

Carbon nanotubes gave Damascus blades an edge...

Damascus blades are famous for their remarkable strength and sharpness, but much of what made these blades great has remained a mystery – until now. Marianne Reibold and colleagues at the University of Dresden have used high-resolution transmission microscopy to analyse steel from the blade of a 17th century Damascus sabre and found carbon nanotubes.

Damascus steel has a very high carbon content but somehow blacksmiths were able to overcome the brittleness that arises from plates of cementite – a compound of carbon and iron – that would form in such high-carbon steel. The team in Dresden has

found evidence indicating that cementite nanowires formed in the steel could have been protected by the carbon nanotubes.

The medieval recipe for the steel was highly detailed and included specific woods which may have provided carbon to form the nanotubes. Trial and error optimization of thermal cycling and forging could have lined up the nanotubes. These in turn could have helped organize planes of cementite in a way that provided sharpness without weakening the blade itself.

Further reading

M Reibold *et al.* 2006 *Nature* **444** 286.

...and are used in a device providing one-way heat flow

Rectifiers for electrical current are common, but the analogous devices for heat are less well known. Now CW Chang of the University of California at Berkeley and colleagues have demonstrated a nanoscale device they describe as a “solid-state thermal rectifier”, made of carbon and boron nitride nanotubes loaded with heavy molecules.

The device is not understandable in

terms of ordinary heat flow carried by linear vibrational modes. Instead, it seems to depend on energy transfer by solitons. Such devices could revolutionize how we deal with heat in applications from microelectronics to large-scale heating and cooling.

Further reading

CW Chang *et al.* 2006 *Science* **314** 1121.

The benefits of wine

The benefits of alcohol, particularly red wine, are well known. Now researchers in the UK have identified what may be the key chemical contributing to vascular health, and which red wines may be best for your heart.

Roger Corder of the William Harvey Research Institute in Barts and The London Queen Mary's School of Medicine and Dentistry and colleagues have investigated the vasoactivity – the effect on the diameter of blood vessels – of key compounds in red wine. These include resveratrol, which occurs in the skin of red grapes. The researchers

found that the greatest dilatation comes from oligomeric procyanidins (OPCs). They also found that the best wines for OPCs come from south-west France and Sardinia, where traditional wine-making techniques seem to boost OPC content by as much as a factor of four over other red wines, and where men in particular show increased longevity (Corder *et al.* 2006).

Also, a recent study shows that resveratrol seems to mimic the beneficial effects of calorie-restricted diets (Baur *et al.* 2006).

Further reading

Joseph A Baur *et al.* 2006 *Nature* **444** 337.
R Corder *et al.* 2006 *Nature* **444** 566.

Sleep really does help your memory

Researchers have long recognized that sleep plays some role in the consolidation of memory, in particular when it is accompanied by brain-wave frequencies less than 1 Hz. But are these brain waves part of the memory-enhancing process, or just an indicator of something else going on?

Lisa Marshall and colleagues at the University of Lübeck in Germany have shown that the application of an oscillating voltage of 0.75 Hz to the skulls of human volunteers during early non-REM sleep can actually improve memory. The signal applied was about 1.2 mV per millimetre, which is just enough to produce similar to normal signals at the surface of the brain.

So it seems that low-frequency electrical activity itself plays a role in memory. How long it will be before headbands with the right electronics go on sale to students looking for an edge is anyone's guess.

Further reading

Lisa Marshall *et al.* 2006 *Nature* **444** 610.

Heavy fusion comes to the laboratory

Researchers have demonstrated several ways of achieving table-top fusion, but the fusion of heavier nuclei remained something requiring more exotic equipment (or stars). Now Isidore Last and Joshua Jortner of Tel-Aviv University have calculated that there may be an easy route to nucleosynthesis in the laboratory, using nanodroplets of methane, water and ammonia.

The idea is to blast the droplet with intense femtosecond-long laser pulses. Very strong ionization then leads to a “coulomb explosion” which should be able to fuse nuclei heavier than deuterons. It might even be able to reproduce the reactions of the carbon–nitrogen–oxygen cycle that takes place in stars.

Further reading

Isidore Last and Joshua Jortner 2006 *Phys. Rev. Lett.* **97** 173401.