Ceftaroline binds to a crucial bacterial protein called 'penicillin binding protein 2a (PBP2a)' at a location separate from the active site. This triggers an allosteric conformational change that enables another ceftaroline molecule to enter the active site of PBP2a — thereby inhibiting its function. However, bacterial strains that are resistant to ceftaroline have now been identified. These strains contain mutated PBP2a and so far a double mutant (N146K/E150K) and a triple mutant (N146K/E150K/H351N) have been identified.

Now, a team led by Juan A. Hermoso and Shahriar Mobashery of the CSIC in Madrid and University of Notre Dame, respectively, have shown how these mutations confer resistance to ceftaroline. To study the interactions of ceftaroline with the allosteric site of wild-type PBP2a and its mutants, the team first had to 'block' the active site because ceftaroline can interact with both. They achieved this by acylating the active sites using a high concentration of the penicillin oxacillin. However, experiments measuring the binding of ceftaroline to the allosteric site showed insufficient differences between the wild-type and the mutants to account for the antibiotic resistance.

Next they looked at the effect of the mutations on the binding-induced conformational change by using an assay to determine how accessible it renders the active site. This showed that the mutations interfere with the conformational change, significantly reducing access to the active site. The development of antibiotic resistance through mutations that interfere with a conformational change represents a new mechanism for such resistant behaviour. Analysing the crystal structure of the N146K/E150K double mutant showed that this protein adopts a series of alternative side-chain interactions, which interrupt the conformational change observed in the wild-type protein. *RJ*

CARBON NANOMATERIALS

Targeted tubes

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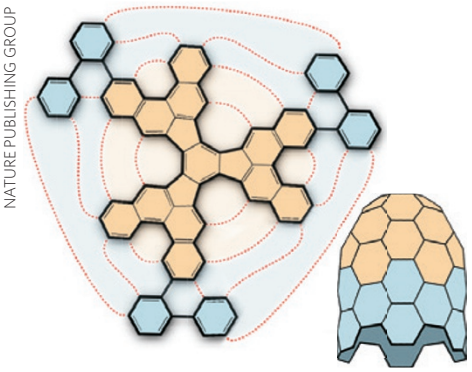
The electronic properties of single-walled carbon nanotubes are dictated by their diameters and also by how the graphene lattice from which they are notionally made has been rolled up. In 'armchair' structures, polyacene chains run parallel to the long axis of the tube, whereas it is poly-*p*-phenylenes that do this in 'zigzig' nanotubes. 'Chiral' nanotubes are those in which neither of these substructures run straight from one end of the tubes



NATURE PUBLISHING GROUP

to the other, but rather twist along their length. Carbon nanotubes are typically made as a mixture of different tube types, although samples with narrow diameter distributions can be obtained using various synthesis techniques or post-synthetic separation methods.

Now, a team of researchers in Germany and Switzerland, led by Konstantin Amsharov and Roman Fasel, have shown that by using a defined molecular precursor it is possible to very selectively produce carbon nanotubes of just a single type. Starting from 2-acetonaphthone, a three-fold symmetric polycyclic hydrocarbon ($C_{96}H_{54}$, pictured) was prepared using traditional solution-phase organic synthesis. When this precursor was deposited on to a platinum surface and heated to 770 K under ultrahigh-vacuum conditions, a surface-catalysed cyclodehydrogenation (CDH) reaction resulted in more than half of the polycyclic hydrocarbons forming atomically precise nanotube caps. Although other structures were also created through alternative CDH reactions, none of these products could act as seeds for nanotube growth.

When the nanotube caps were exposed to carbon sources such as ethanol or ethene at temperatures from 670–770 K they grew away from the metal substrate, which was confirmed by scanning tunnelling microscopy (STM). Characterization of the surface-bound nanotubes with Raman spectroscopy suggested that only nanotubes with a (6,6) chiral index had been formed, and high-resolution STM images of nanotubes lying flat on the surface were also consistent with the hexagonal lattice expected in such a structure. Taken together, the evidence suggests that an atomically precise precursor leads to a single cap structure, which, in turn, controls the subsequent nanotube growth. *SC*

Written by Stuart Cantrill, Stephen Davey, Claire Hansell and Russell Johnson.

blogroll

Life in the lab

Mourning a loss and celebrating the everyday.

The public hearing over the laboratory accident that claimed the life of Sheharbano (Sheri) Sangji concluded on 20 June 2014. Jyllian Kemsley and Michael Torrice broke the story for *Chemical and Engineering News* on Twitter (http://go.nature.com/AUrud9). Writing at The Safety Zone blog, Kemsley aggregated chemists' responses (http://go.nature.com/V61Oza) and wrote a myth-busting post detailing and correcting misconceptions that some chemists had about the events that led to Sangji's death (http://go.nature.com/RO3CsT). The chemistry community owes a debt of gratitude to Kemsley and Torrice for their outstanding coverage of this tragedy.

Elsewhere in the blogosphere, Paul Bracher (http://go.nature.com/xmOOZo) and Chemjobber (http://go.nature.com/DjUEGY) initiated lively discussions about the outcomes of the legal proceedings. A major thought running through these conversations was that university-employed chemical researchers are not protected from workplace hazards in the same manner as industrial chemists. This raises the question of what protection graduate students and postdocs are entitled to, if they are not considered employees of a university? While these issues remain for us to sort out, my thoughts turn to Sheri's family and friends who will always live with her loss.

During this time of introspection, chemists also came together to celebrate the small victories, the setbacks, and the spinning wheels that constitute life in the lab. Doctor Galactic hosted #realtimechemweek in which chemists shared their 'everyday' on Twitter. The highlight of this celebration was the post announcing 'Tweets of the Week' (http://go.nature.com/nlymbx). While we normally celebrate publications and grants, it is good for us to celebrate the mundane and acknowledge the risks that accompany being a chemist.

Written by Matthew Hartings, who blogs at http://sciencegeist.net/