction between drug-loaded nanocarriers and target cells or tissues. Imaging contrast moieties can be attached to these carriers for tracking their real-time biodistribution and accumulation in target cells or tissues. Torchilin has recently highlighted recent developments in this field. *Torchilin, V.P., Nature Reviews Drug Discovery, 2014, DOI 10.1038/nrd4333.*
- Scientists at the University of Chengdu, China, published an efficient method for the direct, auxiliary-assisted intermolecular C-H phosphorylation of non-acidic benzamide β -C-H bonds. Inexpensive copper acetate and mild conditions can be employed. The method offers a novel and straightforward way for the synthesis of ortho-phosphonated benzoic acid derivatives and demonstrates excellent functional group tolerance. *Wang, S., Guo, R., Wang, G., Chen, S-Y., Yu, X-Q., Chem.Comm., 2014, DOI 10.1039/C4CC06246A.*
- The remarkable photoactive features of organic-inorganic hybrid perovskites have enabled the preparation of a novel class of highly efficient solar cells. However, the fundamental properties which determine the performance of these devices are still under-explored. Japanese scientists from four different Research Institutes have now investigated the local mobility, recombination, and energetic landscape of charge carriers in a prototype $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite employing a laser-flash time-resolved microwave conductivity technique. The study provided a basis for understanding the solar cell operation, while highlighting the relevance of the mesoporous layer and the perovskite fabrication process. *Oga, H., Saeki, A., Ogomi, Y., Hayase, S., Seki, S., J.Am.Chem.Soc., 2014, DOI 10.1021/ja506936f.*
- A transition-metal-free Hunsdiecker reaction of electron-rich arenecarboxylic acids and aryl aldehydes has been developed using KBr and KI as the halogen source in aqueous media. A number of aryl bromides and iodides can be conveniently synthesized via an I_2O_5 -mediated decarboxylative halogenation of the corresponding carboxylic acids and/or aldehydes. The yields are a bit variable, but the reaction has several advantages including scalability and an easy and safe operation. The work was performed at the Lanzhou University, China. *Li, Z., Wang, K., Liu, Z-Q., Synlett., 2014, DOI 10.1055/s-0034-1378583.*

- Assembly-line synthesis of organic molecules with tailored shapes has been investigated by groups of Bristol University and the Novartis Horsham Research Centre. Using an iterative, reagent-controlled homologation sequence it was found possible to convert simple boronic esters into complex molecules bearing ten contiguous methyl substituents with full stereocontrol. The process relies on the reactivity of α -lithioethyltri-isopropyl benzoate, which readily inserts into C-B bonds with exceptionally high fidelity and stereocontrol. Each chain-extension step generates a new boronic ester, which is immediately ready for further homologation. The results will facilitate the rational design of molecules with predictable shapes. *Burns, M., Essafi, S., Bame, J.R., Bull, S.P., Webster, M.P., Balieu, S., Dale, J.W., Butts, C.P., Harvey, J.N., Aggarwal, V.K., Nature, 2014, 513, 183-188.*
- Biosynthetic chemists at the University of Leeds developed a novel approach for an efficient discovery of bioactive scaffolds, which they termed “activity-directed synthesis”. The idea is to steer reactions with alternative outcomes towards functional products. The method was illustrated for arrays of catalyzed reactions of α -diazo amides that have an outcome which is critically dependent on the specific reaction conditions. The products were analyzed at increasingly low concentration and the results used in the design of a subsequent reaction array. Promising reactions were finally scaled up and, after purification, submicromolar ligands based on two scaffolds with no previous annotated activity against the androgen receptor were discovered. The authors claim that the new approach makes it possible to discover both bioactive small molecules and associated synthetic routes, analogous to the evolution of biosynthetic pathways to yield natural products. *Karageorgis, G., Warriner, S., Nelson, A., Nature Chem., 2014, 6, 872-876.*
- Groups at the University of Georgia and Michigan State University have shown, in a computational study, that H-bonding interactions that increase cyclic $4n+2$ π -electron delocalization enhance aromaticity. Aromaticity is decreased when such interactions are weakened as a result of more localized quinoidal π character. Such H-bonding/aromaticity interplay has been demonstrated by tautomeric equilibria of π -conjugated heterocyclic compounds in protic solvents and other H-bonding environments. *Wu, J.I., Jackson, J.E., von Rague Schleyer, P., J.Am.Chem.Soc., 2014, DOI 10.1021/ja507202f.*
- Catalytic C-H functionalizations are becoming increasingly popular for application in sustainable syntheses. Ackermann (University of Göttingen) has published a review (until summer 2014) focused on the application of inexpensive cobalt complexes as catalysts for C-H arylation with challenging organic electrophiles. Particularly high catalytic efficacy can be realized employing cobalt complexes of N-heterocyclic carbenes under mild reaction conditions. The author predicts further exciting developments such as asymmetric C-H functionalizations. *Ackermann, L., J.Org.Chem., 2014, DOI 10.1021/jo501361k.*
- An interesting conclusion was drawn in a recent Science paper: “as much as half of the water in Earth’s oceans could be older than the sun”. A group of American and English astronomers claim that the interstellar clouds where Sun-like stars are currently forming and therefore the material from which the Sun formed, possess a higher proportion of heavy water compared to the current Solar System. The reason is that the inclusion of deuterium is favored by the continuous bombardment of these clouds by cosmic rays. Therefore, the young Sun’s radiation was insufficient to explain the amount of heavy water seen today in the Solar System and, therefore, must have existed before. It is estimated that between 30 and 50% of the water in Earth’s oceans must be older than the Sun! *Cleaves, L.I., Bergin, E.A., Alexander, C.M.O’D, Du, F., Graninger, D., Öberg, K.I., Harries, T.J., Science, 2014, 345, 1590-1593.*

Jan Engberts

New appointments



Soma Chaudhary, PhD
1 October
Group Otto



Xingchen Yan, PhD
1 October
Group Harutyunyan



Gang Ye, PhD
1 October
Group Chiechi



Juan Fernando Collados
PostDoc—1 October
Group Harutyunyan



Mickel Jens Hansen, PhD
1 October
Group Feringa

Gerrit Dirk Roke, PhD
1 October
Group Feringa

Di Zhu, PhD
1 October
Group Hirsch

PhD Defences

Friday, November 21st

@ 11:00 **Derk Jan van Dijken** will defend his PhD thesis. Title: “Responsive supramolecular systems”. Promotor: Prof dr. B.L. Feringa

@ 16:15 **Willem Arend Velema** will defend his PhD thesis. Title: “Photopharmacology”. Promotor: Prof dr. B.L. Feringa

Friday, November 28th

@ 16:15 **Kuan Yen Chen** will defend his PhD thesis. Title: “Multivalent molecular motors for surface attachment”. Promotor: Prof dr. B.L. Feringa

Stratingh Lectures



Backer Lecture 2014

Thursday, November 6th

Prof. John Hartwig, University of California, Berkeley

Room: **5161.0151**

Time: **16:00** hrs

Title: **Selective Functionalization of Alkyl and Aryl C-H Bonds – Installation of Temporary Functional Groups**

Tuesday, November 11th

Dr. Sylvestre Bonnet
Leiden University

Room: **5111.0022**
Time: **16:00**



Title: **Light activation of anticancer prodrugs with blue, yellow, and red photons**

Werkbespreking: Thursday morning 8.30 hrs, room 5111.0080

November 6th—Stefano Pizzolato—Highly thermally stable molecular switches: properties study and application in catalysis

November 13th—Erik Pinxterhuis— Research towards the application of D,L-phenylglycinamide in enantioselective liquid-liquid extraction

November 20th—Piotr Nowak—Cooperative effects in systems chemistry

November 27th—Jos Kistemaker—Achiral unidirectional molecular motors

December 4th—Douwe Zijlstra—Study of the Michael addition on unsaturated nitriles using a ruthenium pincer complex AND **Mehrnoosh Jahani Bahnamiri**—Fullerene derivatives with increased dielectric constant

December 11th—Niek Eisink—Selective modifications of unprotected carbohydrates

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