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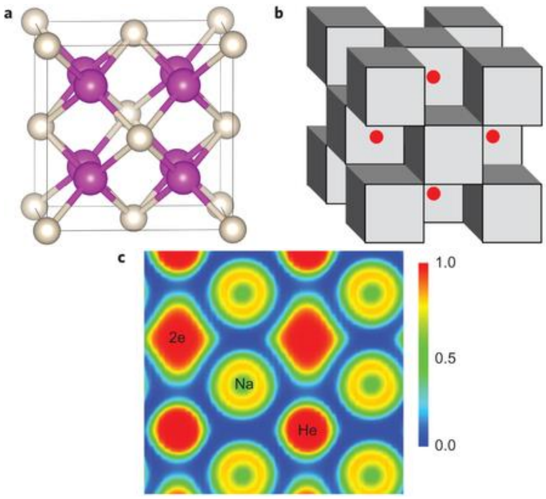
Editorial

We are focusing to develop scientific knowledge of students towards chemical science. The articles published here are collected by our scholars and originally published in trusted sources.

P. Naveenkumar
K. Bama

First Stable Helium Compound



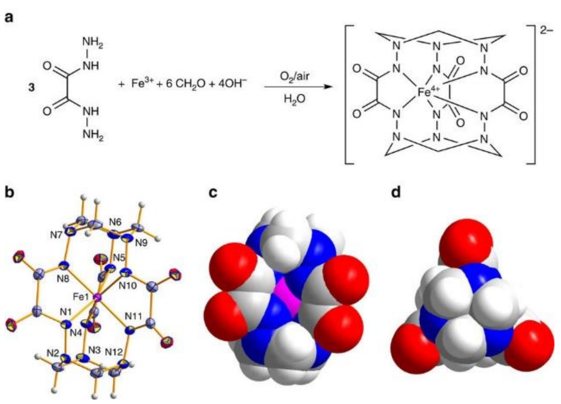
Artem R. Oganov, Stony Brook University, New York, USA, Skolkovo Institute of Science and Technology, Moscow, Russia, Northwestern Polytechnical University, Xi'an, China, and colleagues have for the first time produced a stable chemical compound with helium. So far, He has been considered to be chemically inert. The researchers found with theoretical calculations that Na_2He has a lower enthalpy than a mixture of elemental sodium and helium at pressures above 160 GPa; a sign of a stable crystal structure under these conditions. In the case of pressures generated in the laboratory, sodium is also the only element with which helium contains such a compound.

The chemists exerted extreme pressure to a mixture of sodium and helium in a diamond anvil cell. At pressures above 113 GPa, the measurements showed a change by means of X-ray crystallography and Raman spectroscopy: the mixture of the two elements had become a crystalline compound. In its structure, Na_2He resembles an ionic, salt-like crystal. In this, the helium atoms form a cubic lattice, similar to a 3D chessboard, in which each black field is occupied by helium. The white fields are covered by an electron pair surrounded bysodium ions. Thus this compound is an electride, a crystal of positively charged ionic nuclei, in which highly localized valence electrons play the role of the anions. Helium leads to this localization of the electrons and makes the exotic crystal a non-conductor.

Source
http://www.nature.com/nchem/journal/vaop/ncurrent/full/nchem.2716.html

Collected by M. Senthil Kumaran

Stable Iron(IV) Complexes



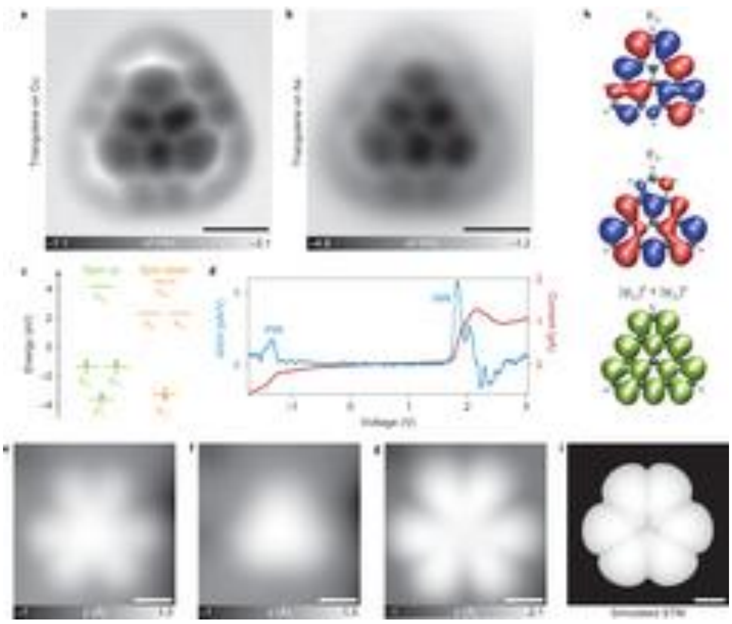
In nature, iron, the fourth most abundant element of the Earth's crust, occurs in its stable forms either as the native metal or in its compounds in the +2 or +3 (low-valent) oxidation states. High-valent iron (+4, +5, +6) compounds are not formed spontaneously at ambient conditions, and the ones obtained synthetically appear to be unstable in polar organic solvents, especially aqueous solutions, and this is what limits their studies and use. Here we describe unprecedented iron(IV) hexahydrazide clathrochelate complexes that are assembled in alkaline aqueous media from iron(III) salts, oxalodihydrazide and formaldehyde in the course of a metal-templated reaction accompanied by air oxidation. The complexes can exist indefinitely at ambient conditions without any sign of decomposition in water, nonaqueous solutions and in the solid state. We anticipate that our findings may open a way to aqueous solution and polynuclear high-valent iron chemistry that remains underexplored and presents an important challenge.

Source
http://www.nature.com/articles/ncomms14099

Collected by C. Saravanan.

***The materials are collected from the sources given at the bottom of the articles. We sincerely acknowledge all the authors and publishers of these sources.**

Elusive Triangulene Created for the First Time



Researchers at IBM have created an elusive molecule by knocking around atoms using a needle-like microscope tip. The flat, triangular fragment of a mesh of carbon atoms, called triangulene, is too unstable to be made by conventional chemical synthesis, and could find use in electronics. This isn't the first time that atomic manipulation has been used to create unstable molecules that couldn't be made conventionally — but this one is especially desirable. "Triangulene is the first molecule that we've made that chemists have tried hard, and failed, to make already," says Leo Gross, who led the IBM team at the firm's laboratories in Zurich, Switzerland.The creation of triangulene demonstrates a new type of chemical synthesis, says Philip Moriarty, a nanoscientist who specializes in molecular manipulation at the University of Nottingham, UK. In conventional synthesis, chemists react molecules together to build up larger structures. Here, by contrast, atoms on individual molecules were physically manipulated using a microscope.But making molecules one at a time will be useful only in particular situations. And the method is unlikely to work for those with complicated shapes or structures that make it hard to identify or target individual atoms.

UNSTABLE TRIANGLE

Triangulene is similar to a fragment of graphene, the atom-thick material in which carbon atoms are joined in a hexagonal mesh. The new molecule is made up of six hexagons of carbon joined along their edges to form a triangle, with hydrogen atoms around the sides (see 'Radical triangle'). Two of the outer carbon atoms contain unpaired electrons that can't pair up to make a stable bond.Such a molecule is highly unstable because the unpaired electrons tend to react with anything around them. "As soon as you synthesize it, it will oxidize," says Niko Pavliček, a member of the IBM team. So far, the closest conventional synthesis has come to making molecules of this sort involves buffering the reactive edges with bulky hydrocarbon appendages.The IBM team turned to a scanning probe microscope, which has a needle-sharp tip that 'feels' a material's shape. The technique is usually used to image molecules, by measuring attractive forces between the tip and sample, or the electric currents that pass between them. The IBM team has demonstrated that, if the tip has a small molecule such as carbon monoxide attached to it, force microscopy can provide images of such high resolution that they resemble the ball-and-stick diagrams of chemistry textbooks. Gross's team has already shown how the microscope can be used to direct the course of chemical reactions and make unstable 'intermediate' molecules. To produce triangulene, the team began with a precursor molecule called dihydrotriangulene, which lacks the reactive unpaired electrons. The precursors were synthesized by chemists at the University of Warwick in Coventry, UK.The researchers deposited these molecules on a surface — salt, solid xenon and copper are all suitable — and inspected them under the microscope.They then used two successive voltage pulses from the tip, carefully positioned above the molecules, to blast off two hydrogen atoms and create the unpaired electrons. The work is published in *Nature Nanotechnology*.The team then imaged the products with the microscope, first picking up a carbon monoxide molecule to acquire the high resolution. The images had the shape and symmetry predicted for triangulene. Under the high-vacuum, low-temperature conditions of the experiments, the molecules remained stable for as long as the researchers looked.

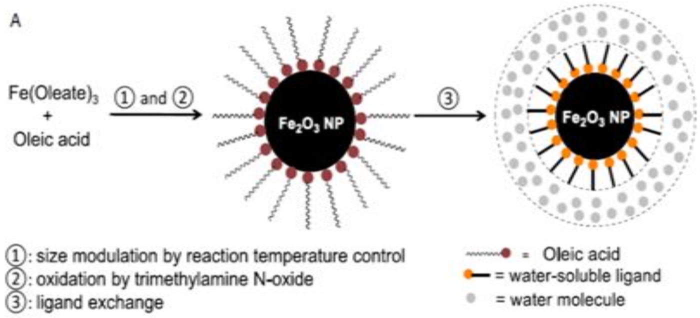
Source

http://www.nature.com/nnano/journal/vaop/ncurrent/full/nnano.2016.305.html

Collected by B. M. Ashwin

Nano-contrast agent for Magnetic Resonance Imaging

Medical imaging is routine in the diagnosis and staging of a wide range of medical conditions. In particular, magnetic resonance imaging (MRI) is critical for visualizing soft tissue and organs, with over 60million MRI procedures performed each year worldwide. Gadolinium-based contrast agents (GBCAs) are the mainstream MRI contrast agents used in the clinic. GBCAs have shown efficacy and are safe to use with most patients; however, some GBCAs have a small risk of adverse effects, including nephrogenic systemic fibrosis (NSF), the untreatable condition recently linked to gadolinium (Gd) exposure during MRI with contrast. In addition, Gd deposition in the human brain has been reported following contrast, and this is now under investigation by the US Food and Drug Administration (FDA). To overcome this issue, specially coated iron oxide nanoparticle developed by a team at Massachusetts Institute of Technology (MTI), Cambridge, elsewhere could provide an alternative to conventional gadolinium-based contrast agents used for magnetic resonance imaging (MRI) procedures.



Super paramagnetic iron oxide nanoparticles (SPIONs) are single-domain magnetic iron oxide particles with hydrodynamic diameters (HDs) ranging from single nanometres to >100 nm. SPIONs can be monodisperse and coated by biologically compatible ligands, are chemically and biologically stable, and are generally non-toxic in vivo. In place of gadolinium-based contrast agents, the researchers have found that they can produce similar MRI contrast with tiny nanoparticles of iron oxide that have been treated with a zwitterion coating. (Zwitterions are molecules that have areas of both positive and negative electrical charges, which cancel out to make them neutral overall.). Iron oxide particles have been largely used as a negative (dark) contrast agents, but radiologists vastly prefer positive (light) contrast agents such as gadolinium-based agents, as negative contrast can sometimes be difficult to distinguish from certain imaging artifacts and internal bleeding. But while the gadolinium-based agents have become the standard, evidence shows that in some very rare cases, they can lead to an untreatable condition called nephrogenic systemic fibrosis, which can be fatal. Subsequently, the significant innovative finding by the MTI team was to combine two existing techniques: making very tiny particles of iron oxide, and attaching certain molecules (called surface ligands) to the outsides of these particles to optimize their characteristics. The iron oxide inorganic core is small enough to produce a pronounced positive contrast in MRI, and the zwitterionic surface ligand, which was recently developed by Wei and his co-workers, makes the iron oxide particles water-soluble, compact, and biocompatible. The combination of a very tiny iron oxide core and an ultrathin ligand shell leads to a total hydrodynamic diameter of 4.7 nanometers, below the 5.5-nanometer renal clearance threshold. This means that the coated iron oxide should quickly clear through the kidneys and not accumulate. This renal clearance property is an important feature where the particles perform comparably to gadolinium-based contrast agents. Finally , they reveal that zwitterion-coated exceedingly small super paramagnetic iron oxide nanoparticles (ZES -SPIONs) have a small enough HD to show kidney clearance, and that their T_1 contrast power is high enough that these particles can be used for magnetic resonance angiography (MRA)and conventional positive MRI contrast. This is an example of a class of Gd-free MRI contrast agents that could be used for MRA in a way that is similar to the GBCAs. Moreover, unlike existing SPION-based MRI contrast agents, which exhibit prolonged contrast and a potential for iron overload, the pharmacokinetic properties of ZES-SPIONs are such that long term contrast changes may be avoided, and the iron dose that remains in the body can be kept in a safe range. This material system can be the basis for developing positive Gd-free MRI contrast agents as alternatives to GBCAs in the clinic.

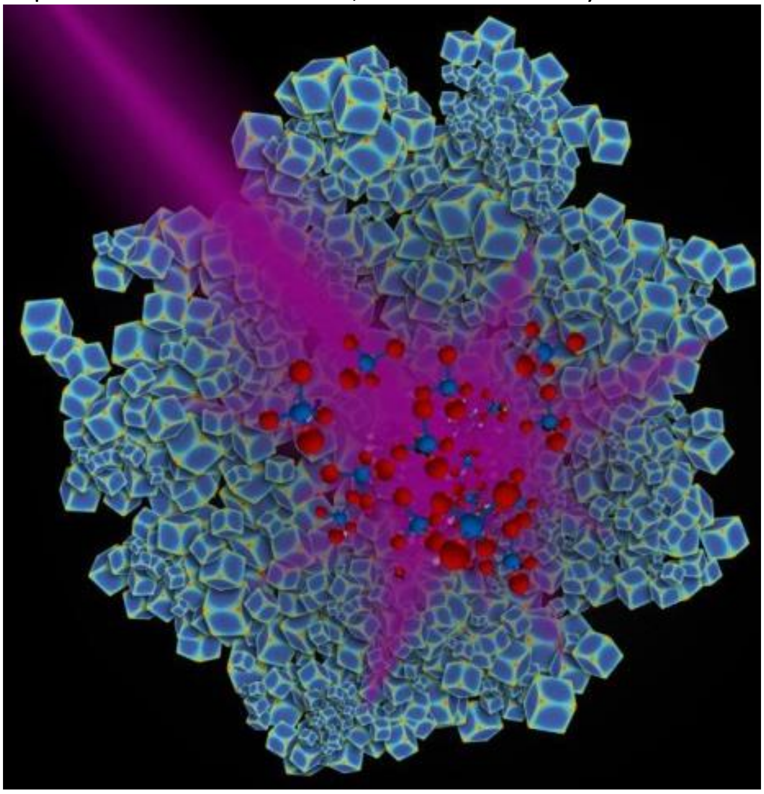
Source

http://www.pnas.org/content/early/2017/02/09/1620145114/F2.expansion.html

Collected by R. Mangaiyarkarasi

Light-driven reaction converts Carbon dioxide into Fuel

Duke University researchers have developed tiny nanoparticles that help convert carbon dioxide into methane using only ultraviolet light as an energy source. Having found a catalyst that can do this important chemistry using ultraviolet light, the team now hopes to develop a version that would run on natural sunlight, a potential boon to alternative energy. Chemists have long sought an efficient, light-driven catalyst to power this reaction, which could help reduce the growing levels of fuels only are the rhodium nanoparticles made more efficient when illuminated by light, they have the advantage of strongly favoring the formation of methane rather than an equal mix of methane and undesirable side-products like carbon monoxide. This strong "selectivity" of the light-driven catalysis may also extend to other important chemical reactions, the researchers say.



Now the team plans to test whether their light-powered technique might drive other reactions that are currently catalyzed with heated rhodium metal. By tweaking the size of the rhodium nanoparticles, they also hope to develop a version of the catalyst that is powered by sunlight, creating a solar-powered reaction that could be integrated into renewable energy systems. "Our discovery of the unique way light can efficiently, selectively influence catalysis came as a result of an on-going collaboration between experimentalists and theorists," Liu said. "Professor Weitao Yang's group in the Duke Chemistry department provided critical theoretical insights that helped us understand what was happening. This sort of analysis can be applied to many important chemical reactions, and we have only just begun to explore this exciting new approach to catalysis."

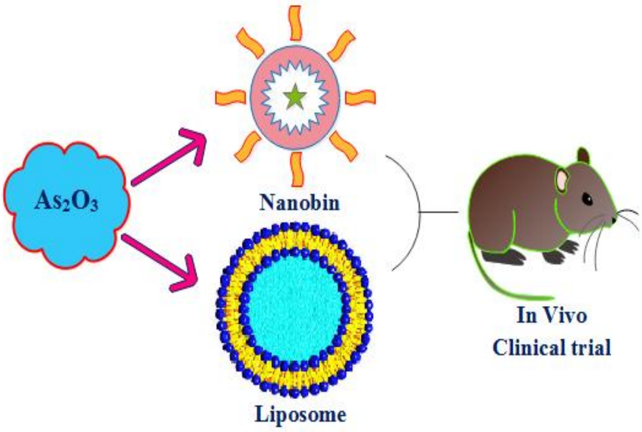
Source

http://www.nature.com/articles/ncomms14542

Collected by P. Naveen.

Arsenic nanomaterials for the effective treatment of solid tumour therapy

Nanomaterials based therapy has recently announced itself as a possible next-generation therapy that is able to cure acute promyelocytic leukemia (APL). The use of nanomaterials in cancer therapy is attractive for several reasons: they exhibit unique pharmacokinetics, including minimal renal filtration; they have high surface to volume ratios and they may be constructed from a wide range of materials used to encapsulate or solubilize therapeutic agents for drug delivery or to provide unique, magnetic, and electrical properties for imaging and remote actuation. To date, in virtue of advantages of drug delivery by nanovehicles, such as large loading capacity, sustained release, prolonged circulation time in blood, and multi-functional platform, the efficacy of many traditional chemotherapy agents has been improved. Arsenic trioxide (As_2O_3 ATO) has achieved great clinical success on the treatment of APL, found in traditional Chinese medicine records, has been approved by Food and Drug Administration (FDA). There are currently over 100 active clinical trials involving inorganic arsenic or organoarsenic compounds registered with the FDA for the treatment of cancers.



Some of the earliest records of direct applications of arsenic to treat disease are found in traditional Chinese medicine, where it was used as a devitalizing agent prior to dental work. Hippocrates and other ancient Greek physicians used arsenic as an escharotic a substance that destroys tissue and produces a thick black scab known as an eschar, to treat skin and breast cancers.

Source

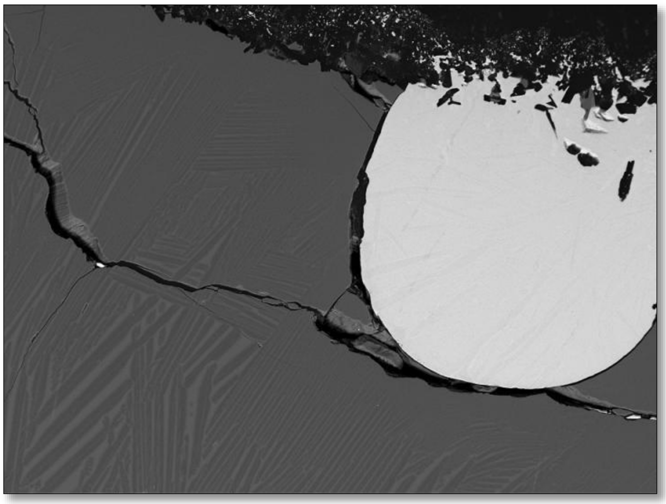
http://pubs.rsc.org/doi/10.1039/C5NR07860A

Collected by B. Suganya Barathi

Different 'flavors' of iron and nickel around the Solar System

High-precision analyses of Fe stable isotope ratios in planetary materials have revealed significant variations among the currently sampled planets and asteroids. As Fe is one of the most abundant elements in the bulk Earth and a major element in the cores, mantles, and crusts of the terrestrial planets and large asteroids, these isotopic variations have the potential to record information about the conditions of planetary formation and differentiation.

Recently the solar system, planetary cores began to form, with heavier elements, notably iron, moving into the centre of the developing mass. Elardo group's showed that **interactions between iron and nickel** under the **extreme pressures and temperatures** similar to a planetary interior can help scientists understand the period in our Solar System's youth when planets were forming and their cores were created - Their findings and resulting in what the researchers call a range of iron "flavors'" are published by Nature Geoscience.



Elardo and Shahar were able to use laboratory tools to mimic the conditions found deep inside Earth and other planets in order to determine why iron isotopic ratios can vary under different planetary formation conditions. They found that nickel is the key to unlocking the mystery. Under the conditions in which the Moon, Mars, and the asteroid Vesta's cores were formed, preferential **interactions with nickel retain high concentrations of lighter iron isotopes in the mantle**. However, **under** the **hotter and higher-pressure conditions** expected during Earth's core formation process, this nickel effect disappears, which can help explain the differences between lavas from Earth and other planetary bodies, and the similarity between Earth's mantle and primitive meteorites. "There's still a lot to learn about the geochemical evolution of planets," Elardo group's said. "But laboratory experiments allow us to probe to depths we can't reach and understand how planetary interiors formed and changed through time".

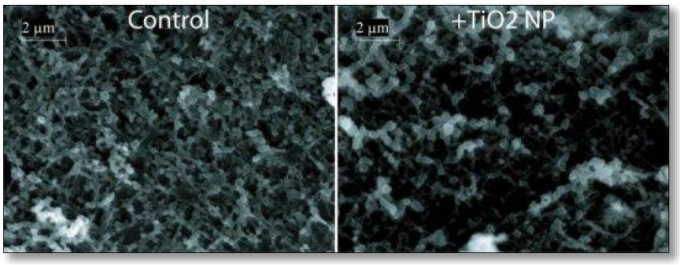
Source

http://www.nature.com/ngeo/journal/vaop/ncurrent/full/ngeo2896.html

Collected by S. Jegatheeswaran.

Food additive found in candy, gum could alter digestive cell structure and function

Small intestinal cells hindered by chronic exposure to common food additive. A small intestinal cell culture model to the physiological equivalent of a meal's worth of titanium oxide nanoparticles, 30 nanometers across, over four hours (acute exposure), or three meals worth over five days (chronic exposure) Gretchen Mahler group's researchers said.



A few researchers found 89 common tested for food products including gum, twinkies, and mayonnaise and found that they all contained titanium dioxide. About five percent of products in that study contained titanium dioxide as nanoparticles. Dunkin Donuts stopped using powdered sugar with titanium dioxide nanoparticles in 2015 in response to pressure from the support group.

"To avoid foods rich in titanium oxide nanoparticles you should avoid processed foods, and especially candy".

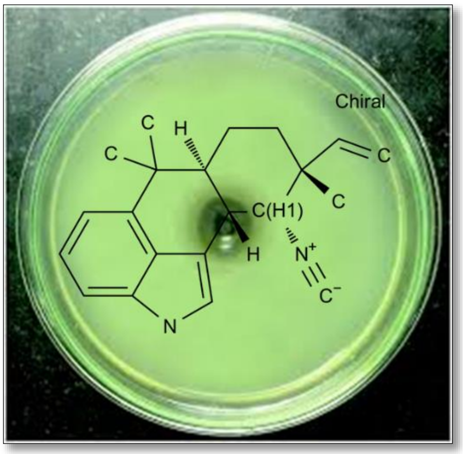
Source

https://www.ncbi.nlm.nih.gov/pubmed?term=%22The+Journal+of+nutritional+biochemistry%22%5BJournal%5D

Collected by S. Ambika

Novel biosynthesis of hapalindole - type alkaloids for biological applications

Discovery is expected to impact pharmaceutical and agricultural industries. Alkaloids are natural nitrogen-containing compounds produced by plants and microbes. These molecules, such as morphine and quinine, are important human medicines. Alkaloids are typically polycyclic in nature. While the polycyclic characteristics are important for their bioactivities, these features impede their chemical syntheses in the laboratory and their applications as pharmaceuticals.



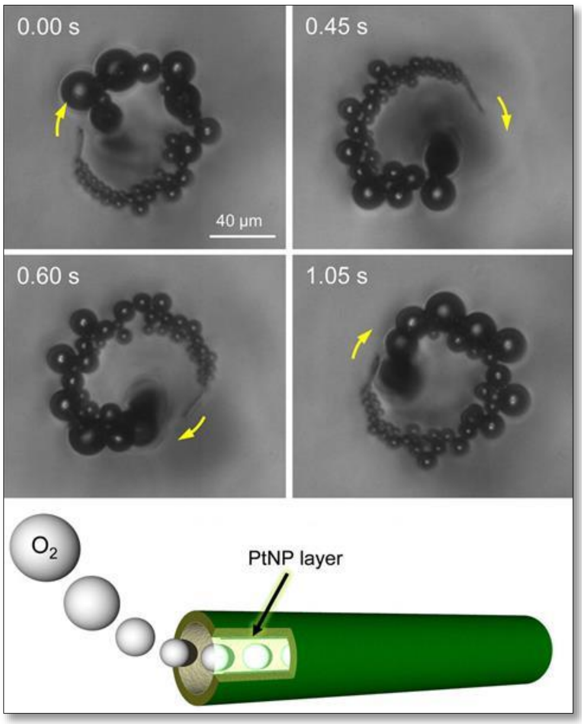
"In our laboratory, we introduced and excellent finding U-family proteins characterized as a novel family of cyclization enzymes, we now have the complete biocatalyst tool sets in hand to synthesize these molecules. After six years Xinyu Liu group hard work and several groundbreaking works generated from my lab on the **biosynthesis of hapalindole-type alkaloids,** we finally have a chemoenzymatic platform to advance these remarkable molecules for pharmaceutical applications particularly drug discoveries.

Source

http://pubs.rsc.org/en/content/articlelanding/2017/cc/c7cc00782e#!divAbstract

Collected by K. Bama

Micro-macaroni and cheese hordes up pathogens



Macaroni-like microtubes that self-propel using hydrogen peroxide as fuel have been developed by chemists in Japan. The tiny hollow tubes are flexible, simple to manufacture and can capture dyes and bacteria such as E. coli while wandering around a surface. Structures that work in a very similar way - using platinum to break down hydrogen peroxide and produce bubbles of oxygen that propel them along - have been developed before. But Teruyuki Komatsu researchers groups were developed a novel method called 'wet templating' that allows them to tailor the tubes with layers of different materials using only solutions and syringes. Starting with a polycarbonate template, the team built a protein surface that is then covered by a thin, monoatomic platinum layer.

The polycarbonate scaffold is removed using organic solvents such as dimethylformamide. Because the platinum layer is much thinner than the protein surface, the tubes have unprecedented flexibility. Daniela Wilson comments that this flexibility 'definitely important for biomedical applications in comparison to hard-metal motors.'

Because of the toxicity of hydrogen peroxide, however, biomedical applications are still a long way off. 'However, the fabrication method seems versatile for employing other kinds of **biomaterial for diverse applications**,' Schmidt. Komatsu's team said, it is already looking to improve on their recipe: 'We are challenging to prepare photo-irradiation and biological-force induced moving microtubes'.

Source

http://onlinelibrary.wiley.com/doi/10.1002/chem.201605055/abstract

Collected by M. Balaji and A. Sangili.

Spider silk stronger than steel

Spider silk strength is in the loop: Discovery of hidden

thread in silk of deadly spider inspires material-toughening strategy. Scientists have discovered **microscopic metastructures** in the web of the recluse spider that offer a blueprint for tough new materials. At first glance, the venomous yet timid Chilean recluse spider (Loxosceles laeta) seems to be highly disorganised in constructing its web. Traversing its lair, it deposits clumpy bales of silk in a messy, tangled cobweb. Look closer. William and Mary showed that the spider carefully choreographs its spinnerets to sew silk in **thousands of micrometre-sized loops**. When strained, the loops sequentially open to reveal hidden length in the thread, dissipating energy and staving off breakage.

Schniepp explained, this toughening strategy depends on the material's morphology. The recluse spider's silk thread is ribbon-shaped, allowing high strand-to-strand contact and strength at the loop joints - each withstands substantial stress before opening. The ribbon is also flexible, owing to its thinness, which avoids concentration of stress on the fibre as it opens.

After unravelling the spider's strategy, and with the help of a mathematical model and inspired to build its own ribbon-loop-toughened metamaterial, at the macroscale. 'We had some adhesive tape in our draw, so we simply formed one loop in it and immediately saw a 30 % enhancement in the material's toughness,' Schniepp said. He explains that more loops lead to greater gains. The team's model predicts that, by adding enough loops, some types of fibre would become 1000 % tougher. 'Just by adding these loops, you're really changing the characteristics of the material, transcending its properties.' Moreover, Spider silk does not elicit an immune response, making it an ideal material for several applications in the medical field.

This has wide-reaching implications. Spider silk, already five times stronger by weight than steel, becomes tougher when looped. A Schniepp group explains that intrinsically strong yet brittle carbon fibre would become pseudo-ductile and less prone to catastrophic failure if looped. Some specialist in biomaterials department takes further inspiration from the spider's strategy: 'The level of toughness achieved is spectacular, but more important is the ability to stretch the fibre structure to a great extent without breaking it [by unravelling the hidden length]. Such extreme stretchability, can play a significant role in fabricating new, lightweight biomaterials for wearable devices or protection.' Schniepp admits that these potential applications might be difficult to realise, owing to challenges in forming, manipulating and bonding ribbon fibres. However, the team hopes that their discovery will point the way to a new generation of tough metamaterials, all with a common thread.

Source

http://pubs.rsc.org/en/content/articlelanding/2017/mh/c6mh00473c/unauth#!divAbstract

Collected by P. Nithya

CSIR

The CSIR examination for JRF/NET is advertised for 2017. The last date for application is June 18th 2017. Further information is available at the following website.

http://csirhrdg.res.in/

SET

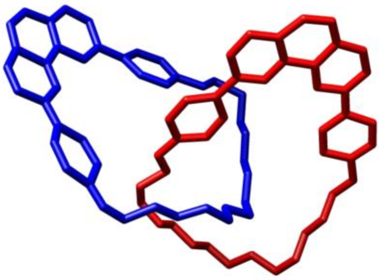
State level eligibility test has been announced. Last dated is 12.03.2017

For further details click the link bellow

http://www.motherteresawomenuniv.ac.in/news.html

Noble prize for supramolecular chemistry – 2016

Sauvage was born in Paris in 1944, and earned his PhD from the Université Louis-Pasteur under the supervision of Jean-Marie Lehn, himself a 1987 winner of the Nobel Prize in Chemistry. During his PhD work, he contributed to the first syntheses of the cryptand ligands.



Sauvage's scientific work has focused on creating molecules that mimic the functions of machines by changing their conformation in response to an external signal. His Nobel Prize work was done in 1983, when he was the first to synthesize a catenane, a complex of two interlocking ring-shaped molecules, which were bonded mechanically rather than chemically. Because these two rings can move relative to each other, the Nobel Prize cited this as a vital initial effort towards making molecular machine. The other two recipients of the prize followed up by later creating a rotaxane and a molecular rotor. Other research includes electrochemical reduction of CO_2 and models of the photosynthetic reaction center. A large theme of his work is molecular topology, specifically mechanically-interlocked molecular architectures. He is currently emeritus professor at the University of Strasbourg (Unistra). He shared the 2016 Nobel Prize in Chemistry "for the design and synthesis of molecular machines" with Sir J. Fraser Stoddart and Bernard L. Feringa.

Source

www.nobelprize.org

Collected by M. Senthil Kumaran

Post-doctoral positions

Post-doctoral position at Miami

The University of Miami Miller School of Medicine's Division of Infectious Diseases has an exciting opportunity for a Post-Doctoral Associate. Under the direction of the Principle Investigator, this position will work with the data manager and will interact with the clinical research nurses and investigators to support their research efforts. Also will focus and assist on data management as per established protocols. A Ph.D. degree is required in this type of position.
http://www.postdocjobs.com/jobs/jobdetail.php?jobid=4019815

Post-doctoral position at Cancer center

Employer: The University of Texas M. D. Anderson Cancer Center
Job Number: 4019813
Date Posted: 03/07/2017
Application Deadline: Open Until Filled
For further details click the link bellow
http://www.postdocjobs.com/jobs/jobdetail.php?jobid=4019813

Post-doctoral position at Yale University

Employer: Yale University School of Medicine
Job Number: 4019802
Date Posted: 03/06/2017
Application Deadline: Open Until Filled
For further details click the link bellow
http://www.postdocjobs.com/jobs/jobdetail.php?jobid=4019802

Post-doctoral position at Chapman University

Employer: School of Pharmacy
Job Number: 4019799
Date Posted: 03/04/2017
Application Deadline: Open Until Filled
For further details click the link bellow
http://www.postdocjobs.com/jobs/jobdetail.php?jobid=4019799

Senior Scientist Computational Toxicologist-Toxicokinetics Neuchatel, Switzerland

Philip Moris International looking for talented computationa scientists in chemistry and biology.
For further details click the link bellow
https://www.pmi.com/

Conferences

Symposium on Inorganic Chemical Biology-2017 is going to held at School of Chemistry, Madurai Kamaraj University, Madurai on 16,17th March 2017
For further details click the link bellow
https://icbmku2017.wixsite.com/icbmku2017

Conference Photoinduced Processes in Nucleic Acids and Proteins: Faraday Discussion
11 - 13 January 2018, Kerala, India
Light induced chemical and physical processes in small organic-/inorganic-/bio-molecules have been a subject of experimental and theoretical research for several decades.
For further details click the link bellow
http://www.rsc.org/events/asia/india

The symposium on Advances in Boronic Organic Chemistry - AdBOC 2017 is organised as part of the Marie Sklodowska-Curie Initial Training Network CoSSHNet (Complementary Synthetic Strategies toward Heterocyclic Boronates) and will be held in Sheffield (UK) on the 15th of September 2017. The event covers the lattest advances in boronic organic chemistry and their use in chemistry.
For further details click the link bellow
http://www.chemistry-conferences.com/2017/09/15%20-%2015%20Advances%20in%20Boronic%20Organic%20Chemistry%20(AdBOC%20-%202017)%20(Sheffield%20-%20UK).htm

The **International Symposium on Synthesis and Catalysis** (ISySyCat2017) will take place at the University of Evora from September 5-8 2017. The city of Evora besides its striking beauty, uniqueness and hospitality is steeped in history having being the home to the Romans, the Moors, Visigoth's and the kings of Portugal. The walled city with its Roman temple, palaces and old cathedrals is a UNESCO world heritage. The conference will focus on contemporary organic and organometallic synthesis and catalysis. We invite participants from academia and industry from all over the world, as can be seen from the list of speakers. We are looking forward to seeing you in Evora in September 2017.
For further details click the link bellow
http://www.chemistry-conferences.com/2017/09/05%20-%2008%20International%20Symposium%20on%20Synthesis%20and%20Catalysis%20(Evora%20-%20PT).htm