

Metallurgy

Cost and compromise in alloy engineering

Appl. Phys. Lett. **83**, 4527–4529 (2003)

There's such a thing as too much choice, as materials scientists searching for new alloys know. There is a phenomenal number of ways of combining four or more metallic elements. So an experimental search for the ideal alloy for a particular application is often impractical. Thomas Bligaard and colleagues propose an alternative. They have used first-principles computational methods to predict relevant properties, such as heats of formation and bulk moduli (in essence, compressibility), for more than 64,000 different alloys. Such calculations are now accurate enough to be considered 'virtual experiments'.

But choosing an engineering material is rarely about optimizing a single property. A common compromise is that between performance and cost. Bligaard *et al.* say that such a compromise is similar to the balance sought between utility, cost and risk in economics, and they suggest that it can be found using the notion of Pareto optima: solutions that cannot be improved in one respect without degrading them in another. They show how to find the Pareto-optimal alloys that balance compressibility against cost. Low compressibility implies not only hardness but also often low thermal expansion, which is needed for precision engineering. The authors suggest new mid-priced candidate alloys such as ruthenium silicide.

Philip Ball

Meteorite impacts

Dinosaurs were not roasted

Geology **31**, 1061–1064 (2003)

Wildfires did not ravage the planet after the giant meteorite impact at the end of the Cretaceous period, according to Claire M. Belcher and co-workers.

They have looked at North American sedimentary rocks dating from the Cretaceous–Tertiary (K/T) boundary, 65 million years

ago, searching for signs of charcoal that signify ancient wildfires. Whereas soot, seen previously in K/T sediments, could be transported over long distances in the atmosphere and could have been produced from fossil fuels at the impact site, only burnt vegetation can generate charcoal.

The researchers took samples along a transect from Colorado to Saskatchewan, the nearest site being 2,300 km from the impact site at Chicxulub in Mexico. They found that the amount of charcoal in the K/T-boundary layers was actually several times less than that in other Cretaceous sediments, arguing strongly that there were no impact-induced wildfires across North America. This in turn implies that some previous estimates of the thermal power delivered by the K/T meteorite are substantially too high. **Philip Ball**

Cancer

Sporadic insights

Cell **115**, 523–535 (2003)

Inherited mutations in the *BRCA1* or *BRCA2* genes that result in complete loss of function of the BRCA proteins account for most cases of familial breast and ovarian cancer. But the overwhelming majority of breast and ovarian cancers are sporadic, not inherited, and here mutations in *BRCA* genes are hardly ever seen. Luke Hughes-Davies and colleagues now identify *EMSY* as a gene that is multiplied in such cancers and provides a link to *BRCA2*.

The BRCA proteins are implicated in cellular processes such as regulating gene transcription, repairing DNA and remodelling chromosome architecture, although their precise role is unclear. Hughes-Davies *et al.* find that the EMSY protein can bind BRCA2, silencing its ability to activate transcription. But EMSY also represses transcription directly, localizes to sites of repair following DNA damage, and associates with proteins that regulate chromosome structure. BRCA2 and EMSY seem, physically and functionally, to be intimately linked.

The authors' clinical studies show that *EMSY* is frequently, and almost exclusively, multiplied in sporadic breast

and ovarian cancers. And patients with 'sporadic' *EMSY* amplification or 'familial' *BRCA2* deletion have remarkably similar cancer types.

Furthermore, in patients without metastases, *EMSY* amplification is associated with a poor prognosis.

Hughes-Davies *et al.* propose that they have uncovered a missing link to the BRCA2 pathway in sporadic breast cancer.

Marie-Thérèse Heemels

Virology

Smallpox selective potential

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Around 10% of Europeans have a degree of protection against HIV because they lack a gene for a receptor, CCR5, that is found on the surface of certain immune cells targeted by the virus. But why does the mutation exist? HIV has not been killing people for long enough for natural selection to have favoured it, and the CCR5 deletion is very rare in people of non-European origin. Alison P. Galvani and Montgomery Slatkin consider that past selection by smallpox could be the answer.

They argue that, like HIV, susceptibility to infection by smallpox virus may have hinged on the presence of CCR5. Even slight protection from smallpox, which kills 30% of those it infects, would have been a strong selective force. Pan-European smallpox pandemics date back at least 2,000 years, enough to account for the incidence of the CCR5 deletion.

An earlier hypothesis pointed to bubonic plague as the selective force. But Galvani and Montgomery conclude that plague did not kill enough Europeans of non-reproductive age, over a long enough period, to be the explanation. However, there have been no studies to identify a mechanism by which a loss of CCR5 might protect against smallpox. As the authors point out, without such data the smallpox hypothesis remains speculative.

Tom Clarke

Vision

An eye for colour

J. Neurosci. **23**, 10873–10878 (2003)

Flies and other invertebrates can sense light of many different wavelengths, ranging from ultraviolet (UV) to the visible colours. UV vision is used for foraging, navigation and mate selection. One molecule in particular underlies sensitivity to both UV and visible light. Rhodopsin, as it is known, is made of two parts: a light-sensitive chemical group that is bound to the opsin protein.

Ernesto Salcedo *et al.* report that if a specific amino acid in the binding pocket on opsin is a glutamate or asparagine, flies can sense blue light. If the amino acid is a lysine, the invertebrate eye responds to UV.

Previous studies had shown that the same site is altered in some forms of human night blindness, and also mediates UV vision in birds. Amino-acid changes at different sites are responsible for UV vision in fish, reptiles and rodents. Salcedo *et al.* conclude that UV vision may have arisen independently in vertebrate and invertebrate species, but that the molecular mechanism underpinning this type of vision is probably similar.

Helen R. Pilcher

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