#### Synthesis of Self-Assembled Porphyrin Nanoparticle Photosensitizers

Wang, D.; Niu, L.; Qiao, Z.-Y.; Cheng, D.-B.; Wang, J.; Zhong, Y.; Bai, F.\*; Wang, H.\*; Fan, H.\* <u>ACS Nano</u>, **2018**, ASAP.



The use of nanoparticles as a potential building block for photosensitizers has recently become a focus of interest in the field of photocatalysis and photodynamic therapy. Porphyrins and their derivatives are effective photosensitizers due to extended  $\pi$ -conjugated electronic structure, high molar absorption from visible to near-infrared spectrum, and high singlet oxygen quantum yields as well as chemical versatility. In this paper, we report a synthesis of self-assembled porphyrin nanoparticle photosensitizers using zinc *meso*-tetra(4-pyridyl)porphyrin (ZnTPyP) through a confined noncovalent self-assembly process. Scanning electron microscopy reveals formation of monodisperse cubic nanoparticles. UV-vis characterizations reveal that optical absorption of the nanoparticles exhibits a red shift due to noncovalent self-assembly of porphyrins, which not only effectively increase intensity of light absorption but also extend light absorption broadly covering visible light for enhanced photodynamic therapy. Electron spin-resonance spectroscopy (ESR) studies show the resultant porphyrin nanoparticles release a high yield of singlet oxygen. Nitric oxide (NO) coordinates to central metal Zn ions to form stabilized ZnTPyP@NO nanoparticles. We show that under light irradiation ZnTPyP@NO nanoparticles release highly reactive peroxynitrite molecules that exhibit enhanced antibacterial photodynamic therapy (APDT) activity. The ease of the synthesis of self-assembled porphyrin nanoparticles and light-triggered release of highly reactive moieties represent a completely different photosensitizer system for APDT application.

**Comment**: We read a lot (especially me with ACS Nano) about photodynamic therapy but most of the time it concerns hard materials. Here it occurs with soft self-assembled materials (although there is zinc inside). I'm also always intrigued by the formation of nanocubes...

#### On the Formation and Morphology of Lipid Nanoparticles Containing Ionizable Cationic Lipids and siRNA

Kulkarni, J. A.; Darjuan, M. M.; Mercer, J. E.; Chen, S.; van der Meel, R.; Thevalt, J. L.; Tam, Y. Y. C.; Cullis, P. R.\* <u>ACS Nano. 2018, ASAP.</u>



Lipid nanoparticles (LNPs) containing short interfering RNA (LNP-siRNA) and optimized ionizable cationic lipids are now clinically validated systems for silencing disease-causing genes in hepatocytes following intravenous administration. However, the mechanism of formation and certain structural features of LNP-siRNA remain obscure. These systems are formed from lipid mixtures (cationic lipid, distearoylphosphatidylcholine, cholesterol, and PEG-lipid) dissolved in ethanol that is rapidly mixed with siRNA in aqueous buffer at a pH (pH 4) where the ionizable lipid is positively charged. The resulting dispersion is then dialyzed against a normal saline buffer to remove residual ethanol and raise the pH to 7.4 (above the  $pK_a$  of the cationic lipid) to produce the finished LNP-siRNA systems. Here we provide cryogenic transmission electron microscopy (cryo-TEM) and X-ray evidence that the complexes formed between siRNA and ionizable lipid at pH 4 correspond to tightly packed bilayer structures with siRNA sandwiched between closely apposed monolayers. Further, it is shown that ionizable lipid not complexed to siRNA promotes formation of very small vesicular structures at pH 4 that coalesce to form larger LNP structures with amorphous electron dense cores at pH 7.4. A mechanism of formation of LNP-siRNA systems is proposed whereby siRNA is first sandwiched between closely apposed lipid monolayers at pH 4 and subsequently trapped in these structures as the pH is raised to 7.4, whereas ionizable lipid not interacting with siRNA moves from bilayer structure to adopt an amorphous oil phase located in the center of the LNP as the pH is raised. This model is discussed in terms of previous hypotheses and potential relevance to the design of LNP-siRNA systems.

**Comment**: A nice study concerning gene delivery for silencing therapies. I found the use of the cryo TEM to characterize the vesicles was very efficient.

#### 3D Microniches Reveal the Importance of Cell Size and Shape.

Bao, M.; Xie, J.; Piruska, A.; Huck, W. T. S. Nat. Commun. 2017, 8, 1962.





Geometrical cues have been shown to alter gene expression and differentiation on 2D substrates. However, little is known about how geometrical cues affect cell function in 3D. One major reason for this lack of understanding is rooted in the difficulties of controlling cell geometry in a complex 3D setting and for long periods of culture. Here, we present a robust method to control cell volume and shape of individual human mesenchymal stem cells (hMSCs) inside 3D microniches with a range of different geometries (e.g., cylinder, triangular prism, cubic, and cuboid). We find that the actin filaments, focal adhesions, nuclear shape, YAP/TAZ localization, cell contractility, nuclear accumulation of histone deacetylase 3, and lineage selection are all sensitive to cell volume. **Our 3D microniches enable fundamental studies on the impact of biophysical cues on cell fate**, and have potential applications in investigating how multicellular architectures organize within geometrically well-defined 3D spaces.

**Comment**: A typical "why has no-one tried this before?" Of course the problem is always going to be to which extend the results are significant because the results are image-based. But the approach, and chemistry involved, are noteworthy.

#### Planning Chemical Syntheses with Deep Neural Networks and Symbolic AI

Segler, M. H. S.\*; Preuss, M.; Waller, M. P.\* Nature 2018, 555, 604.



To plan the syntheses of small organic molecules, chemists use retrosynthesis, a problemsolving technique in which target molecules are recursively transformed into increasingly simpler precursors. Computer-aided retrosynthesis would be a valuable tool but at present it is slow and provides results of unsatisfactory quality. Here we use Monte Carlo tree search and symbolic artificial intelligence (AI) to discover retrosynthetic routes. We combined Monte Carlo tree search with an expansion policy network that guides the search, and a filter network to pre-select the most promising retrosynthetic steps. These deep neural networks were trained on essentially all reactions ever published in organic chemistry. Our system solves for almost twice as many molecules, thirty times faster than the traditional computer-aided search method, which is based on extracted rules and hand-designed heuristics. In a double-blind AB test, chemists on average considered our computer-generated routes to be equivalent to reported literature routes.

**Comment:** I guess most of you have spent countless hours learning organic chemistry. The fact is that the only way to get good at it is by repetition. And you ought to have wondered why computers cannot do this for us. The answer is, probably, because the logic behind is not as clear as we are inclined to believe, which in turn explains why just feeding a computer –or student– with rules typically fails. But many examples keep appearing with more and more human-like solutions. The example above is just one that made quite some noise some weeks back.

#### Readily Functionalized AAA-DDD Triply Hydrogen-bonded Motifs

Tong, F.; Linares-Mendez, I. J.; Han, Y.-F.; Wisner, J. A.; Wang, H.-B.\*; *Org. Biomol. Chem.* **2018**, DOI:10.1039/C8OB00479J.



Herein we present a new, readily functionalized AAA-DDD hydrogen bond array. A novel AAA monomeric unit (3a-b) was obtained from a two-step synthetic procedure starting with 2-aminonicotinaldehyde via microwave radiation (overall yield of 52-66%). <sup>1</sup>H NMR and fluorescence spectroscopy confirmed the complexation event with a calculated association constant of  $1.57 \times 10^7$  M<sup>-1</sup>. Likewise, the usefulness of this triple hydrogen bond motif in supramolecular polymerization was demonstrated through viscosity measurements in a crosslinked supramolecular alternating copolymer.

**Comment**: Supramolecular copolymers with high viscosities are good for material applications. The approach used in the paper to build the supramolecular copolymer is worth a closer look.

#### A Highly Efficient Dual-diazonium Reagent for Protein Crosslinking and Construction of a Virus-based Gel

Ma, D.; Zhang, J.; Zhang, C.; Men, Y.; Sun, H.; Li, L.-Y.; Yi, L.\*; Xi, Z.\*; *Org. Biomol. Chem.* **2018**, DOI: 10.1039/C8OB00169C.



A new bench-stable reagent with double diazonium sites was designed and synthesized for protein crosslinking. Based on the highly efficient diazonium-Tyr coupling reaction, a direct mixture of the reagent and tobacco mosaic virus led to the formation of a new hydrogel, which could be degraded by chemicals and could be used to encapsulate small molecules for sustained release. Because plant viruses exhibit many chemical characteristics like protein labelling and nucleic acid packaging, the virus-based hydrogel will have large chemical space for further functionalization. Besides, this dual-diazonium reagent should be a generally useful crosslinker for chemical biology and biomaterials.

**Comment:** They present a hydrogel formed from tobacco mosaic virus. The crosslinking strategy using a bis-diazonium linker is new. The use of bionanostructures in chemical materials is cool.

#### Temperature-dependent Self-assembly of a Purely Organic Cage in Water

Zheng, X.; Zhang, Y.; Wu, G.; Liu, J.-R.; Cao, N.; Wang, L.; Wang, Y.; Li, X.; Yang, C.\*; Li, H.\* *Chem. Commun.* **2018**, *54*, 3138.



Using a novel dynamic covalent approach relying on reversible hydrazone formation, a purely organic 3-dimensional prismatic cage was developed in water at elevated temperatures. By lowering the temperature, the hydrazone bond becomes kinetically inert. This self-assembled cage acts as an effective receptor for donor–acceptor pairs, whose interactions are weak in the absence of the cage.

**Comment:** The dynamic covalent bond is quite interesting, especially the applications in molecular cages and covalent organic frameworks. This paper shows the synthesis of a water-soluble molecular cage that could bind some guest molecules containing hydrophobic moieties. Could we design a similar structure originating from the triarylamine core? And would it accommodate some guest upon the light irradiation?

#### **Direct Single-Molecule Dynamic Detection of Chemical Reactions**

Guan, J.; Jia, C.; Li, Y.; Liu, Z.; Wang, J.; Yang, Z.; Gu, C.; Su, D.; Houk, K.\*; Zhang, D.\*; Guo X.\* <u>Sci. Adv. **2018**</u>, *4*, 2177.



Single-molecule detection can reveal time trajectories and reaction pathways of individual intermediates/transition states in chemical reactions and biological processes, which is of fundamental importance to elucidate their intrinsic mechanisms. We present a reliable, label-free single-molecule approach that allows us to directly explore the dynamic process of basic chemical reactions at the single-event level by using stable graphene-molecule single-molecule junctions. These junctions are constructed by covalently connecting a single molecule with a 9-fluorenone center to nanogapped graphene electrodes. For the first time, real-time single-molecule electrical measurements unambiguously show reproducible large-amplitude two-level fluctuations that are highly dependent on solvent environments in a nucleophilic addition reaction of hydroxylamine to

a carbonyl group. Both theoretical simulations and ensemble experiments prove that this observation originates from the reversible transition between the reactant and a new intermediate state within a time scale of a few microseconds. These investigations open up a new route that is able to be immediately applied to probe fast single-molecule physics or biophysics with high time resolution, making an important contribution to broad fields beyond reaction chemistry.

**Comment**: This device structure is able to directly study stochastic fluctuations under equilibrium conditions and to reveal time trajectories and reaction pathways of individual intermediate/transition states in nonequilibrated systems for either chemical reactions or biological processes such as protein folding and DNA sequencing.

#### A Natural Glycyrrhizic Acid-Tailored Light-Responsive Gelator

Fang, H.; Zhao, X.; Lin, Y.; Yang, S.\*; Hu, J.\* Chem. Asian J. 2018, ASAP.



The construction of stimuli-responsive materials by using naturally occurring molecules as building blocks has received increasing attention owing to their bioavailability, biocompatibility, and biodegradability. Herein, a symmetrical azobenzene-functionalized natural glycyrrhizic acid (trans-GAG) was synthesized and could form stable supramolecular gels in DMSO/H2O and MeOH/H2O. Owing to trans–cis isomerization, this gel exhibited typical light-responsive behavior that led to a reversible gel–sol transition accompanied by a variation in morphology and rheology. Additionally, this trans-GAG gel displayed a distinct injectable self-healing property and outstanding biocompatibility. This work provides a simple yet rational strategy to fabricate stimuli-responsive materials from naturally occurring, eco-friendly molecules.

**Comment**: This work provides a simple yet rational strategy to fabricate stimuli-responsive materials from naturally-occurring eco-friendly molecules.

#### Dual Physical Crosslinking Strategy to Construct Moldable Hydrogels with Ultrahigh Strength and Toughness

Cao, J.; Li, J.; Chen, Y.; Zhang, L.; Zhou, J.\* Adv. Funct. Mater. 2018, 1800739.



A dual physical crosslinking (DPC) strategy is used to construct moldable hydrogels with ultrahigh strength and toughness. First, polyelectrolyte complex (PEC) hydrogels are prepared through the in situ polymerization of acrylic acid monomers in the concentrated chitosan (Ch) solutions. Subsequently,  $Ag^+$  ions are introduced into the PEC hydrogels to form coordination bonds between -NH<sub>2</sub> and -COOH groups. High-density electrostatic interaction and coordination bonds endow the DPC hydrogels with high strength and toughness. The mechanical properties of the DPC hydrogels strongly depend on the weight ratio of Ch to poly(acrylic acid) and the loading concentration of  $Ag^+$  ions. When the loading concentration of  $Ag^+$  ions is in the range of 1.0-1.5 mol L<sup>-1</sup>, DPC 0.10-0.25 hydrogels display the maximum tensile strength (24.0 MPa) and toughness (84.7 MJ m<sup>-3</sup>) with a strain of more than 600%. Specially, the DPC hydrogels display an excellent moldable behavior due to the reversible properties of the electrostatic interaction and coordination bonds. The DPC strategy can also be applied in various other systems and opens a new avenue to fabricate hydrogels with outstanding mechanical properties and antibacterial activities.

**Comment**: Hydrogels with ultrahigh strength and toughness could be obtained in a dual physical crosslinking (DPC) strategy. The resultant gels were crosslinked by non-covalent/electrostatic interactions and coordination bonds, but still possessed considerably high strength and toughness. What about combining negatively charged triphenylamine nanofibers with positively charged chitosan? It is useful to know that the positively charged chitosan needs a pre-treatment such as the one described in this paper.

# Interfacial Self-Assembly of Amphiphilic Dual Temperature Responsive Actuating Janus Particles



Amphiphilic Janus particles feature the combination of two different functional materials in one single colloid, as well as the possibility of self-assembly at interfaces into complex superstructures. In this article, the self-assembly of dual temperature responsive amphiphilic Janus particles at liquid-liquid interfaces and their subsequent conversion into an actuating layer-shaped surface are presented. These microparticles are produced in a capillaries based continuous flow microfluidic device by photoinitiated radical polymerization. The hydrophobic part of the Janus particles contains a liquid crystalline elastomer (LCE), which performs a strong actuation up to 95% during the nematic-isotropic phase transition. The other side consists of a p(NIPAAm) hydrogel, which features volumetric expansions up to 280% below the lower critical solution temperature. A multistep molding process is developed to uniformly align the Janus particles at a toluene/water boundary surface and to embed the particles into a hydrogel matrix. A particle covered hydrogel layer is obtained, which features a collective actuation of the rod-like LCE parts on the surface and a bundling of the resulting forces during the phase transition.

**Comment**: Is it possible for Chuan to use the curing strategy described in this paper to get the intact AuNP-triphenylamine composite nanofilm? Just like it is shown in the second illustration.

#### Aromatic Thioethers as Novel Luminophores with Aggregation-Induced Fluorescence and Phosphorescence

Voskuhl, J; Riebe, S; Vallet, C; Vight, F; Gonzalez-Abradelo, D; Wölper, C;. Strassert, C. A; Jansen, G; Knauer, S;\* <u>*Chem. Eur. J.* 2018, 10.1002/chem.201701867</u>



Here we report on a novel system based on aromatic thioethers with unique luminescence properties. Fifteen different compounds were investigated in detail on their luminescence properties using UV-vis absorption, steady-state and time-resolved luminescence spectroscopy. Excited state lifetimes as well as quantum yields were determined, and the toxicity towards HeLa cells was investigated. Besides X-ray analysis also quantum chemical calculations were performed to gain deeper insights in the unique behavior of this facile system. The studied compounds reveal remarkable fluorescence emission ranging from 437 to 588 nm as well as phosphorescence (up to 5  $\mu$ s).

**Comment**: The research of new AIE systems is an important topic because of the many applications they can have. Here are described the luminescent properties for some aromatic thioethers.

#### Interlocked Photo-Degradable Macrocycles Allow One-Off Photo-triggerable Gelation of Organo- and Hydrogelators

Chiu, S. H.; Tung, S. T.; Cheng, H. T.; Inthasot, A.; Hsueh, F. C.; Yan, P. C; Gu, T. J.;Lai, C. C.\* *Chem. Eur. J* 2018, 10.1002/chem.201705753





[2]Rotaxanes displaying one-off photo-triggerable gelation properties have been synthesized through the "clipping" of photo-degradable macrocycles around the amide or urea functionalities of organo- and hydrogelators. Irradiation with UV light cleaved the photo-labile macrocyclic components from the [2]rotaxanes, resulting in the free gelators being released into solution and, thereafter, forming gels. When the rate of gelation was sufficiently rapid, selective gelation of specific regions of the solution—and, indeed, photo-patterning of the solution—was possible.

**Comment**: Here is described an interesting photo-controllable gelator, which undergo sol-gel tansformation upon light irradiation.

#### Self-Templated Generation of Triggerable and Restorable Nonequilibrium Micelles

Dähling, C.; Houston, J. E.; Radulescu, A.; Drechsler, M.; Brugnoni, M.; Mori, H.; Pergushov, D. V.; Plamper, F. A.\* <u>ACS Macro Lett. 2018, 7, 341.</u>



intermediate steps for concentration of IPEC dispersion (see Supporting Information)
kinetically frozen non-equilibrium structures

Conditional variations can lead to micellar transformations resulting in various (equilibrium) morphologies. However, creating differently shaped assemblies under the same final conditions (same ingredients, composition, temperature, etc.) is challenging. We present a thermoresponsive polyelectrolyte system allowing a pathway-dependent preparation of kinetically stable spherical star-like or cylindrical micelles. In more detail, a temperature-induced structure switch is used to generate equilibrated interpolyelectrolyte complex (IPEC) micelles of different morphologies (templates) below and above the lower critical solution temperature in the presence of plasticizer (salt). Then, lowering the salt concentration at a specific temperature kinetically freezes the formed IPECs, keeping the respective microstructural information encoded in the frozen IPEC also at other temperatures. Hence, different nonequilibrium morphologies at the same final conditions are provided. The salt-triggered transition from nonequilibrium to equilibrium micelles can be repeated for the same sample, highlighting a system with an on-demand changeable and restorable structure.

**Comment:** The system the authors used is quite complex: a branched polymeric architecture with PEG (for stability), *q*PDMAEMA & PVS (polyelectrolytes) and PNIPAM (for thermoresponsivity). With this structure, **different micellar morphologies can be achieved depending on the sample preparation**, and, most importantly, they can be frozen by removal

of the salt (that acts as a plasticizer). The whole system is reversible, so the authors suggest that it can be used for "accumulation and release of energy in smart nanoscale systems".

#### Transition-Metal-Free Decarboxylative Bromination of Aromatic Carboxylic Acids

Quibell, J. M.; Perry, J. P. P.; Cannas, D. M.; Larrosa, I.\* Chem. Sci., 2018, Advance Article.



Methods for the conversion of aliphatic acids to alkyl halides have progressed significantly over the past century, however, the analogous decarboxylative bromination of aromatic acids has remained a longstanding challenge. The development of efficient methods for the synthesis of aryl bromides is of great importance as they are versatile reagents in synthesis and are present in many functional molecules. Herein we report a **transition metal-free decarboxylative bromination of aromatic acids**. The reaction is **applicable to many electron-rich aromatic** and **heteroaromatic acids** which have previously proved poor substrates for Hunsdiecker-type reactions. In addition, our preliminary mechanistic study suggests that radical intermediates are not involved in this reaction, which is in contrast to classical Hunsdiecker-type reactivity. Overall, the process demonstrates a useful method for producing valuable reagents from inexpensive and abundant starting materials.

**Comment:** For a long time, the decarboxylative bromination of aromatic acids remained unsatisfying (requirement of stoichiometric transition metal salts, low selectivity and/or low yield). In this paper, a novel approach is proposed in order to obtain aryl bromides with relatively good yields. The authors also presented more than 50 examples to support their methodology. To sum up, it would be interesting to keep this work in mind for future synthesis.

#### Iron-Catalyzed Urea Synthesis: Dehydrogenative Coupling of Methanol and Amines

Lane, E. M.; Hazari, N.; Bernskoetter, W. H.\* Chem. Sci., 2018, Advance Article.



Substituted ureas have numerous applications but their synthesis typically requires the use of highly toxic starting materials. Herein we describe the first **base-metal catalyst** for the **selective synthesis of symmetric ureas** *via* **the dehydrogenative coupling of methanol with primary amines**. Using a pincer supported iron catalyst, a range of ureas was generated with isolated yields

of up to 80% (corresponding to a catalytic turnover of up to 160) and with  $H_2$  as the sole byproduct. Mechanistic studies indicate a stepwise pathway beginning with methanol dehydrogenation to give formaldehyde, which is trapped by amine to afford a formamide. The formamide is then dehydrogenated to produce a transient isocyanate, which reacts with another equivalent of amine to form a urea. These mechanistic insights enabled the development of an iron-catalyzed method for the synthesis of unsymmetric ureas from amides and amines.

**Comment:** This paper presents a novel Fe-based catalyst to form asymmetric ureas. Even if it seems quite sensitive to steric hindrance, it remains a quite economic and efficient reaction (according to the few examples showed). I think it could be good to follow the evolution of this work, especially when an optimized version of the catalyst will be published, in order to use it in our own synthesis.

#### **Gas-Responsive Polymers**

Zhang, Q.; Lei, L.; Zhu, S. ACS Macro Lett. 2017, 6, 515.



Gas-responsive polymers have inspired much interest over the past ten years. Gas triggers can interact with functionalities on polymer chains and, thus, modulate their chain structures, architectures, and aggregation states. This review summarizes the latest research progresses in the theme of developing different gas triggers for fine control over some critical properties of polymers, as well as their potential applications in various areas. We focus on the **interactions/reactions between gases and gas-responsive functionalities of polymers** and highlight some state-of-art developments, which provided good insight and understanding of each particular gas-responsive polymer. We also offer a perspective point of view on future research directions on gas-responsive polymers, both in fundamental studies and in potential application developments.

**Comment:** When we think about stimuli-responsiveness, we often think of pH-, photo- or chemo-responsive functionalities. However, some functionalities are sensitive to gases; when combined with polymeric materials advantages, it can provide **a new class of stimuli-responsive materials**. This mini-review explains the mechanisms and applications of such materials.

### From Isodesmic to Highly Cooperative: Reverting the Supramolecular Polymerization Mechanism in Water by Fine Monomer Design

C, N. M.; Pujals, S.; Bochicchio, D.; Pavan, G. M.; Torres, T.\*; Albertazzi, L.\*; García-Iglesias, M.\* *Chem. Commun.* **2018**. Doi: 10.1039/c8cc01259h.



Two structurally-similar discotic molecules able to self-assemble in water, forming supramolecular fibers, are reported. While both self-assembled polymers are indistinguishable from a morphological point-of-view, a dramatic change in their polymerization mechanism is observed (i.e., one self-assemble via an isodesmic mechanism, while the other shows one of the highest cooperativity values).

**Comment:** Actually, this paper is not impressive to me. What attracted my attention is the supramolecular polymerization mechanism in introduction part. If you want to know more about that, this is the link for a review <u>*Chem. Rev.*</u> 2009, 109, 5687–5754</u>. Besides, this paper provides a theoretical method (coarse-grained model) to explore the supramolecular polymerization mechanism for water-soluble  $C_3$  molecules.

#### Photoswitching of DNA hybridization using a molecular motor

Lubbe, A. S.; Liu, Q.; Smith, S. J.; Vries, J. W.; Kistemaker, J. C. M.; De Fries, A. H.; Faustino, I.; Meng, Z.; Szymanski, W.\*; Herrman, A.\*; Feringa, B. L.\* *J. Am. Chem. Soc.* **2018**, *ASAP*.



Reversible control over the functionality of biological systems via external triggers may be used in future medicine to reduce the need for invasive procedures. Additionally, externally regulated biomacromolecules are now considered as particularly attractive tools in nanoscience and the design of smart materials, due to their highly programmable nature and complex functionality. Incorporation of photoswitches into biomolecules, such as peptides, antibiotics and nucleic acids, has generated exciting results in the past few years. Molecular motors offer the potential for new and more precise methods of photoregulation, due to their multistate switching cycle, unidirectionality of rotation, and helicity inversion during the rotational steps. Aided by computational studies, we designed and synthesized a photoswitchable DNA hairpin, in which a molecular motor serves as the bridgehead unit. After determining that motor function was not affected by the rigid arms of the linker, solid phase synthesis was employed to incorporate the motor into an 8 base pair self-complimentary DNA strand. With the photoswitchable bridgehead in place, hairpin formation was unimpaired, while the motor part of this advanced biohybrid system retains excellent photochemical properties. Rotation of the motor generates large changes in structure, and as a consequence the duplex stability of the oligonucleotide could be regulated by UV light irradiation. Additionally, Molecular Dynamics computations were employed to rationalize the observed behavior of the motor-DNA hybrid. The results presented herein establish molecular motors as powerful multistate switches for application in biological environments.

**Comment**: Even if this paper is a little bit long and the characterization quite limited, the works done is interesting on several aspects. First, the integration of molecular motors to get biohybrid systems is one of the most promising fields for this out-of-equilibrium system. Secondly, the way that they managed (or just presented) the project should be inspiring for many projects. Indeed, they have used DFT calculation to optimize the system and then molecular dynamics calculations to explain the surprising result of the experiments.

#### A Molecular Trefoil Knot from a Trimeric Circular Helicate

Zhang, L.; August, D.; Zhong, J.; Whitehead, J. F. S.; Vitorica-Yrezabal, I. J.; Leigh, D. A.\* J. Am. Chem. Soc. 2018, ASAP.



We report the two-step synthesis of a molecular trefoil knot in 90% overall yield through the self-assembly of a 12-component trimeric circular zinc helicate followed by ring closing metathesis of six pendant alkene chains. Both the trimeric circular helicate intermediate and the resulting trefoil knot were characterized by NMR spectroscopy, mass spectrometry, and X-ray crystallography.

**Comment**: David Leigh did a simply work? What a surprise, he deserves to be in the literature of the week. To be more serious, since J. P. Sauvage the evolution of the strategy and the efficiency of the synthesis of interlocked molecules is fascinating. In this paper, the synthetic strategy is very

smart and the result is breathtaking (90% yield for trefoil knot). Of course the characterization used is well known but very nicely optimized!

#### Diastereoselective Synthesis of an Advanced Intermediate of Thapsigargin and Other 6,12-Guaianolides Using a RCEYM Strategy

Jouanneau, M.; Bonepally, K., R.; Zhong, J.; Jeuken, A.; Tap, A.,; Guillot, R.; Ardisson, J.; Férezou, J-P.; Prunet, J.\* *Org. lett.* **2018**, *ASAP*.



A new and flexible approach toward the synthesis of 6,12-guaianolide anticancer drugs such as trilobolides or thapsigargin has been developed that could be applied to the preparation of analogues with a modified ring system. The synthesis starts from commercial 2-methylcyclopentane-1,3-dione, only relying on diastereoselective reactions for the construction of the stereogenic centers at C1, C3, C6, and C10 and features a high-yielding ring-closing enyne metathesis (RCEYM) step for the formation of the [5,7] bicyclic core.

**Comment**: This paper is a fully organic study about the synthesis of active molecules. The synthesis strategy to get highly functional molecules is always surprising and inspiring. Indeed, this paper could help us to keep our eyes open on different aspects in synthetic chemistry, especially on stereodivergent synthesis.

# Self-Assembly of Amphiphiles into Vesicles and Fibrils: Investigation of Structure and Dynamics Using Spectroscopy and Microscopy Techniques

Kundu, N.; Banik, D.; Sarkar, N.\* *Langmuir* **2018**, *ASAP*.



Amphiphiles are a class of molecules which are known to assemble into a variety of nanostructures. The understanding and applications of self-assembled systems are based on what has been learned from biology. Among the vast number of self-assemblies, in this article, we have

described the formation, characterization, and dynamics of two important biologically inspired assemblies: vesicles and fibrils. Vesicles, which can be classified into several categories depending on the sizes and components, are of great interest due to their potential applications in drug delivery and as nanoscale reactors. The structure and dynamics of vesicles can also mimic the complex geometry of the cell membrane. On the other hand, the self-assembly of proteins, peptides, and even single amino acids leads to a number of disorders. Thus, a complete understanding of these selfassembled systems is necessary. In this article, we discuss recent work on vesicular aggregates composed of phospholipids, fatty acids, and ionic as well as nonionic surfactants and single amino acid-based fibrils such as phenylalanine and tyrosine. Beside the characterization, we also emphasize the excited-state dynamics inside the aggregates for a proper understanding of the organization, reactivity, and heterogeneity of the aggregates.

**Comment**: Interesting paper about self-assembled amphiphilic structures. This paper gives us an overview of the type of analysis on such systems and also an idea of the relationship between environment and structure. But one of the most interesting points is the study of dynamics within the amphiphilic structures.

#### Tough, Swelling-Resistant, Self-Healing, and Adhesive Dual-CrossLinked Hydrogels Based on Polymer–Tannic Acid Multiple Hydrogen Bonds

Fan, H.; Wang, J. and Jin, X.\* <u>Macromolecules</u>, **2018**, *51*,1696–1705



We demonstrate a facile and universal strategy in the fabrication of **dual-cross-linked** (DC) single network hydrogels with **high toughness**, "nonswellability", rapid self-healing, and versatile adhesiveness based on polymer–tannic acid (TA) multiple hydrogen bonds. Two widely used hydrogels, physically cross-linked poly(vinyl alcohol) and chemically cross-linked polyacrylamide, have been transformed to TA-based DC hydrogels by dipping the corresponding aerogels into TA solution. The second cross-link via multiple polymer–TA hydrogen bonds effectively suppresses the crack propagation, resulting in both DC gels with high mechanical strength. But these two TA-based DC hydrogels go through different deformation mechanisms during the stretching based on analyzing their stress–strain curves using the Mooney–Rivlin equation. Moreover, these DC hydrogels are swelling-resistant, with strong toughness, good self-recoverability, rapid self-healing, and versatile adhesiveness. This work provides a simple route to fabricate multifunctional DC hydrogels, hopefully promoting their applications as biomedical materials.

**Comment:** I was excited by the really huge modulii of the hydrogels. The production of this material seems to be quite scalable to semi industrial scale.

#### Design of Polyurethane Composed of Only Hard Main Chain with Oligo(ethylene glycol) Units as Side Chain Simultaneously Achieved High Biocompatible and Mechanical Properties

Ahner, J.; Micheel, M.; Geitner, R.; Schmitt, M.; Popp, J.; Dietzek, B. and Hager, M.\* *Macromolecules*, **2017**, *50*, 3789–3795



The implementation of a self-healing functionality into materials has become a prevalent approach for materials which require long-term reliability. As of today, the restoration of mechanical properties has dominated the research on self-healing materials, whereas research on **healing of other functionalities** (e.g., conductivity or optical properties) is still in its infancy. Here, the first conjugated polymer, which can restore its optical properties after photodamage is reported. The proposed self-healing mechanism relies on a **thermally triggered imine metathesis** between the conjugated polymer and additional macromolecular healing agents with no catalyst needed. **Comment:** The self-healing ability, namely, recovery of optical properties of imine-based donor-acceptor conjugated polymers is discussed here. The prerequisites for an efficient optical property recovery are proposed. Among them, a relatively low  $T_g$  is necessary for most known self-healing process.

#### **Catalytic Peptide Assemblies**

Zozulia, O.; Dolan, M. A.; Korendovych, I. V.\* Chem. Soc. Rev. 2018, ASAP.



Self-assembly of molecules often results in new emerging properties. Even very short peptides can self-assemble into structures with a variety of physical and structural characteristics. Remarkably, many peptide assemblies show high catalytic activity in model reactions reaching efficiencies comparable to those found in natural enzymes by weight. In this review, we discuss different strategies used to rationally develop self-assembled peptide catalysts with natural and unnatural backbones as well as with metal-containing cofactors.

**Comment:** The only kind of papers in which "HSGQQKFQFQFEQQ" means something else than "the author got angry on his keyboard" ... All jokes apart, Yali and Chris: could this be a part of a base for a presentation on peptide assemblies leading to why your PhD projects are a bit different.

#### Combined In Situ Illumination-NMR-UV/Vis Spectroscopy: A New Mechanistic Tool In Photochemistry

Seegerer, A.; Nitschke, P.; Gschwind, R. M.\* Angew. Chem. Int. Ed. 2018, ASAP.



Synthetic applications in photochemistry are booming. Despite great progress in the development of new reactions, mechanistic investigations are still challenging. Therefore, we present a fully automated in situ combination of NMR spectroscopy, UV/Vis spectroscopy, and illumination to allow simultaneous and time-resolved detection of paramagnetic and diamagnetic species. This optical fiber-based setup enables the first acquisition of combined UV/Vis and NMR spectra in photocatalysis, as demonstrated on a conPET process. Furthermore, the broad applicability of combined UVNMR spectroscopy for light-induced processes is demonstrated on a structural and quantitative analysis of a photoswitch, including rate modulation and stabilization of transient species by temperature variation. Owing to the flexibility regarding the NMR hardware, temperature, and light sources, we expect wide-ranging applications of this setup in various research fields.

**Comment:** At first difficult to read so it might take a few tries (especially for organic chemists), but I think this paper is worth reading. I think that the development of a technique is interesting to read, especially with such an example of combination of techniques we are susceptible to use every day and, furthermore, applied to the example of a photoswitch.

## Functional Liquid Crystals towards the Next Generation of Materials

Kato, T.\*; Uchida, J.; Ichikawa, T.; Sakamoto, T. Angew. Chem. Int. Ed. 2018, ASAP.



Since the discovery of the liquid-crystalline state in 1888, liquid crystal science has made great advances through fusion with various technologies and disciplines. Recently, new molecular design strategies and new self-assembled structures have been developed as a result of the progress made in synthetic procedures and characterization techniques. Since these liquid crystals exhibit new functions and properties derived from their nanostructures and alignment, a variety of new functions for liquid crystals, such as transport for energy applications, separation for environmental applications, chromism, sensing, electrooptical effects, actuation, and templating have been proposed. This Review presents recent advances of liquid crystals that should contribute to the next generation of materials.

**Comment:** If we forget about the overuse of the word "new" in this review, I think it might give a quick overview of the recent advances in the liquid-crystal based materials field.