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Spotlights on Recent *JACS* Publications

RAPID, REAL-TIME CELL SECRETION ASSAY SYSTEM

Cytokines—proteins involved in communication between cells and important as markers for medical diagnoses—are essential to immunological research. Many cytokine analysis techniques take a long time, must be repeated for each marker, or cannot be used in a large-scale study. Now, Matthew S. Luchansky and Ryan C. Bailey have developed a fast and simple new system that allows concentrations of multiple analyte molecules to be detected in real time (DOI: 10.1021/ja2087618).

The team used their biosensing chip to simultaneously quantitate several human cytokines from cell culture samples. They monitored the time-dependent secretion of cytokines from T cells, which are critical in controlling immune response. These experiments did not require fluorescent or enzymatic tags, which are common in other immunological assays.

The device can detect multiple nucleic acids and protein biomarkers at once. To detect targets, the silicon photonic chip directs infrared light toward microrings on the device—the light shifts to longer wavelengths when target biomolecules bind the microring.

Fast analysis and simple sample preparation make this scalable system ideal for high-throughput assays. Additionally, scientists may expand their understanding of immune system responses by using this technology to observe the release of cytokine molecules in real time. **Kenneth J. Moore**

SERS FLOTATION DEVICES CREATE LAB-ON-A-BUBBLE

Analytical chemists use surface-enhanced Raman scattering (SERS) spectroscopy to detect chemicals adsorbed to gold nanoparticles. Often, a magnet is used to concentrate paramagnetic beads, which couple to the nanoparticles only in the presence of a compound of interest, prior to SERS analysis. A magnetic field's strength falls dramatically with distance, slowing down the collection process.

To speed things up, Keith T. Carron and co-workers developed what they call a lab-on-a-bubble, hollow 50-μm-diameter silica spheres studded with 50-nm-diameter gold nanoparticles, which can capture certain chemicals in solution (DOI: 10.1021/ja208463f). Like ping-pong balls, the spheres float in water. When the researchers mix the nanoparticle-covered spheres into an analytical sample, they pop up to the surface, where the scientists can probe them with a Raman laser.

Using this technique, the researchers could detect cyanide ions down to 173 ppt, similar to the sensitivity using gold nanoparticles alone. SERS signals from the faster, simpler bubble method have considerably less noise and are about 28 times larger than SERS signals from gold nanoparticles alone. The larger signal is due to the bubbles' prevention of nanoparticle aggregation. The lab-on-a-bubble method has been adapted to detect biological molecules using immunoassays, and potential applications include point-of-care diagnostics. **JeffreyM. Perkel,** *special to C&EN*

NEW RNA SIMULATION KNOWS WHEN TO FOLD 'EM

Ribonucleic acid (RNA) is vital to a wide range of processes in nearly all living cells, including reaction catalysis, regulation of gene expression, and communication of cellular signals. How RNA folds into precise, active structures has a role in its function. To better understand this process, D. Thirumalai and co-workers have presented new computer simulations for the folding and unfolding kinetics of human telomerase (hTR), a RNA responsible for adding junk DNA to the end of our chromosomes to prevent the loss of important coding information (DOI: 10.1021/ja2092823).

Specifically, the authors have targeted the hTR pseudoknot, a structural element similar to a kink in a garden hose, which disrupts the regular base-pair sequence. This structure, critical for activity, is challenging to predict because the base pairs may overlap each other, instead of occurring in a regular order. The authors present a 3D phase diagram for hTR pseudoknot folding as a function of temperature and ion concentration, suggesting hidden states in the RNA folding process that were not previously known.

Because of the generality of the forces that regulate folding for all RNA molecules, the authors predict that their findings are applicable to other RNA folding systems. This simulation may lead to a better understanding of forces that control RNA folding and function in our cells. **Leigh Krietsch Boerner, Ph.D.**

BORON-CONTAINING MACROCYCLES SHOW POTENTIAL FOR OPTOELECTRONICS APPLICATIONS

Researchers led by Frieder Jäkle synthesized a 48-member macrocycle containing six Lewis acid boron centers (DOI: 10.1021/ja209602z). Bora-cyclophanes, this new class of highly luminescent, electron-deficient boron-containing compounds, are a sharp contrast to more commonly studied nitrogen-containing, electron-rich macrocycles such as naturally occurring porphyrins like in heme and chlorophyll.

Macrocycles are large, cyclic molecules, and scientists are interested in conjugated macrocycles for their useful optical and electronic properties, as well as their ability to assemble or stack into well-defined structures. For example, macrocycles may form channels for selective ion transport across membranes. Optoelectronics researchers, who study electronic devices that detect or control light, are particularly interested in conjugated macrocycles with optical properties that change in response to external stimuli.

When the new bora-cyclophane molecule binds to negatively charged ions, the team observed a drop in luminescence because the ring system is disrupted and the complex becomes electron-rich. Luminescence is restored as the bora-cyclophane again becomes highly electron-deficient when no longer bound to anions. Because of such distinct and reversible switching, this

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new class of hexaborane compounds could be applied to detect negatively charged ions in environmental or biological assays. Bora-cyclophanes might also be incorporated into materials whose optical properties could be controlled in response to the presence or absence of anions. **Christine Herman**

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