



A Fast Read on the Latest in Lab Automation

MAY 2008



This Month's Lab Man Podcast and Blog

An Automated Crystal Ball?

X-ray crystallography has long been used as a tool for studying the structure of proteins, but the process of creating and evaluating protein crystals for this analysis has always been a tedious and very artful endeavor. The long story of automating this process is a fascinating case study of how to and not to approach automating a laboratory process. The LabMan discusses this with Eric Baldwin, Director of Protein Crystallography at Bristol-Myers Squibb. [Podcast](#); [Blog](#).



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Electronic Device Automation Leads Way for Lab-on-Chip Design

Controlled Environments Magazine (05/05/08)

At the International Symposium on Physical Design, scientists reported that they are adapting electronic device automation (EDA) techniques to automate lab-on-chip devices. The microfluidic technology is capable of carrying out medical tests and identifying chemicals. One obstacle for microfluidic algorithms is a lack of standardization: while there are individual variations to EDAs, they are made up of the same types of components. Also, interconnections between the two technologies work differently, with channels in microfluidic chips able to cross without shorts, unlike electronic chips. Researchers working to automate lab-on-chip design include those at Carnegie Mellon University, Duke University, Oak Ridge National Laboratory, the University of Texas, and National Taiwan University.

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Prepping Robots to Perform Surgery

New York Times (05/04/08) Feder, Barnaby J.

Robots are a \$1 billion component of the medical device industry, but though hospitals have been quick to adopt robotic technology, many are losing money or making poor returns on their investments. Robots with the ability to handle small tools skillfully have led to less invasive procedures and faster recovery times. Many urologists, for example, see robots as the best way to prevent harm to nerves vital to bladder control and sexual potency during prostate surgery. Yet many health care providers and insurers remain skeptical, waiting for more evidence to prove that the benefits of robotic technology justify the costs. The da Vinci robot developed by Intuitive Surgical and used by many urologists now in prostate surgery costs \$1.3 million on average, not counting the hundreds of thousands of dollars that must be spent on service and to replace attachments after each procedure. "The real story is that this is a technology that has been disseminated fairly widely prematurely," says Winifred Hayes, chief executive of Hayes Inc., a Lansdale, Pa.-based health care technology consulting firm. But there are plenty of advocates for the use of robots in medical procedures. "If you are looking at the future, it's hard to envision a hospital not offering robotics," says Robert Glenning, chief financial officer at the Hackensack University Medical Center in New Jersey, which has purchased five da Vinci robots and has a sixth on loan from Intuitive Surgical that is used to train visiting physicians.

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Drugs Revolution Is a World First for Hospital's Experts

Portsmouth Today (UK) (05/01/08)

Researchers at Queen Alexandra Hospital in the United Kingdom have been conducting mass trials of cancer drugs that are expected to considerably improve efforts at developing tumor treatments. A sophisticated robot enables scientists to test more than 500 drugs simultaneously, using cells extracted from a single human tumor. Although the new drug development process takes about a decade and can cost over 500 million pounds, researchers hope that the new process will be able to drive faster development of cancer-fighting drugs, particularly since the laboratory method consists of conducting trials with actual human cells. The robotic method touts a high accuracy rate, and the automation involved allows a significantly higher number of samples to be pipetted compared to doing it all by hand. The technique is expected to help scientists determine which drugs should undergo advanced development and which treatments prove ineffective in earlier clinical stages.

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Dolomite's Microfluidics Technology Enables Nanoparticle Synthesis

Business Weekly (05/01/08) Blackburn, Richard

A British firm is working with researchers at Newcastle University to investigate the use of microfluidics for synthesizing nanoparticles. Microfluidics seeks to make possible small-scale fluid control and analysis. Dolomite's initiative involves creating a glass microchip with several reaction chambers using such techniques as lithographic patterning, isotropic etching of glass substrates, and thermal bonding of glass substrates. The biggest benefit of this kind of device is "the ability to perform parallel-array or multidimensional types of analyses in a small localized environment," explains Gillian Davis, Dolomite's commercial director. The university's nanoparticle synthesis project is being headed by Mike Loughran at the School of Chemical Engineering and Advanced Materials. He has been working on three areas of research: the creation of silicon-based fluorescent nanoparticles (quantum dots) to label biomolecules, polymeric nanosensors for intracellular analysis and drug delivery, and catalytic nanoparticles for specific chemistries or for purification.

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Rover Instrument to Sniff Out Life on Mars

New Scientist SPACE (05/01/08) Battersby, Stephen

NASA has provided \$2 million in funding for the Urey instrument, which is designed to look for amino acids on Mars. The instrument is scheduled to fly on the European Space Agency's ExoMars mission in 2013. Though current analysis of chemical signs of life can be ambiguous, scientists believe that the Urey instrument will be able to identify if amino acids on Mars were made by living organisms. The symmetry of each amino acid can be in either of two configurations: L and D. Amino acids from life forms on earth are of the L configuration. The instrument will include a lab-on-a-chip that can separate different chemicals using electrophoresis. Viewing the reaction of an amino acid with the chiral molecule α -cyclodextrin will allow the instrument to tell the difference between the two forms. One researcher noted that the ideal situation would be if Urey only finds D-amino acids, which would be solid evidence of truly alien life. If the instrument finds L acids, it is possible that microbes from Earth seeded Mars. The ExoMars mission will carry a drill able to dig two meters into the surface, beneath the upper layers that do not allow for the long-term survival of organic molecules.

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Chromatography in the Extreme

Chemical & Engineering News (04/28/08) Vol. 86 , No. 17 , P. 17 ; Jacoby, Mitch

Researchers say speed is an important aspect of the chemical separations that occur in liquid chromatography (LC). One of the biggest breakthroughs was the 2004 introduction of Waters Corp.'s Acquity UltraPerformance Liquid Chromatography (UPLC) system, which had columns filled with spherical, evenly sized silica particles measuring less than 2 μm in diameter. This enabled the mobile phase to be driven through the columns at pressures of up to 15,000 psi. Compared to HPLC, UPLC's average run times are reduced to about one-eighth that of standard studies of impurity levels in drug compounds, according to Jeremy B. Desai, executive vice president for research and development at drug maker Apotex. Researchers are also seeking better column-packing materials for traditional and ultra HPLC tools. James W. Jorgenson and his team at the University of North Carolina, Chapel Hill, are working with silica particles that measure 1.0 μm to 1.5 μm in diameter and require the use of 100,000-psi pumps. The LC community is also working with Fused-Core particles that are made of a solid, nonporous silica core measuring 1.7 μm in diameter that are covered by a 0.5 μm -thick porous silica shell, providing an overall diameter of 2.7 μm . Chemistry professor Peter Carr at the University of Minnesota says zirconia can be used to make a column-packing material that is more stable than silica.

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Microfluidic Aerobatics

Chemical & Engineering News (04/28/08) Vol. 86 , No. 17 , P. 42

Digital microfluidics is a technology in which single droplets are processed on an array of electrodes. To date, the technology has been restricted to a horizontal plane, which limits the number of samples that can be assessed. Now, researchers at the University of Toronto, led by Aaron Wheeler, have developed a new way to manipulate the droplets via all-terrain droplet actuation (ATDA). ATDA can be used on various device shapes because the copper electrodes are placed on flexible polyimide substrates that can be bent. Possible shapes for the arrays include staircases, spirals, and upside-down architectures. Wheeler and his colleagues have used ATDA to cycle droplets on oxygen- and temperature-sensitive sensors. In addition, they were able to form a device that concentrates oligonucleotides from a solution that contains histone proteins.

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Atrium Unveils Automated Lab

Middletown Journal (Ohio) (04/25/08) Latta, Tiffany

Atrium Medical Center in Ohio will now be able to test more blood and urine samples and cut down on the time lab technicians spend with patient samples, thanks to their new automated chemistry laboratory system. The StreamLAB Analytical Workcell with integrated Vista analyzers reads barcode labels, and it organizes, spins, and takes the caps off the tubes before sending them to an analyzer to be tested. It also puts the caps back on and can temporarily store the tubes. The system can manage over 1 million tests every year, with none taking longer than 10 minutes. Atrium Medical Center is the second hospital in the country to get the system, after Scripps Hospital in San Diego.

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Biologists Initiate Plan to Map Human Proteome

Nature (04/24/08) Vol. 452 , No. 7190 , P. 920 ; Pearson, Helen

A scientific endeavor for executing the Human Proteome Project has been deemed as monumental in scope but critical for the future of drug developments. Similar to the Human Genome Project, the latest scientific project attempts to conduct communal research for examining a single protein produced from each gene. Though the logistics of attempting such a project were once viewed as virtually impossible, scientists have found that the number of protein-coding genes were considerably overestimated, boosting the feasibility of the bioinformatics venture. Scientists intend to approach proteome mapping in three ways: using mass spectrometry; generating antibodies to each protein and using these to show its location in tissues and cells; and systematically identifying which protein it interacts with in protein complexes. Yet issues such as technology standardization remain a problem, and the project has also received criticism for lacking a specific clinical focus. However, with improved mass spectrometry techniques and the ability to more accurately identify proteins, researchers hope the proteome project could be promising for the future of biomarkers and other mechanisms for detecting and eliminating diseases.

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Michigan HTS Lab to Use \$331K Grant from HHS for Robotics

GenomeWeb Daily News (04/22/08)

The Michigan High Throughput Screening Center announced plans to use a \$331,000 grant from the U.S. Department of Health and Human Services to improve its robotics lab equipment. The center, located on the campus of Kalamazoo Valley Community College, will purchase new low-volume liquid handling robots. A spokesperson for the center said that officials are already looking at a few different systems but have not yet decided on a vendor. The nonprofit facility supports both public and private researching in several areas, including genomics and structural biology. The center also offers contract-research lab services without charging licensing fees or royalties.

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Nano Test Tubes Successfully Isolate Individual Proteins

LabTechnologist.com (04/22/2008) Robson, David

Researchers at the U.S. National Institute of Standards and Technology (NIST) have created a system that isolates proteins at the nano level using small drops of water. The droplets and proteins are contained in an oily barrier and can be handled using laser light "tweezers." The technique could be valuable to researchers who examine the structural or dynamic changes in molecules. For instance, researchers believe that disruptions in how a protein is folded inside cells might be the cause of diseases like Parkinson's and Alzheimer's. According to a recent paper in *Langmuir*, the technique was used successfully to separate a single protein inside a droplet. The research team found that a blend of perfluorinated oils worked best with the optical tweezers because of the oil's optical characteristics. "The molecules we work with are water-soluble, so they 'partition' only into the water droplet," explained NIST's Lori Goldner, who developed the system. In addition to mimicking cell-like conditions, the droplets might be useful for examining tiny amounts of rare or costly materials to reduce waste.

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Some Doubt Genome's Value as Health Tool

Boston Globe (04/21/08) Goldberg, Carey

Several companies have begun performing simple saliva tests for consumers to allow them to see whether they carry genes linked to higher or lower risks for a variety of diseases. These companies say that their services--which can cost anywhere from under \$1,000 to \$350,000—are already helping people. Dr. David Agus, the cofounder of the personal genomics company Navigenics, cited the case of a 39-year-old female client who took a saliva test and found that she was at a heightened risk for colon cancer. After getting the results of the test, the client got a colonoscopy that turned up a potentially cancerous polyp, Dr. Agus noted. However, others say that the services offered by companies such as Navigenics are not valuable yet because no one knows how to use the information from the tests to improve health. "The field is in such horrendous flux that you can't really say for sure that this gene variant is related to this disease and how much, and that will be a moving target for the next few years," said Dr. Muin Khoury, the director of public health genomics at the U.S. Centers for Disease Control and Prevention. In addition, the results of the tests could give consumers a false sense of security if the results are negative for a type of genetic variation that is linked to a particular disease, said Dr. David Altshuler, a researcher at the Broad Institute in Cambridge, Mass. who has led the way in linking genes to the risk of common diseases. He noted that consumers could still be at risk for certain diseases because they may carry genetic variations that the tests do not look for.

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State Law Enforcement Uses New Technology *Chillicothe Gazette (OH) (04/17/08) Phillips, Ashley*

Ohio law enforcement officers use a Laboratory Information System (LIMS) to quickly track the status of evidence. The Web-based application gives officers, investigators, and technicians the ability to pre-log evidence at their location, search a database of evidence submissions, and print final reports. Previously, officers did not find out the results of samples they submitted for up to seven days after the results were discovered. However, the LIMS allows officers to know the results as soon as data is entered into the system. The prosecutor's office also uses LIMS to track the status of evidence in a case.

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Pathogen Detector *The Engineer Online (04/17/08)*

The European Defence Agency could soon receive an airborne pathogen detection system. NanoIdent Technologies and ChipShop, a German company, are developing for the agency the PathoID-Chip, which is capable of identifying several chemical and biological agents that are in the air at the same time, and in less time than conventional test methods. The system should help minimize exposure, as it will conduct tests—which are completed within minutes—every 10 minutes.

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Saliva Can Help Diagnose Heart Attack, Study Shows *Nanotechwire.com (04/17/08)*

Researchers at the University of Texas at Austin believe that a new nano-bio-chip could be used for early diagnosis of a heart attack. The nano chip analyzes a patient's saliva, which is placed on a credit card-sized lab card that holds the nano chip. The card is then inserted into an analyzer, which can determine the patient's cardiac status. The test is not only capable of determining if the patient is currently having a heart attack, but whether he or she is at a high risk of having a heart attack in the future. Researchers say that the nano chip assay can produce results in around 15 minutes. Researchers tested the saliva test on 80 clinical patients and determined that it is nearly as reliable as a standard blood serum test. Though the new technology is still in the clinical testing phase, it could soon be commercially developed and used on ambulances and at doctor's offices. In 2008 an estimated 770,000 Americans will have a new coronary attack, while 430,000 will have a recurrent attack.

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Hawaii to Track Produce *American Shipper (04/15/08)*

The Hawaii Department of Agriculture announced a three-year pilot program to track produce using radio frequency identification (RFID) technology. Small RFID devices will be attached to crates and containers, allowing the state to track produce from farms to the store in an effort to improve safety. If there is a health emergency, health officials will have the ability to track the questionable shipment back to its farm. Several supermarket chains and farms already use RFID technology, but Hawaii will be the first state to run a statewide trial. Four farms will initially take part in the program, which is funded by \$500,000 in grants. The state is looking for an additional \$1.1 million necessary to pay for the program for the full three years. State officials said that they hope the cost of RFID technology will drop so more farms can afford to use it. Each RFID tag costs just 17 cents, but the readers cost \$3,000.

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New DNA Sequencing Strategy Could Be Vital During Disease Outbreak

Cordis News Service (04/14/08) La Scola, B.

Traditional DNA sequencing techniques are being used to unravel the genomes of virulent bacteria, and about 450 species have been uncovered, though the process is slow. However, a study published in *Genome Research* could hold the key to using a rapidly sequenced, incomplete genome to provide enough data to scientists combating a possible outbreak. French and Swedish scientists, including Dr. Bernard La Scola of the University of the Mediterranean, used rapid sequencing technology to obtain the genome of *Francisella tularensis*, which can be fatal to patients. As a result, the researchers uncovered a number of genes linked to the strain's virulence and a gene linked to mutation associated with quinolone resistance. The rapid sequencing technique also provided researchers with enough data to differentiate their strain of the bacterium from other forms of *F. tularensis*. Dr. La Scola said, "We demonstrated that this strategy was efficient to detect gene polymorphisms such as a gene modification responsible for antibiotic resistance, and loss of genetic material." This process will reduce gene sequencing time by six weeks, according to the study. Dr. La Scola notes that further technology advancements could further reduce sequencing times.

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Rapid Molecular Screening for Multidrug-Resistant Tuberculosis in a High-Volume Public Health Laboratory in South Africa

American Journal of Respiratory and Critical Care Medicine (04/01/08) Vol. 177, P. 787; Barnard, Marinus; Albert, Heidi; Coetzee, Gerrit

Due to the difficulty of timely screening methods in South Africa for tuberculosis control of HIV infection and multidrug resistance, researchers conducted an assay to determine the performance and feasibility of implementing a commercial molecular line-probe assay. Methods in-place for TB detection in the country takes up to months, while rapid molecular testing for testing drug resistance is available but has not been widely used in areas where TB is highly-concentrated. Researchers analyzed smear-positive sputum specimens from high-risk TB multidrug resistant patients, attempting to detect rifampicin and isoniazid resistance. Findings were assessed with comparison to conventional liquid culture and drug susceptibility testing on solid medium. Results indicated that the assay provided adequate screening on contaminated specimens from conventional culture and on smear-negative, culture-positive specimens, while interpretable results were produced from smear-positive specimens within a 2-day time frame. Researchers determined that the molecular assay produced accurate results for MDR TB, noting that the technology has the ability to transform MDR TB diagnosis in areas where timely diagnosis is a critical issue.

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vCJD Filter for Blood Could Be in Use 'by Summer'

Chemistry World (04/08) Peplow, Mark

By the end of this year, blood banks in the United Kingdom could be using a new filter to remove the proteins responsible for variant Creutzfeldt-Jakob disease (vCJD) from patients' blood. The hand-sized device is already approved in Europe and is now being considered by U.K. and Irish health services. A patient develops vCJD when prions, or misfolded proteins, accumulate in brain tissue, thus causing the brain to fail. Until now there have been no tests to find out whether a person carries vCJD proteins. In under an hour, the disposable filter can clean a pack of contaminated blood, stripping it of any prions. After the device was tested, the only difference between the infected and clean blood was that no prions were left in the clean blood; no other changes occurred. According to researcher Patrick Gurgel of ProMetic Life Sciences, the device potentially could allow millions of people who had previously been excluded to donate blood. Gurgel, who presented the technology at the American Chemical Society Meeting in New Orleans, noted that "this is the first device that is on the market [for prion filtration]." It would cost about 100 million pounds for the U.K. Department of Health to implement the system nationwide.

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Heading for the Big Time

Scientist (04/08) Vol. 22 , No. 4 , P. 60 ; Buetow, Kenneth

The National Cancer Institute's (NCI's) pioneer network, the Cancer Biomedical Information Grid, is a collaborative database of cancer research and data supplied by various institutions around the world. The site was created out of a need by scientists to comparatively study data from a variety of fields, including genomics, proteomics, pathology, imaging, and clinical trials. Because the database depends on scientific contributions from sources in different locations, caBIG uses a services-oriented platform called caGrid that connects the tools and infrastructures used by individual laboratories. More than 190 organizations, from informatics experts and bench researchers to patient advocates and senior executives at pharmaceutical companies, have contributed to caBIG, as well as the NCI-designated Cancer Centers, federal agencies, academic institutions, nonprofit organizations, and pharmaceutical companies. Since the database's genesis in 2004, researchers have published 45 articles based on data mined from caBIG.

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*"Sometimes I wonder if there's more to life
than unlocking the mysteries of the universe"*