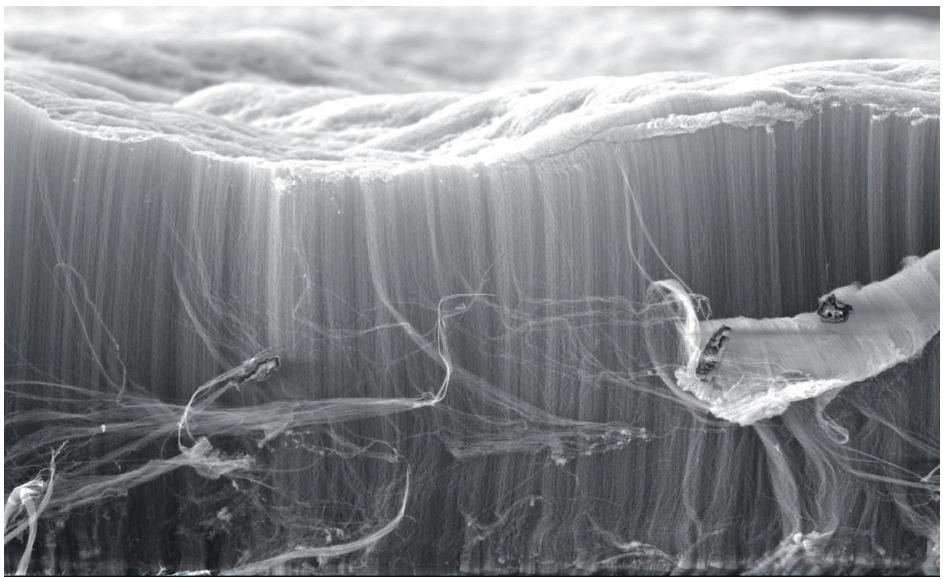

APPLIED PHYSICS

Darker Detectors

Infrared radiation is normally detected by its conversion to heat through absorption at surfaces. The darker the detector surface, the less incoming radiation is reflected away: Dark coatings are thus applied to materials that can convert heat into an electrical signal, such as lithium tantalate, a pyroelectric that generates a temporary change in voltage as its temperature changes. Carbon nanotubes grown as vertically aligned arrays have been reported to be the darkest of materials, but challenges remain in using them to create detectors. Lehman *et al*. grew multiwall carbon nanotubes on a lithium tantalate crystal surface. The catalytic growth conditions (temperatures of 750°C) were above the Curie temperature, so the surface had to be heated, repoled with an electric field, and then cooled to restore its full pyroelectricity. However, higher growth temperatures resulted in longer and more uniform nanotube coatings. Reported reflectances across the detector were less than 0.1% for wavelengths between 0.4 and 4 μm, and less than 1% in the mid-infrared region spanning 4 to 14 μm. — PDS

Nano Lett. **10**, 10.1021/nl100582j (2010).

BIOMATERIALS

Inside Out Synthesis

Methods to synthesize nanomaterials from aqueous metal precursors may one day build on biomineralization mechanisms. Microorganisms often mediate the formation of simple elemental metal or metal-oxide nanoparticulate precipitates at the cell surface. After exposing yeast cells to cerium ions, Jiang *et al.* instead observed the formation of needle-like cerium(III) phosphate (rather than oxide) nanoparticles on the cell surface, even though no phosphate ions were added to the solution. By controlling the pH during further exposure experiments, the authors concluded that the phosphate originated from inside the cells and was likely released as a toxicity response to high concentrations of cerium at the surface. The experiments showed that the precipitation step was decoupled from metabolic reactions and adsorption of Ce^{3+} ions onto the cell wall. In addition to providing a basis for understanding nanoparticle synthesis, the results imply that cerium and other potentially harmful rare earth elements that are present in low concentrations in environmental systems may be sequestered at the cell surface of indigenous microorganisms. — NW

Chem. Geol. 10.1016/j.chemgeo.2010.07.010 (2010).

BIOMEDICINE

Adding ZPP to Cancer Detection

Like many other cancers, prostate cancer is more responsive to therapy when it is diagnosed at an early stage. Blood tests for PSA (prostate-specific antigen), a cancer screening strategy introduced over two decades ago, have led to a significant reduction in death rates from the disease. The PSA test is imperfect, however, because it fails to distinguish cancer from some benign conditions of the prostate and hence can lead to overdiagnosis and overtreatment. Researchers have continued to search for more sensitive and specific markers for detecting and monitoring the disease.

Ghosh *et al.* have begun to explore whether the solution might be as simple as monitoring the zinc content of prostate tissue. Healthy prostate tissue contains high levels of mobile zinc, but these levels fall dramatically when malignant (but not benign) growth occurs. By combining a zinc-specific fluorescent probe, ZPP1, with optical imaging approaches, the authors found that they could detect and follow noninvasively the progression of prostate cancer in mice by monitoring zinc loss in prostate tissue over time. The authors speculate that once optical imaging approaches are adapted for clinical use, this zinc test could potentially be developed into a sensitive and specific tool for human prostate cancer detection. — PAK

Cancer Res. **70**, 6119 (2010).

PHYSIOLOGY

Deep Brain Stimulation

Seasonal changes are reflected in the phenotype and physiology of many organisms, for example, changes of color or insulating power in fur or feathers, and also in reproductive activity. Tracking the seasons can be achieved by detecting the variation in the length of the day, and the vertebrate eye is the most obvious organ that would be involved, but work from nearly a century ago suggested that deep brain photoreceptors do exist.

In studies of the seasonal breeder the Japanese quail (*Coturnix japonica*), Nakane *et al.* report the identification of Opsin 5 as a deep brain photoreceptor that functions in seasonal reproduction. This opsin responds to short-wavelength light, and neurons expressing Opsin 5 (shown stained brown in the paraventricular organ) are structurally similar to retinal photoreceptor cells. The projections of these neurons reach the vicinity of the pituitary, providing a photoperiodic transduction pathway from sunlight to the neuroendocrine system. Because Opsin 5 is also expressed in the mammalian retina and brain, this pathway may be germane to human physiology and behavior. — BAP

Proc. Natl. Acad. Sci. U.S.A. **107**, 10.1073/pnas.1006393107 (2010).

CREDIT (TOP TO BOTTOM): LEHMAN *ET AL., NANO LETT.* 10, 10.1021/NL100582J (2010); NAKANE *ET AL., PROC. NATL. ACAD. SCI. U.S.A.* 107, 10.1073/PNAS.1006393107 (2010)

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