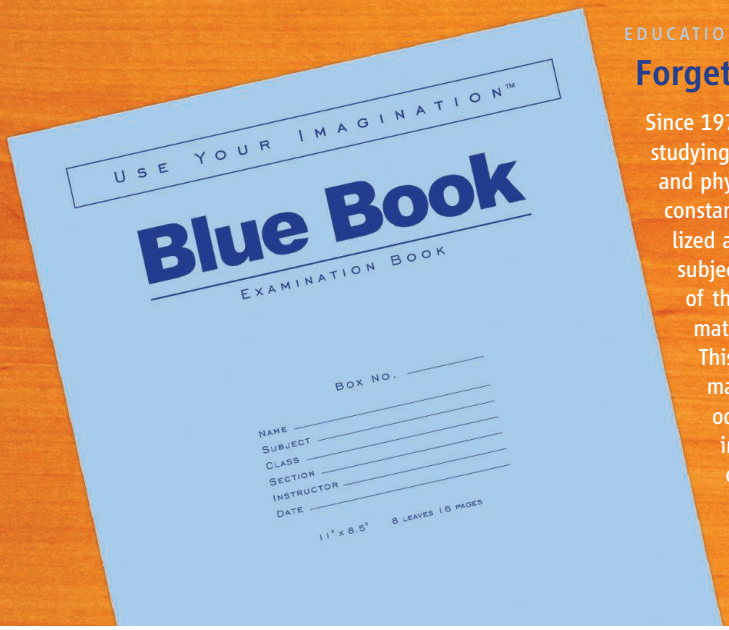
EDITORS' CHOICE

EDITED BY KRISTEN MUELLER AND JAKE YESTON



EDUCATION

Forget Me Not

Since 1975, the same Prior Knowledge Test (PKT) has been given to incoming students studying physics at the University of Bristol, UK. Designed to identify areas of math and physics that might need extra attention in the curriculum, PKT scores remained constant through 1991, decreased dramatically between 1992 and 2000, and stabilized after 2001, suggesting a clear change in the ability of students in the tested subjects. Barham argues that the decrease in scores was caused by modularization of the secondary education curriculum, which resulted in students learning the material required for each module examination and failing to retain it afterward. This highlights the dangers of a "learn and forget" approach to physics and math, and the author suggests that university faculty adapt their teaching methods to allow for the changes in preparedness of incoming students, particularly in math, where large parts of multistage calculations should not be skipped over. Furthermore, he argues for encouraging the understanding that physics and math are coherent disciplines, wherein material taught at all levels must be retained for a complete understanding of the subject. — MM

Phys. Educ. **47**, 162 (2012).

APPLIED PHYSICS

Optically Adapting

When light passes through the atmosphere, fluctuations in air density can introduce distortions in the optical wavefront, resulting in aberrations of an image. For high-end astronomical telescopes, adaptive optics in the form of deformable mirrors can be used to iron out the distortions in the wavefronts and effectively remove the twinkle from the stars. The dense arrays of microelectromechanical systems used for such adaptive optics applications tend to be costly add-ons because of the detailed fabrication and control hardware required. Bonora *et al.* introduce a simpler adaptive optics system in which the deformable mirror is controlled by light. Their deformable mirror is an electrostatic membrane mirror with one of the electrodes replaced by a photoconductive material. The electrostatic coupling and thus the extent of the local deformation can therefore be controlled by varying the intensity of light hitting the photoconductive electrode. The authors argue that such a simple design should make adaptive optics readily available for other applications. — ISO

Opt. Express **20**, 5178 (2012).

CHEMISTRY

Core Function

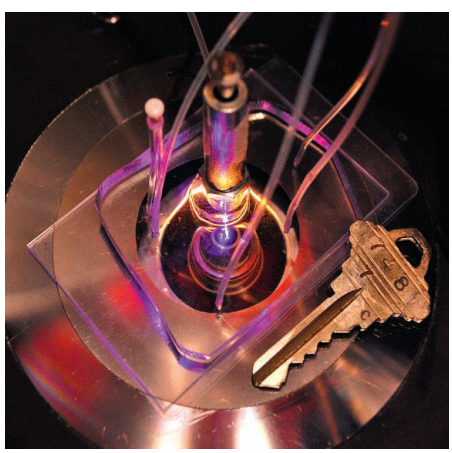
Numerous metalloenzymes make use of their metal centers to promote substrate oxidations in a highly controlled fashion. Chemists have long wondered in this context how much of the reactivity is intrinsic to the local coordination environment of the active site, and how much relies on the extended scaffolding of the surrounding protein. Citek *et al.* now show that in the particular case of tyrosinase—an enzyme that oxidizes phenols in the service of melanin biosynthesis—a bimetallic complex that essentially constitutes the bare active site manifests its central reactivity pattern at low temperature. In the enzyme, two copper ions, each held in place by three imidazole rings tethered to histidines, bind oxygen via a bridging side-on coordination motif. The authors find that combining a copper salt, imidazole, and oxygen in solution at −125°C in arbitrary order leads directly to assembly of a complex that mimics the active site structurally (based on x-ray, ultraviolet, and optical absorption spectroscopy) and functionally (based on the relative kinetics of reactions with phenols of varying electronic properties). The complex falls apart as the temperature goes up, suggesting that the primary role of the protein in this case is to keep the naturally reactive coordination sphere intact and inhibit destructive side reactions. — JSY

Nat. Chem. **4**, 10.1038/NCHEM.1284 (2012).

BIOTECHNOLOGY

Rare Sightings

The isolation and analysis of rare cells, particularly circulating tumor cells (CTCs), is central to advances in personalized medicine. Various approaches have been used to isolate these cells, which are typically present at concentrations of just 1 to 10 cells per milliliter of blood, below the threshold of conventional flow cytometry techniques. However, it has been difficult to ensure detection of all cells, to avoid stressing or damaging the cells during isolation, and to recover the cells after imaging. To overcome these problems, Schiro *et al.* have developed a microfluidic platform, in which blood is broken down into nanoliter aliquots that are ranked for the presence or absence of CTCs. CTCs were



labeled with fluorescent antibodies to enable detection. Those aliquots containing CTCs were then sorted into a collection channel and filtered to enrich the rare cells within a small area. In this area, individual live CTCs could be imaged with minimal stress or could be removed for further studies. The method allows analysis of 1 ml of blood within 20 min, with no false positives and a recovery efficiency of 93%. The method should also be applicable to other rare cell types. — JFU

Angew. Chem. Int. Ed. **51**, 10.1002/anie.201108695 (2012).

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