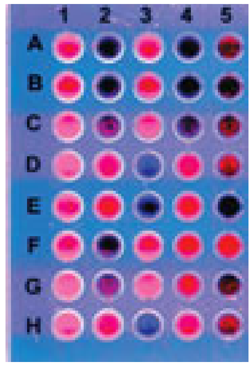
TPP derivatives for protein detection

Andrew Hamilton and colleagues at Yale University have created a library of tetraphenylporphyrin (TPP) derivatives that bind to a variety of proteins. The TPP derivatives can be used for high-throughput proteomics, medical diagnostics, and bioterrorism applications in which multiple types of proteins need to be rapidly detected.

TPP is a synthetic chemical with a large hydrophobic surface that can interact with the hydrophobic surfaces of proteins. To expand the range of proteins recognized by TPP, the periphery molecule can be derivatized with side groups. Derivatives of TPP are highly fluorescent, but the fluorescence can be quenched by certain proteins.

Hamilton and colleagues reasoned that a large number of TPP derivatives in an array format would have a number of different binding characteristics. The array could respond to a mixture of proteins with various surface characteristics. Because the fluorescence quenching of the TPP derivatives depends on the ability of the protein to form complexes, quenching can provide information about the protein surface characteristics.



An array of eight TPP derivatives (A–H) showed changes in fluorescence when incubated with a buffer control (1) and four different proteins (2–5).

The investigators synthesized a library of TPP derivatives that contained either charged or hydrophobic sidegroups. They chose eight of the TPP derivatives to form a test array and then selected four proteins with very different surface properties, ranging from acidic to alkaline.

When the four proteins were incubated with the test array, the array showed a distinctive pattern of fluorescence and quenching of the TPP derivatives. Quenching of certain derivatives by the proteins indicated that the proteins could form complexes with the TPP molecule. The investigators thus demonstrated that an array of TPP derivatives could provide information about the individual protein surfaces. (*J. Am. Chem. Soc.* **2004**, *126*, 5656–5657)

Imaging heat flow through materials

Using a technique called time-domain thermoreflectance, David Cahill and colleagues at the University of Illinois and General Electric Co. have created microscale resolution images of thermal conductivity at thousands of locations in materials generated by combinatorial chemistry. Thermal conductivity, or how fast heat moves through a material, is difficult to predict and measure because it depends on more than just a material's composition. The researchers found that the thermal conductivity of individual crystal grains varies, depending on the orientation of the grains in a sample. Knowledge of the variation in thermal conductivity in a material provides useful information about its structure. (*Nat. Mater.* **2004**, *3*, 298–301)

A bright idea for antigen detection—update

The article on which this Current (*Anal. Chem.* **2004**, *76*, 7 A) was based has been retracted from *Nature Biotechnology* by the authors.

Detecting perfluorochemicals in humans

Perfluorochemicals (PFCs) have been used for about 50 years in the manufacturing of insecticides, surfactants, protective coatings for fabrics and cookware, and many other products. Although PFCs have not been definitively linked to health problems in humans, several animal studies suggest that these chemicals could pose a danger. Because current methods for detecting PFCs in humans are laborious and time-consuming, Antonia Calafat and co-workers at the Centers for Disease Control and Prevention developed a high-throughput technique that is suitable for large epidemiological studies.

The researchers used the new method, which involves automated solid-phase extraction (SPE) followed by LC/MS/MS, to measure the levels of 13 PFCs spiked in calf serum and human breast milk. Detection limits in both serum and milk were 0.1–1 ng/mL, which are lower than those previously reported in serum and environmental water samples.

The SPE-LC/MS/MS technique was also used to measure PFCs in serum from 20 adults with no documented exposure to PFCs. Five PFCs were present in detectable concentrations. Thus, the researchers emphasize the need for additional exposure monitoring of the U.S. general population. (*Environ. Sci. Technol.* **2004**, *38*, 3698–3704)