
Strategic Directions International, Inc.

INSTRUMENT BUSINESS OUTLOOK



Strategic Information for the Analytical & Life Science Instrument Industry

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New Products Emphasize High Resolution at ASMS 2018

The 66th annual conference of the American Society of Mass Spectrometry (ASMS) was held June 3 to June 7 in San Diego, California. Compared to 2017 (see [IBO 6/15/17](#)), total conference turnout jumped 12.8% to reach 7,147 attendees. ASMS 2019 is scheduled for June 2 to June 6 in Atlanta, Georgia. Several companies debuted new MS products and software at the show, making for an eventful show.

Agilent Technologies

Citing the statistic that 75% of lab managers say maintenance and downtime is their biggest source of frustration, at its ASMS press conference, Agilent Technologies discussed new “innovations with purpose” that would cut down on maintenance time, particularly the Ultivo LC/MS, which had been introduced at last year’s ASMS conference. In fact, it was pointed out that regular maintenance on the Ultivo takes about an hour, compared to nine hours for other MS systems. The convenience of its design and customizable software was highlighted by Carlos Sepúlveda of Agrolab Mexico, the first customer of Agilent’s Ultivo LC/MS.

Agilent announced it will now offer the InfinityLab Flex Bench, available for the Ultivo and the 1260 or 1290 Infinity II LCs. The Flex Bench offers slide-out storage shelves for these instruments for easier and more convenient access. It includes a quiet cover for the rough pump. The company also discussed support for new applications for its Ultivo system, including screening for harmful compounds in food and environmental samples.

Agilent announced, partially in lieu of marketing materials, it would donate \$50,000 to 1 of 3 cancer research organizations: the Cancer Research Institute, the Lung Cancer Research Foundation or the Children’s Cancer Research Fund. Conferees were able to vote for 1 of these 3 in the Agilent hospitality suite. At the conclusion of the ASMS conference, Agilent announced that the money would be going to the Children’s Cancer Research Fund.

Bruker

At its press conference, Bruker made it a point to emphasize the importance of speed, particularly in medicinal chemistry. To that end, the company’s signature product introduction was the scimaX magnetic resonance MS (MRMS), which is designed to be ideal for applications such as MALDI imaging, metabolomics, clinical phenomics and petroleomics. The scimaX is able to handle up to 200 samples a day. It offers a 1 second switch between ESI and MALDI ionization sources, a mass resolution of 20 million (unmatched in the market, according to the company) and a small footprint. It also uses the novel Bruker Maxwell magnet technology, which does not require nitrogen or helium gas for cryocooling. The unit is now shipping for a price between \$1.25 million and \$1.4 million.

Software was also a part of Bruker’s product introductions. The company released the Metaboscape 4.0 software package for metabolomics and lipidomics research, which enables data processing on Bruker’s LC-QTOF-MS/MS, GC-APCI-QTOF, LC-TIMS-MS and MRMS systems. There were also software updates for the timsTOF Pro, including online Parallel Accumulation Serial Fragmentation (PASEF), that accommodate improved sensitivity, speed, precision and signal-to-noise ratio.

SCIEX

In communicating how SCIEX’s MS solutions work to the benefit of health care, wellness and safety, the company highlighted several technologies that have been introduced recently. These include the Citrine MS/MS for clinical diagnostics and the C100HT Biologics Analyzer. SCIEX also introduced the OptiFlow Quant Solution, which delivers microflow quantitation for peptides. Fitting on the front of its triple quadrupole or QTRAP MS instruments, the system is easy to use and delivers high sensitivity, according to the company.

SCIEX announced new software updates as well, including the launch of SCIEX OS 1.4, which offers regulatory compliance with the FDA’s 21 CFR Part 11 on electronic records and signatures, as well as updated calculation data processing algorithms and automatic outlier removal. The update is backwards compatible with all SCIEX triple quadrupole, QTRAP and triple TOF MS instruments, plus the X-series QTOF MS systems.

SCIEX also introduced BioPharmaView Software 3.0 for the LC/MS Multiple Attribute Methodology (MAM) Workflow in pharmaceutical/biotechnology and CRO labs. It offers simplified streamlined process monitoring of high-resolution LC/MS assays during biologics development. This allows biologics to be characterized in a shorter time and in more detail.

Shimadzu

Shimadzu introduced the LCMS-9030 Q-TOF MS, a research-grade system designed for high-resolution, accurate mass detection, with very fast data acquisition rates. Its quadrupole mass range is 10-20,000 m/z, and its TOF mass range is 10-40,000 m/z. Its signal-to-noise ratio is greater than 3000:1, a significant improvement over its predecessor, the LCMS-8050.

Shimadzu also introduced the C2MAP-2000 for commercial availability in North America, which provides automated sample preparation for culture media samples being analyzed by LC/MS/MS, drastically saving time. It can be operated in batch mode, the recommended method in which the pretreatment of all samples is performed first, or sequential mode, where pretreatment, dilution and LC/MS/MS analysis are performed in sequence. The C2MAP software allows the user to easily associate the treated sample and measurement results, and visually monitor the sample status on the C2MAP-2000 rack. The platform generally costs between \$120,000 and \$140,000.

Thermo Fisher Scientific

Thermo Fisher Scientific launched the Orbitrap ID-X Tribrid MS, which combines quadrupole, Orbitrap and linear ion trap mass analyzer technology. Designed for small molecule analysis, the instrument boasts an automated novel acquisition workflow called AcquireX, an MSⁿ library tool for custom spectral libraries, and m/z Logic for automated MSⁿ data processing. The software can also annotate compounds using MSⁿ and HCD/CID fragmentation to demystify unknowns.

The Thermo Scientific Q Exactive UHMR Hybrid Quadrupole-Orbitrap Mass Spectrometer was also introduced. Ideal for the structural analysis of proteins, the instrument features high sensitivity, up to a mass range of 80,000 m/z. Able to overcome the difficulty in achieving proper resolution for large protein complexes with few charges, the system offers a new window into the discovery of disease mechanisms and new biotherapeutics by offering visualizations of drug binding and drug interactions.

Also showcased at the Thermo Fisher press conference was the newest addition to the company's line of triple quadrupole MS systems, the TSQ Fortis, which is designed for routine high-performance applications, particularly in food and environmental labs. The instrument offers high-precision analysis in complex matrices, tool-free maintenance and ease of use, according to the company.

Waters

At ASMS, Waters debuted its Xevo TQ-GC, the company's newest GC/MS system since the discontinuation of the triple quadrupole Waters Quattro micro GC/MS several years ago. The Xevo TQ-GC is designed to be a workhorse instrument for food and environmental laboratories. The system is electron ionization based and boasts ease of use, high-performance and high-throughput capabilities. It is slated for commercial release toward the end of the third quarter.

Waters will also be releasing the DART QDa with LiveID sometime in the third quarter. The mass detector is designed to address food-authenticity testing applications, having the ability to directly analyze solid and liquid samples, with minimal sample preparation and no requirement for chromatography. The system will also be available with a Practical MS Education Package for teaching laboratories.

New: 2018 Sample Preparation Techniques Market Analysis and Perspectives



A detailed and concise analysis of three sample preparation categories: preparative chromatography, extraction techniques, and nucleic acid preparation.



- A detailed and concise global perspective of the sample prep market
- Contains valuable market figures and representations using secondary sources
- Reference for corporate planning, strategic marketing, business valuation, acquisition due diligence, and other business activities
- Results of a 29-35 question online survey of more than 450 sample prep end users from around the world

Contact reports@bioinfoinc.com or **707-778-3080 x19** for more information or visit

<https://bioinfoinc.com/product/sample-prep-market-data/>

The Facets and Future of Microfluidics

Microfluidics is the science of controlling and manipulating fluids, allowing the analysis and use of lower levels of sample, chemical and reagent volume. The technology provides quick reaction times, optimized sensitivity, greater temperature control, portability and simpler automation at a cost-effective price. The technology has significant potential to be utilized in numerous applications, and OEM microfluidics companies like Dolomite Microfluidics and Fluigent are focused on working with their customers to support the technology's growth into other sectors.

Both Dolomite and Fluigent provide OEM solutions for microfluidics, and are involved in collaborations and initiatives to help drive microfluidic technology across multiple applications. Dolomite partnered with OptoRobotix and Bioneer in 2013 to develop a cutting-edge stem cell handling technology, and, more recently, joined forces with Partek in May to develop a single-cell analysis pipeline on Partek's NGS data analysis software, Partek Flow.

A spinout from the Curie Institute, Fluigent was established in Paris in 2005. In April, Fluigent partnered with Sculpteo, a 3D printing service company, and 10 other companies as the lead of the HoliFAB project, a Horizon 2020 initiative dedicated to accelerating industrialization in microfluidics using 3D printing.

IBO spoke with Richard Gray, head of Dolomite, and Robert Pelletier, president of Fluigent, to discuss the utilization, challenges and future of microfluidics.

Issues and Solutions

While microfluidic technology has great advantages, including ease of use, high throughput and multiplexed assays, quick and precise analyses, low reagent usage, and overall cost reductions, the technology is not without its limitations.

Fluid shear stress can be an issue in microfluidics, and it increases the more viscous a sample is and also due to fluid velocity. “Cell suspensions can be a challenge, particularly where the cells are fragile,” said Mr. Gray. “Care is also required where the fluids contain beads or particles which have a very different density to the fluid (for example, RNA capture beads sometimes have a 40% higher density than the fluid, and can drop out of suspension very quickly).” Other challenging sample types, as Mr. Pelletier, explained, are oils, blood, alginates and polymers. As Fluigent specializes in pressure-based solutions to improve flow control, the company uses pressure to solve the issues that challenging samples may come with. “Issues with viscous substances are typically resolved through either using higher pressures to drive flow rates, or through iterative chip designs to enlarge the channel sizes and improve flow characteristics,” said Mr. Pelletier.

Dolomite also has its own solution to address shear stress. “We’ve developed methods to feed these suspensions gently and successfully,” explained Mr. Gray. “Our Edge connection technology maintains flow in a single plane as it enters and exits the chip, thus reducing shear when compared to conventional connector methods (which require a 90 degree change of direction, often coupled with rapid deceleration and acceleration as fluid passes through inlet and outlet holes).”

Chips are an important tool in microfluidics devices, as they help control and confine fluids at a microscale level. The microfluidic chip provides many functionalities and allows for users to generate multi-step reactions without requiring a high level of expertise. Various materials are used to make microfluidics chips, such as Polydimethylsiloxane (PDMS), silicon, glass, hydrogel and paper, which each have their benefits. PDMS is most commonly used to create microfluidics chips due to its elasticity, permeability, transparency and low costs. However, a major drawback is that the material can absorb hydrophobic molecules and water vapor, which can then be released over the course of an experiment, potentially skewing results.

To address these challenges, Dolomite chiefly makes its chips from glass, which has proven to work best with the company’s customers’ applications. Mr. Gray explained that the benefits of glass include pressure capability, thermal performance, chemical resistance, precision, lifetime and ease of connection. Moreover, Dolomite can customize the chip based on its customer’s application to ensure optimal performance. “We can coat glass chips to ensure they are hydrophobic when required,” said Mr. Gray. “We use a different coating when working with the fluorocarbon oils that are popular for cell biology work. Fluorocarbon oils absorb large amounts of gas, which can mean cells remain viable in droplets for many days.” If UV transparency is required, Dolomite uses fused silica (quartz), and can create plastic chips if glass is not viable, with polymers such as COC (Cyclic Olefin Copolymer) and COP (Cyclo Olefin Polymer), and acrylic glass, also known as PMMA, or Poly(methyl methacrylate). For example, Dolomite’s Nadia product family, an automated, microfluidic droplet-based system for single-cell research, uses a disposable injection molded 8-lane polymer chip.

“The main element is optimizing the entire system (chip and fluid handling) to achieve the desired performance.”

Dolomite continues to develop new and specialized methods to address chip challenges, as chips are a key component of the technology. “We have specialized channel designs; for example, our 3D pore technology was developed to handle challenges such as feeding sticky polymers,” Mr. Gray said. “We have also expanded our chemistry capability, and will shortly be launching new reagents and surfactants to improve performance and throughput for a range of applications.”

Keeping abreast with customers’ research and operational challenges is imperative for companies such as Dolomite and Fluigent. As Mr. Pelletier noted, although Fluigent is not a chip company by definition, it is important for the

company to stay informed of various chip materials and applications in order to best serve its customer base. “The key is understanding one’s analytical needs, their desired materials and their limitations, and making recommendations based on limitations and budget—often there is a balance that needs to be struck,” he said. For example, he explained, many customers may prefer to prototype various designs in PDMS in order to optimize performance and settle on a conclusive design, before moving on to a more cost-effective material. “One needs to keep in mind the chemistry of what is taking place at each step along the way to suggest surface coatings, different surfactants, etc.,” he continued. “The main element is optimizing the entire system (chip and fluid handling) to achieve the desired performance.”

Another imperative feature of microfluidics is the key to the technology itself: flow control. The microfluidic device on which fluid flow occurs and the equipment controlling the flow are essentially the most fundamental aspects of microfluidics. Numerous solutions for flow control are available, such as pressure controllers and generators, liquid pumps (peristaltic and piezo-electric), electro-osmotic pumps and syringe pumps. The latter are the most commonly used in microfluidics, due to their flow stability performance, constant mean flow rates, low costs and ease of use. However, syringe pumps can limit fluid dispensing volume and flow rate responsiveness can be rather slow.

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In recent years, alternative flow control techniques have emerged, such as pressure-based solutions. “We use pressure pumps, which can be coupled with flow sensors to give closed loop flow rate control,” said Mr. Gray. “Pressure pumps have fast response, smooth flow, scalability from μL to liter reservoir scale, with flow rate capability from 100nl/min to 500ml/min from the same device. We are developing these systems further to give real time monitoring of performance—such as droplet size—and will then take another step to give real-time control of droplet size and automated detection of fault conditions.”

According to the company, Fluigent was the first to introduce flow control driven by pressure, and, as Mr. Pelletier noted, has numerous patents on methods to optimize pressure control of fluid flow. “The major limitations of syringe pumps for microfluidics are their pulsatility from the stepper motors at low flow rates and slow response time to microfluidic systems that often have a high degree of resistance,” he explained. “The use of air pressure to drive flow eliminates the pulsatility, due to there being basically no moving parts. As pressure changes can be made virtually instantaneously, one can change a flow rate in a matter of milliseconds, where syringe pumps can take several minutes to reach a stable flow.”

Looking Forward

As microfluidics OEM companies, Dolomite and Fluigent focus on supplying their customers with what they need to accelerate their research, with the companies both conducting their own R&D for new techniques and applications that microfluidics can be used for, as well as manufacturing and customizing microfluidics components based on customer demand. “For our end user/laboratory products, we are continually developing new technologies and applications to drive the business forward,” said Mr. Pelletier. “The other main part of our business is in providing OEM solutions for customers needing pressure-based flow.”

Dolomite also works in tandem with its customers, though it has been taking a greater role in the research aspect recently. “Increasingly, we are leading the R&D to offer new capability and applications to our customers, i.e., we have established a Particle Engineering Team to offer new particle generation systems and chemicals, and can do in-house testing of customer samples to validate methods and protocols,” Mr. Gray explained. “However, we still work with scientists every day, to engineer and fabricate custom devices to meet their needs.”

Microfluidics has great potential to be used in a vast array of industries, such as the burgeoning precision medicine

industry, in which the accuracy and efficiency of microfluidics can have a major impact. Novel applications utilizing microfluidics continue to emerge, such as RedShiftBio's AQS³pro (see [IBO Spotlight](#)), which uses microfluidics for protein characterization analysis. Bruker's recent acquisition of Sierra Sensors (see [Executive Briefing](#)) also points to advances in the technology, as Sierra Sensors combines SPR with microfluidics.

“I think that microfluidics is perhaps more deeply entrenched in areas of medicine and biomedical research than may be outwardly apparent, and with significant economic impact.”

However, microfluidics technology is not as widely adopted as it seems it should be. Mr. Gray pointed to specific issues that may be limiting wider implementation of the technology. “The two primary constraints are: first, a perceived limit of throughput (how can I make a kilogram of drug delivery particles with a microfluidic chip?), and second, how does microfluidics enter a highly regulated area such as diagnostics or precision medicine?,” he explained. “[Dolomite has] addressed the first with our Telos technology, and plan to go further still into areas such as cosmetics. The second remains a significant challenge, and I think that the hurdles of FDA compliance and fast-moving diagnostics technologies have made it hard for companies to enter the market successfully. For the moment, Dolomite is focused on applications in other sectors.”

According to Mr. Pelletier, there is a substantial influence of microfluidics in research, although it may not be as clear from the outset. “I think that microfluidics is perhaps more deeply entrenched in areas of medicine and biomedical research than may be outwardly apparent, and with significant economic impact,” he stated. He noted companies such as Bio-Rad, Cepheid, Illumina, Opko and RainDance all have products that are based on microfluidics.

Microfluidic technology shows promise for numerous applications, and may be able to help drive research in various sectors in the future. “There is a lot of development in the point of care diagnostics area that is microfluidically based,” Mr. Pelletier said. “New companies are coming on to the scene constantly that are using microfluidics for the next generations of bioanalytical devices, drug discovery, cancer diagnostics/therapy, water testing, bacterial detection, protein analysis and more.”

Bruker Enters SPR Market

Hamburg, Germany 6/4/18—Scientific instrument firm Bruker has purchased Sierra Sensors, a developer and manufacturing of SPR-based biosensors. Financial details were not provided. Sierra Sensors' systems determine the specificity, affinity, kinetic rates and thermodynamics of molecular interactions for drug discovery applications. “Real time array SPR+, combined with novel microfluidics, can accelerate many drug discovery workflows, such as fragment-based drug discovery (FBDD) with novel chemistries,” stated Dr. Rohan Thakur, executive vice president for Life Science Mass Spectrometry. “Sierra's SPR technology provides affinity and kinetics of molecular interactions, from target validation all the way to lead optimization. SPR complements our ultrahigh throughput screening (uHTS) mass spectrometry *MALDI PharmaPulse* solution for large-scale primary and targeted secondary screens,” commented Dr. Meike Hamester, the Bruker Daltonics director, Small Molecule Pharma Business. “The complementary nature of both label-free detection technologies opens new dimensions for studying drug targets and their interactions with novel ligand chemistries, helping the pharmaceutical and biotechnology industry design more effective drugs at lower cost.”

Sierra Sensors' headquarters in Hamburg, Germany, will become a Bruker center for excellence for SPR+Array technology, including applications development. The company develops and supplies biosensor-based instrumentation and consumables for the research and clinical diagnostic markets.

Bio-Techne Acquires Cell Separation Technology

Minneapolis, MN 6/7/18—Bio-Techne, whose businesses include developing and manufacturing high-quality purified proteins, has agreed to acquire Quad Technologies for an undisclosed amount. “We are confident that the novel, releasable, customizable, nonmagnetic Quickgel technologies, offered by Quad Technologies for cell separation and activation, represent a breakthrough in process improvements for clinical-grade cell and gene therapy applications as well as for research use,” commented Bio-Techne President and CEO Charles R. Kummeth. “The strategic fit between the two companies is excellent given their shared goal to move our products into clinical applications. Bio-Techne provides us with the resources and quality proteins needed to functionalize our reagents,” stated Quad Technologies CEO Sean Kevlahan. Based in Massachusetts, Quad Technologies has 15 employees.

Quad Technologies’ products address a problem in cell therapy manufacturing by enabling higher recovery rates and increased viability of cells when separated for purification. In contrast to bead-based methods, Quickgel hydrogel can be immediately dissolved after use and is scalable. Earlier this year, the company announced a partnership with Sartorius (see [IBO 1/31/18](#)). For research labs, the company offers the MagCloudz cell separation kits which utilizes its technology for magnetic cell separation without the remnants of magnetic particles. Quad Technologies launched in April its cGMP grade Quickgel platform, which, according to Frank Mortari, vice president of Business Development at Bio-Techne, is being evaluated by customers for both activation and expansion T-cells. “The results to date are encouraging and as customers better appreciate the full spectrum of the advantages the Quickgel products provide, we expect continued adoption of these products in CAR-T applications,” said Mr. Mortari.

Bio-Techne currently offers cGMP proteins for cell therapy manufacturing. According to Mr. Mortari, the company has also been offering cell separation products, including both magnetic and non-magnetic beads for the research market, for over 30 years. “The use of cell-based immune therapies as an alternative treatment for cancer—as opposed to traditional radiation, chemotherapy or surgery—is finding success with various pathologies,” he said. “As this field gains more market acceptance, Bio-Techne is positioning itself as a key provider of quality reagents in the cell therapy space.”

As Mr. Mortari explained, the acquisition of Quad Technologies helps establish Bio-Techne’s position in this market through its unique product offerings. “The acquisition provides another tool and opportunity to participate in this fast growing field by providing a game-changing technology that improves the cell enrichment, activation and expansion processes using the Quickgel technology,” he said. “Additionally, we will continue to develop cell media products and formulations that support the development of the therapeutic T-cell, and build our arsenal of dedicated reagents and technologies to better serve this specialized area of therapeutics in a manner that leads to better and more effective clinical products.”

Gas Analyzer Firm Sold

Hamburg, Germany and Aix-en-Provence, France 5/2/18—AP2E has been acquired by DURAG for an undisclosed amount. DURAG provides solutions for environmental and ambient air monitoring and data management, and ignition systems and safety devices for industrial combustion processes. AP2E’s technology utilizes laser technology for industrial gas analysis. More than four hundred of AP2E’s gas analyzers are in use for mobile and online gas analysis, continuous emission monitoring, process gas monitoring and gas purity controls.

The acquisition closed in April. “We will benefit from the comprehensive know-how of the AP2E team and will expand the environmental sensor technology business area with this acquisition,” stated DURAG CEO Frank-Uwe Schulz. “AP2E will continue to operate from its own premises and will work closely together with the companies of the DURAG GROUP, especially with the international DURAG sales and service organization.”

AP2E’s technology is based on optical feedback cavity enhanced absorption spectroscopy (OFCEAS). “Collaboration with AP2E brings [DURAG] direct product and development expertise, market access (product, references and sales expertise) and manufacturing capabilities,” said a spokesperson for DURAG. “At the moment we are consulting and discussing intensively with AP2E about the first joint sales activities. Possible applications arise in the CEMS and the

FGT (Flue Gas Treatment) markets.” According to a translation of an article on [Go Met](#), AP2E had revenues of €3.5 million (\$4.1 million) in 2017.

Process Analysis Firm Acquired

Boston, San Francisco and Herzliya, Israel 6/6/18—Process Sensing Technologies (PST) has agreed to acquire LDetek for an undisclosed amount. LDetek manufactures online GCs and analyzers that use a plasma-emission detector technology to obtain highly sensitive measurements. End-markets served include specialty/high-purity gas, semiconductors, laboratories and environmental monitoring. “LDetek’s focus on gas chromatography and analysis is extremely complementary to the other businesses in PST’s portfolio, and will enable PST to offer a complete solution in a number of key applications,” said PST CEO Adam Markin. PST is owned by Battery Ventures, whose other process instruments businesses include Analytical Industries, Michell Instruments and Rotronic.

PST provides precision measurement instruments and analyzers for industrial process control, including precision hygrometers, humidity probes, dew-point analyzers and dew-point transmitters for trace moisture measurements in gases and process liquids. According to LDetek, the company’s plasma-emission detector technology is a quartz cell that is submitted to a high-intensity and frequency electromagnetic field, resulting in electroluminescence, which is used as an emission technique to quantify analytes. Once the carrier gas (argon or helium) is ionized, an optical system detects the emitted spectral lines.

First Quarter Financial Results: Agilent Technologies, Bio-Rad Laboratories, Hitachi High-Technologies, HORIBA, Pacific Biosciences

Changes in China Impact Agilent

Total fiscal second quarter revenues for Agilent Technologies grew 9.4% (see [IBO 5/15/18](#)), as organic revenues gained 4.3%. As anticipated, the Chinese Lunar New Year holiday reduced organic sales growth by 1% due to fewer selling days. Sales were down another 1% due to a reorganization of Chinese ministries as well as delayed ICP-MS shipments due to high backlog and Chinese import issues. Consumables, Services and Informatics revenue accounted for 58% of revenues, with the remainder being Instruments. Operating margins declined three-tenths of a percentage point to 17.8%. Gross margin declined 53.7% to 53.4%.

Agilent Technologies Q2 FY18				
	Rev. (\$M)	% of Rev.	% Rev. Growth	Org. Growth
Life Sciences & Applied Markets	\$561	47%	7.3%	3.3%
Agilent CrossLab	\$426	35%	12.7%	4.0%
Diagnostics & Genomics	\$219	18%	9.0%	6.7%

All figures below are organic. By end-market, pharma and biotech sales grew the fastest, up 8% to account for 29% of revenues, with MS, consumables, service and genomics showing strong demand. Sales to the chemical & energy markets rose 5% to represent 24% of revenues, as the company noted a “slight pause” in orders due to trade concerns. However, the company reported strong sales growth for this end-market in China.

Academia and government revenue rose 2% to make up 9% of total sales, led by LC/MS, cell analysis and the CrossLab consumables and service business revenues. Revenue for the Diagnostics and Clinical end-market increased 3% to represent 16% company sales, with strong Reagent Partnership and Genetics sales, but a weaker US pain management market reduced growth by approximately two percentage points.

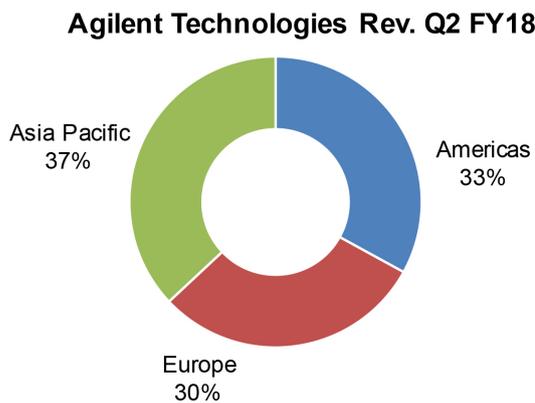
Food revenue fell 1% to account for 10% of company sales, as China reorganized its food safety ministries. The slowdown is expected to affect new instrument sales for 6 to 9 months. Environmental and Forensic sales rose 2% to 12% of company revenues, led by Forensic revenue. Environmental sales were affected by China's reorganization of its environmental ministries.

By segment, the Life Sciences and Applied Markets Group reported strong sales for LC/MS, cell analysis and ICP-MS products. By geography, on a currency neutral basis, Group sales grew 10% in the Americas and 10% in Europe, but Asian sales fell 3%.

Agilent CrossLab revenue rose assisted by double-digit growth in pharma, and academia and government sales, as well as double-digit growth in China. Excluding currency effects, Group sales increased 7% in the Americas, 6% in Europe and 8% in Asia.

Genomics sales, including strong sales of SureSelect NGS target enrichment products, drove Diagnostics & Genomics Group sales growth. Excluding currency effects, Group sales in the Americas rose 3% and 13% in Europe but declined 6% in Asia due to the pathology business.

Regionally, sales in the Americas and Europe grew high single digits, but Chinese sales were flat. For the fiscal year, the company revised its expectations for Chinese sales growth from 10% to 7% due to the reorganizations of the food and environment industries. These government changes are expected to move \$20 million in sales into fiscal 2019. However, Agilent raised its outlook for pharma from 5% to 6%. The company maintained its forecast of 5.5% organic growth for the fiscal year.



Bio-Rad Life Science Sales Excel

Bio-Rad Laboratories Life Science's (LS) first quarter sales increased 13.5%, 8.9% excluding currency, to \$197.8 million, or 36% of company sales (see [IBO 5/15/18](#)). Revenues included RainDance Technologies (see [IBO 1/31/17](#)) sales of \$6 million, up from \$2 million last year. Digital PCR, cell biology, gene expression and process media products fueled LS revenue growth. By region, North American sales were strongest. China and Europe also recorded good demand on a currency neutral basis.

LS gross margins increased approximately 5.2 percentage points due in part to the sales increases, a one-time expense related to RainDance last year, and lower royalty amortization for gene expression products.

Hitachi High-Technologies AMI Fiscal Year Sales Flat

Hitachi High-Technologies Science & Medical Systems (SMS) for the year ending March 31 were nearly flat at ¥188.1 billion (\$1.68 billion = ¥111.68 = \$1) to make up 27% of company sales (see [IBO 4/30/18](#)). Segment operating margin declined due to inventory adjustments and strategic investments.

Hitachi High-Technologies Science & Medical Systems FY18

	Rev. (¥B)	% Rev. Growth	% of Rev.
Electron Microscopes	¥3.5	16.3%	19%
Scientific Instruments	¥3.2	36.3%	17%
Medical Products	¥10.3	-11.7%	55%
Biotechnology Products & Other	¥1.8	14.6%	10%

FY19 SMS revenue are expected to rise 9.0% to ¥2.1 billion (\$1.84 billion). Scientific Instrument revenues are forecast to record the fastest growth, rising 15.4%. Medical Products sales should follow, up 10.2%. Electron Microscopes are expected to increase 4.0%, while Biotechnology Products and Other sales are forecast to be up 1.0%. Aims for the company's increased R&D investments includes development of NGS products, MS for diagnostics and automation technology for electron microscopy.

Hitachi High-Technologies Operating Results FY18

	Op. Profit (¥B)	Chg.	Op. Margin	Chg. (bps)
Science & Medical Systems	\$2.3	-16.2%	12.1%	250

HORIBA Scientific Instrument Sales Rise Double Digits

HORIBA's combined revenues for its Scientific Instruments and Systems (SI) and Process & Environmental Instruments and System (P&E) businesses rose 14.5% in the first quarter to ¥11,492 million (\$105.8 million at ¥108.67 = \$1) to make up 25% of total company sales (see [IBO 5/15/18](#)).

HORIBA Q1 FY18

	Rev. (M)	% Rev. Growth	% of Rev.
Process & Environmental Instruments & Systems	¥4,941.0	17.8%	8%
Scientific Instruments & Systems	¥6,551.0	12.1%	10%

SI sales were driven by the Americas and Japan. SI orders increased 26.9% to ¥6,540 million (\$6,018 million). SI second quarter revenue is forecast to rise 13.8% to ¥6,448 million (\$59.3 million).

HORIBA Q1 FY18

	SI		PE	
	Rev. (M)	% Rev. Growth	Rev. (M)	% Rev. Growth
Japan	¥2,160	13.9%	¥2,671	0.7%
Asia	¥1,339	6.3%	¥1,143	81.1%
Americas	¥1,716	15.4%	¥533	10.8%
Europe	¥1,335	11.3%	¥429	38.2%

First quarter P&E revenue rose due to water quality analyzer and air pollution analyzer sales. P&E orders grew 16.7% to ¥4,366 million (\$4,018 million). However, SI second quarter sales are forecast to fall 21.3% to ¥3,058 million (\$2,814 million).

Pacific Biosciences Sales Decline

First quarter revenues for Pacific Biosciences declined 22.3% (see [IBO 5/15/18](#)) due to lower shipments, missing company expectations. Although Sequel instrument orders were the largest since the fourth quarter of 2015, a majority of the systems did not ship due ongoing preparation of customers' facility. Other factors included a difficult year-over-year comparison. The company estimated an installed base of 400 instruments, including around 250 Sequel systems.

Pacific Biosciences Q1 FY18			
	Rev. (M)	% Rev. Growth	% of Rev.
Product	\$16.3	-23.5%	84%
Instrument	\$7.1	-43.4%	
Consumable	\$9.1	5.5%	
Service and Other	\$3.1	-14.9%	16%

As for Consumables, while sales of Sequel consumables tripled, sales of RS II consumables continued to decline to account for 20% of total Consumable sales. Also affecting Consumables sales was the China's Lunar New Year holiday, which lowered instrument usage, and facility issues with a large customer. Service and other revenue declined due to a fall RS II service sales, which are higher priced than Sequel services.

Geographically, the company highlighted Chinese demand, which accounted for more than 30% of total sales and included multi-unit orders. The country's overall demand is attributed in part to animal and plant sequencing projects. Due to facility-preparedness timing and unpredictable order patterns, the company did not provide a revenue forecast for 2018.

Pacific Biosciences Q1 FY18			
	Rev. (M)	% Rev. Growth	% of Rev.
North America	\$7.8	-27.8%	31%
Europe	\$4.0	-7.0%	16%
Asia Pacific	\$7.6	-22.4%	31%

DNA/RNA Gel Electrophoresis

Since the 1950s, scientists have used gel electrophoresis to separate charged molecules like DNA, RNA and proteins according to their size. The separation can lead to their identification, quantification and purification.

A gel electrophoresis system consists of a gel matrix (typically agarose or polyacrylamide, depending on the size of the fragments) sitting in an electrophoresis tank, a buffer solution that conducts the electric current and a power supply. The molecules travel through the gel when an electric current is applied. Smaller molecules migrate faster than large ones, creating a separation by molecule size on the gel. All molecules need to have the same charge for this to be true. For example, DNA is negatively charged and will therefore move towards the positively charged electrode.

In order to see the separated molecules, the gel needs to be stained. Ethidium bromide has been routinely used for decades to stain DNA/RNA gels, but because it is a potent mutagen, replacements such as SYBR Safe and FlashBlue are becoming more popular.

In the era of genomics, gel electrophoresis is an everyday tool, with facilities from educational labs to applied R&D laboratories utilizing the technique. Despite DNA/RNA electrophoresis being a very simple and cheap technology,

modern techniques such as qPCR and capillary electrophoresis are replacing it. For high-throughput settings such as hospitals and biotech companies, qPCR may be a better option, since PCR product visualization does not require further manual operation and many more samples can be run at the same time.

Academic institutions account for almost half of the total demand for electrophoresis systems, often with multiple units per lab. Forensic laboratories processing DNA/RNA samples use electrophoresis when providing analytical services.

The DNA/RNA electrophoresis market is dominated by GE Healthcare Life Sciences, followed by Bio-Rad Laboratories and Thermo Fisher Scientific. Together, these three companies account for two-thirds of the total market. GE Healthcare offers consumables and components, as well as imaging systems that are highly customizable for specific applications. Bio-Rad's systems are broadly utilized across academic institutions, as they tend to be simple and easy to use. But the company has discontinued high-end products such as the Experion Automated Electrophoresis Station and the ExQuest Spot Cutter. Thermo Fisher is known for its integrated systems and its precast gels that make the electrophoresis process easier and faster.

The DNA/RNA gel electrophoresis market totaled approximately \$260 million in 2017. Innovative integrated systems, which combine the electrophoresis chamber, power supply and visualization into a single unit, will spur growth in the years to come. Although demand for traditional systems is waning in more established regions, their popularity is growing in emerging markets, particularly China and India.

DNA/RNA Electrophoresis at a Glance:

Top vendors

- GE Healthcare Life Sciences
- Bio-Rad Laboratories
- Thermo Fisher Scientific

End-user Markets

- Academia
- Biotechnology
- Government Research

Initial System Prices

- \$2,000-\$120,000

Clinical

Advances in cancer immunotherapy have helped scientists better understand the immune system, such as the development of checkpoint inhibitors, which are medicines that are effective at shrinking numerous types of tumors, including melanoma and certain solid tumors. However, the unpredictability of the efficacy of checkpoint inhibitors led researchers to search for companion molecules that could bolster the checkpoint inhibitors' impact.

Since 2014, the number of clinical studies combining checkpoint inhibitors with other molecules has skyrocketed, from 58 in 2014 to 469 in 2017. Although companies developing experimental immunotherapies have drawn great interest from investors, the immunotherapy space remains a high stakes sector. To address this, companies have spent billions of R&D dollars on discovering immuno-oncology drugs that can improve the effect of checkpoint inhibitors by helping the immune system block proteins used by tumors to impede the immune system, molecules that strengthen the immune system and drugs that can change the environment surrounding a tumor to make it more vulnerable to T-cell attack.

So far, 6 checkpoint inhibitors have been approved by the FDA for cancers including melanoma, lung, kidney,

bladder, gastric, head and neck, Hodgkin's lymphoma, and Merkel cell carcinoma.

Source: [C&EN](#)

Pharmaceuticals

According to new data, the pharmaceutical industry is beginning to stabilize after the financial crisis, with an estimated CAGR of 6% over the next 6 years, driving prescription sales in the industry to \$1.2 trillion by 2024. Orphan drug sales are forecast to reach \$262 billion by 2024, making up 20% of the prescription drug market. Oncology therapies are estimated to grow at a CAGR of 12% over the next 6 years, with sales expected to hit \$233 billion in 2024. These high figures are thought to be driven by expanded accessibility to medicines around the world, as well as launches of novel medicines, such as gene and cell therapies.

Total R&D expenditures for pharmaceutical companies are expected to increase 3.0% each year to total \$203.9 billion in 2024. Roche leads in pharmaceutical R&D, forecast to spend \$11.7 billion on R&D, with Johnson & Johnson and Novartis rounding out the top 3 with \$10.0 billion and \$9.0 billion in R&D expenditures. The increase in R&D is at least partially linked to increasing FDA approvals, with 55 approved New Molecular Entities (NMEs) and biologicals, an increase of over 100% from 2016, when only 27 NMEs and biologicals were approved.

The top therapy segments in the industry by 2024 will be oncology, anti-diabetics, with estimated sales of \$59.5 billion in 2024, and anti-rheumatics, which have forecast sales of \$56.7 billion in 2024. The segment most likely to experience a decline is antivirals therapy, of which sales are expected to fall 0.9% by 2024 to total \$39.9 billion.

Source: [EvaluatePharma](#)

Government

Earlier this month, the NIH released a five-year plan for data science and announced that it will hire a chief data strategist, a first for the agency, to lead the implementation of the plan, along with the NIH Scientific Data Council and NIH Data Science Policy Council. The NIH cites a 2016 survey indicating that data scientists spend 80% of their time collecting and organizing data, leaving only 20% for analytical work, such as mining data for trends and patterns. The recent advances in storage, processing and computation should be taken advantage of, according to the NIH, by utilizing them to establish a secure and sustainable "data ecosystem."

Biomedical data, clinical data and genomics data are a few types of data that require improved storage methods due to their exponential size. Genomics data alone are predicted to equal, if not exceed, total data collected from astronomy, YouTube and Twitter by 2025. According to the NIH, data must be FAIR: Findable, with unique identifiers that make them easy to locate; Accessible, so that they are easily retrievable from a secure system; Interoperable, with a standardized vocabulary so the data can be used and understood across NIH research groups; and Reusable, with concise information regarding data usage licenses and traceability.

Currently, a large portion of biomedical data are maintained by individual scientists or small research groups, and are not standardized in a singular format, making it complicated for scientists to find and utilize their peers' data. To centralize biomedical data and drive efficiency and sustainability in biomedical research, the NIH proposes five aims as part of its data science plan: improving data storage and security, which includes interconnecting new and existing NIH data systems; modernizing data repositories, and better integrating clinical and observational data into biomedical data science; optimizing and growing the NIH data science workforce; and developing policies to underscore FAIR data.

Source: [NIH](#)

China

China is continuing its rise as a global leader in science, forecast to officially surpass the US in scientific publication output by the end of 2018, according to the National Science Board. Although the US spends half a trillion dollars on scientific R&D each year, which is more than any other country, it is closely followed by China, with the EU third and Japan fourth.

Chinese scientists and other foreign-born scientists in the US are heading to China for research, with some calling it the “best place in the world” to establish a research lab. China is spending more on infrastructure than the US or Europe, and along with a growing middle-class, this helps make relocating to China more appealing.

According to some researchers, the Trump administration has enforced policies that devalue their work and threaten their departments with budget cuts, as well as applied strict immigration policies that are hampering the international collaboration and talent acquisition that has long been at the heart of US technological innovation. Because of this, as well as more lax regulations, researchers are attracted to China due to healthy funding from state research institutes and opportunities to conduct a wider range of research. For contrast, the US increased its research expenditures an average of 4% annually between 2000 and 2015, while China upped its research spending an average of 18% each year during the same time period.

Source: [The Washington Post](#)

Chile

Earlier this month, the Chilean government approved plans to create a federal science ministry. Argentina, Brazil, Costa Rica, Cuba, and the Dominican Republic are the only countries in the Latin American region that have science ministries, and Chilean scientists hope that their government’s decision will inspire other Latin American countries to establish ministries as well.

In 2014, R&D expenditures accounted for 0.38% of Chile’s GDP, which is the same as Uruguay but below Argentina and Brazil, which spent 0.59% and 1.17% on GDP in 2014, respectively. Chile’s economy is heavily dependent on exporting natural resources such as copper, but due to unsustainability, the government is looking to focus on “knowledge and creativity” by driving funding for science, technology and education.

Currently, the majority of Chile’s science funding is overseen by the National Commission for Scientific and Technological Research (CONICYT), part of the Ministry of Education. CONICYT had a budget of CLP 328 billion (\$520 million) in 2017, and the monies are split into various funds in many ministries. According to the new law, CONICYT will be replaced by a National Agency for Research and Development, with eight external advisors serving as counselors to the government regarding the allocation of science funding.

Source: [Science](#)

EU

Building upon the positive impacts of Horizon 2020, the European Commission has released a draft budget for its latest research program, Horizon Europe, an initiative for driving research in the sciences and to positively affect job, trade and investment growth. The Commission proposed a research budget of €100 billion (\$117.7 billion), of which €97.6 billion (\$114.9 billion) would be allocated to Horizon Europe. Of that figure, funds would be directed towards the five clusters of Horizon Europe and the Joint Research Center, with the health cluster receiving €7.7

billion (\$9.1 billion); inclusive and secure societies obtaining €2.8 billion (\$3.3 billion); digital and industry securing €15 billion (\$17.7 billion); climate, energy and mobility acquiring €15 billion (\$17.7 billion); and food and natural resources receiving €10 billion (\$11.8 billion).

Horizon Europe will establish a European Innovation Council to facilitate the transfer of breakthrough research technologies into the commercial space, as well as funding possibly disruptive technologies that have significant potential to open up new market opportunities or new markets altogether. As part of Horizon Europe, the Commission will put forth new research and innovation projects, such as cancer, clean transportation or environmental research. Horizon Europe will also require open access to publications and data to help broaden the potential for innovation across Europe.

Source: [European Commission](#)

Molecular Spectroscopy

Company Announcements

Datacolor opened a direct sales and support organization in Ho Chi Minh City, Vietnam, in January. This is the company's 14th branch office.

In May, the **University of Arizona** announced that start-up **Botanisol Analytics** has licensed Raman vacuum ultraviolet spectrometry technology.

Applied Photophysics, the maker of the Chirascan circular dichroism systems and SX-range of stopped-flow spectrometers, signed distribution agreements in May with **Paralab** for Spain and Portugal, and **Alfatest** for Italy to supply academic and biopharmaceutical labs.

Product Introductions

Wilmad-LabGlass launched in March the Reaction Monitoring System NMR Tube, a two-chamber NMR tube for in-tube mixing. It is designed to be a simple solution for acquiring NMR reaction and kinetics data. List price for the 7 in (18 cm) and 8 in (20 cm) models are \$258.00 and \$278.64, respectively.

Porvair Sciences introduced in April black Krystal UV Quartz-bottomed microplates that offer excellent optical transmission in the wavelength range of 185 nm to 110nm, making them ideal for circular dichroism measurements.

In April, **B&W Tek** introduced the QTRam for nondestructive and real-time pharmaceutical content and blend uniformity measurements. Its multiple applications include blend and content uniformity, formulation development and counterfeit detection. It can also be used for at-line monitoring and final product release.

B&W Tek announced in June the TacticID-1064 handheld Raman analyzer for identifying suspicious and unknown substances in the field in real time. The latest addition to the TacticID family, the TacticID-1064 is based on third-generation 1064 nm technology, which provides greatly improved fluorescence elimination, a lower level of detection, faster response time, and safe and direct measurement of darker substances.

Bruker debuted in April an extension of its compact AVANCE NEO NanoBay line of NEO consoles with dual-channel transmit and dual-receive capabilities to its routine 300 and 400 MHz NMR. Also released was the 1.0 GHz NMR TXO CryoProbe, which now also permits ¹⁵N direct detection on GigaHertz NMR spectrometers, and the Biosolids CryoProbe. In addition, Bruker's line of Dynamic Nuclear Polarization (DNP) systems was expanded to include a 263 GHz klystron microwave source for DNP NMR for materials research at 400 MHz, and a 593 GHz gyrotron microwave source for high-field 900 MHz DNP NMR for biological research.

In June, **Bruker** launched the improved IR Biotyper system for microbial strain typing, featuring updated software

In April, **Unchained Labs** introduced the Raman spectroscopy-based Hound for fingerprinting protein and organic

particles as part of the biopharmaceutical manufacturing process. The company also introduced Bouncer, which uses white light reflectometry and laser interferometry to measure the thickness of sprayed-on and baked-on silicone coatings.

JEOL launched in May the JEOL AUTOMAS Solids NMR Probe for its 400–600 MHz systems, enabling fully automatic operation. The JEOL ROTORCARRIER holds the AUTOMAS solids NMR sample tube as it is transported from the auto-sample changer to the top of the magnet. The AUTOMAS NMR Probe then receives the sample and automatically sets it to the magic angle. JEOL also introduced the JEOL HXY NMR for materials science, which is available for JEOL 400–800 MHz systems with rotor diameters. The company released the JEOL HCN MAS NMR Probe, a new triple-resonance solids NMR probe available for 400–800 MHz systems designed for biological samples, and the JEOL Walkup NMR, a new user-interface mode that greatly simplifies NMR operation.

In May, **Edinburgh Instruments** released the Cryosphere for its FLS1000 spectrometer, calling it the only commercial accessory for measuring photoluminescence quantum yield from 77 K to 500 K.

Jenway, a **Cole-Parmer** company, released in May the 7415 Nano micro-volume spectrophotometer, ideal for measuring DNA and RNA concentrations and purity. It succeeds the Genova Nano.

Spectrolight introduced in May the FWS Fluorimeters series, utilizing a high-power, tunable monochromatic beam for excitation.

In May, **Thermo Fisher Scientific** introduced the Thermo Scientific ConservatIR FTIR external reflection accessory for analyzing objects that do not fit inside the sample compartment of Thermo Scientific benchtop Nicolet FTIR spectrometers. Users can measure samples in two modes: specular/diffuse reflection, for non-contact analysis, or attenuated total reflection (ATR), using an optional diamond ATR sampling interface.

Rigaku Analytical Devices added in June QuickDetect mode, a capability that provides automated colorimetrics for trace or nonvisible amounts, to its Progeny ResQ 1064 nm handheld Raman analyzer.

Sales and Orders of Note

In April, contract research and manufacturing organization **AMRI** announced plans to add a **Bruker** AVANCE NEO 600 MHz NMR Spectrometer to its site in Valladolid, Spain. The system will be operational by late 2018.

Life Science Consumables

Company Announcements

Bio-Techne announced in its fiscal third quarter conference call that it has created an Indian subsidiary.

MoBiTec announced that it will distribute **ABP Biosciences'** products in Germany. ABP specializes in fluorescence labeling and detection technologies.

Gene-based Consumables

Company Announcements

In April, **Twist Bioscience** added distribution partners in Asia: **Recenttec** for Japan; **DNA Link** and its subsidiary **LnCBio** for Korea; **Premas Life Sciences** for India; and **BioArrow Technology** for Hong Kong and Macau.

Mammoth Biosciences launched in April with the announcement of the development of a CRISPR-enabled platform capable of detecting any biomarker or disease containing DNA or RNA using CRISPR technology licensed

exclusively from the **University of California**. The company will initially focus on health care applications, with the aim of transforming diagnostic testing across the care continuum from hospital and point-of-care settings to at-home testing. The first application to be explored will be disease detection.

In April, **MilliporeSigma** received a patent for its CRISPR technology in China, the seventh such country. The patent covers integration of an external DNA sequence into the chromosome of eukaryotic cells.

In May, **MilliporeSigma** announced a collaboration with **Washington University in St. Louis** that could lead to the optimizing of nutritional supplements to restore a healthy gut microbial community (microbiome). Under the two-year collaboration, Dr. Jeffrey Gordon of **Washington University School of Medicine** will employ MilliporeSigma's CRISPR genome editing technology in research studies.

In May, the **National Institutes of General Medical Sciences** awarded **BellBrook Labs** a \$1 million phase II Small Business Innovative Research grant to develop new assays to detect cyclic GMP-AMP (cGAMP) levels in biological samples. The new assays will provide direct in-well detection of cGAMP in cell lysates to enable basic cellular research and screening for modulators of the cGAS-STING pathway.

Horizon Discovery announced that Dr. Jonathan Milner stepped down from its Board in May. He owns 8% of Horizon Discovery's issued share capital and 10% of **Abcam's**. Abcam made a bid to acquire Horizon Discovery earlier this year (see [IBO 5/15/18](#)).

In June, **Agilent Technologies** launched a new range of probes to interpret gene expression data from FISH and chromogenic *in situ* hybridization (CISH), including (ASR) EBER RNA CISH and Kappa and Lambda mRNA CISH probes. Agilent expects the new probes to help drive oligonucleotide-based *in situ* hybridization into more research labs.

Product Introductions

In April, **QIAGEN** introduced the real time PCR-based QIAstat-Dx multiplex system, providing a one-step, fully integrated molecular analysis of common syndromes as tested for in syndromes in infections, oncology and other disease.

In June, **Synthego** debuted its Engineered Cells Portfolio, announcing immediate access to Knockout Clone and Pool products, and Advanced Cells products. Knockout Clone and Pool enables single-click online ordering of any human cell line with a guaranteed CRISPR knockout. Knockout Cell Pools can be delivered in as few as 4 weeks and Knockout Cell Clones are delivered in as little as 8 weeks.

Sales and Orders of Note

Sciencion announced in May that **Unisensor** has set up its biostick manufacturing process using its sciFLEXARRAYER technology. Unisensor uses the technology to produce the multiplex biosticks for its unique Extenso milk analysis platform. Extenso can simultaneously detect 100 antibiotic residues and toxins in dairy products in a single test in only 13 minutes.

Cell-based Consumables

Company Announcements

MIMETAS, a provider of organ-on-a-chip products and tissue models, secured \$20.5 million in April as part of a Series B financing round.

In April, **Okinge**, a specialist manufacturer of proteins that are used for control of stem cell growth and

differentiation, closed a seed investment round.

Porvair Sciences announced in April a collaboration with **Persomics** to develop and supply ANSI/SLAS-format arrays as an OEM product for Persomics' ImagineArray. The Persomics ImagineArray, platform replaces traditional microplate wells with contact-printed spots on a slide which is mounted into an SLAS/ANSI-format frame.

In May, **BIOSERA**, a provider of serum and cell media products, entered into an exclusive distribution agreement with **Alliance Global** for the Middle East, Africa and Asia.

In May, **Greiner Bio-One North America** acquired the magnetic 3D cell culture technology that it previously distributed from **Nano 3D Biosciences**.

In a fiscal third quarter **SEC** filing, **Bio-Techne** reported a purchase price of approximately \$51.3 million, net of cash acquired, for Atlanta Biologicals and its affiliated company Scientific Ventures (see [IBO 1/15/18](#)).

Emulate formed a collaboration with **AstraZeneca's Innovative Medicines and Early Development (IMED) Biotech Unit** in May to embed its Organs-on-Chips technology within the laboratories of the IMED Drug Safety organization. The companies initially began collaborating in 2013. The terms of the agreement also allow for the technology to be adopted across AstraZeneca's therapeutic areas and will enable the development of functionality of three other Emulate Organ-Chips—the Lung Tumor-Chip, Lung-Chip and Glomerulus Kidney-Chip.

In June, **FUJIFILM Cellular Dynamics** entered into an exclusive patent license agreement with the **University of California-Irvine** (UCI) to license and commercialize UCI's technologies for derivation of microglia in the commercial research field and also a nonexclusive patent license agreement to commercialize microglia media formulation. The technology enables the company to differentiate pluripotent stem cells into microglia cells, a brain cell type that plays a critical role in preserving the function of the brain.

Protein-based Consumables

Company Announcements

In May, **Abcam** signed a memorandum of understanding for a long-term collaborative strategic partnership with **Shuwen Biotech**, a leading player in the development and commercialization of companion diagnostics.

Synthetic antibody firm **MIP Diagnostics** announced in May that it has secured £1.5 million (\$2.0 million) in funding. The company plans to double its staff to 10.

In May, **VolitionRx** entered into a global sales and distribution agreement with **Active Motif** for a range of its RUO kits. The kits are based on its Nucleosomics technology for exploring epigenetic modifications in circulating cell-free nucleosomes across different diseases from clinical samples.

Product Introductions

In April, **AYOXXA Biosystems** expanded its catalogue of kits for fully scalable multiplex protein analysis with the introduction of the LUNARIS Human 12-Plex Th17 Kit for the quantitative validation of soluble pro-inflammatory T helper 17 cell-related markers. LUNARIS kits are based on a classical sandwich immunoassay principle with fluorescence readout.

In April, **SYGNIS** launched 2view, a unique Western blot detection method, under its **Expedeon** brand name. 2view secondary antibodies are labeled simultaneously with a visible (InnovaCoat GOLD nanoparticles) and proprietary chemiluminescent enzymatic detection system. The gold nanoparticles enable fast visible detection at nanogram level, and the enzymatic detection mechanism enhances sensitivity down to picogram levels of protein.

Bio-Rad Laboratories launched in May the Bio-Plex Pro Human Cytokine Screening Panel for the identification and quantification of 48 different analytes. It features the ability to probe both endogenous and diseased/treated samples with a single assay across a broad range of targets. The panel consists of adaptive immunity cytokines, pro-

inflammatory cytokines and anti-inflammatory cytokines, all in a single well.

In May, **Bio-Rad Laboratories** released a range of anti-vedolizumab antibodies to support research into the treatment of ulcerative colitis and Crohn's disease.

Also in May, **Bio-Rad Laboratories** debuted a range of anti-idiotypic antibodies targeting the immune checkpoint inhibitor drugs pembrolizumab (Keytruda) and nivolumab (Opdivo).

Meridian Bioscience announced in May the availability of critical antigens and antibodies for Nipah virus immunological assay development.

In June, **VICAM**, a **Waters** company, introduced the Zearala-V AQUA, a user friendly lateral flow strip test to accurately detect and measure zearalenone at levels from 0.1-5.0 ppm.

Sengenics launched in June the IMMUNOME v4 Discovery Array and CTA (cancer testis antigens) Array. Both utilize KREX functional proteomics technology that ensures that only correctly folded, functional proteins are immobilized to the microarray surface.

Bioprocess and Process Analysis

Bioprocess Analysis

Company Announcements

Hamilton Bonaduz announced in March the appointment of Dr. Clara Caminada as vice President of the Business Unit Process Analytics. She previously led the Unit's marketing department.

In March, **MilliporeSigma** signed a memorandum of understanding with **Schneider Electric** that aims to automate biopharmaceutical processes for China's biopharmaceutical industry. The memo includes comarketing.

In May, **MilliporeSigma** opened its first BioReliance End-to-End Biodevelopment Center in North America to help customers with biopharmaceutical manufacturing processes. The Center provides cell line-development services, upstream and downstream process development, and non-GMP clinical production for drug manufacturers. The company also announced the expansion of its Advance Biotech Grant Program. Every six months, three recipients will be awarded a total of €200,000 (\$234,000) in free services and products to address their process development challenges. In total, six companies will benefit from MilliporeSigma's Advance Biotech Grant Program each year.

In April, **Pall** entered into a strategic collaboration involving its Biotech business unit and **Artesyn Biosolutions**, a innovator in single-use components and fluid management technologies. The companies will codevelop complete solutions from clinical to commercial scale for single-use automated bioprocessing systems. The partnership furthers Pall Biotech's expansion of its Allegro single-use solution portfolio from upstream through downstream, and to final filling.

Product Introductions

In February, **ABEC** announced large-scale single-use microbial fermentation capability, demonstrating its CSR technology's performance with working volumes up to 1,000 L.

In March, **Sartorius Stedim Biotech** launched the ambr 250 high throughput (ht) perfusion, a new automated parallel bioreactor system designed for rapid cell culture perfusion process development to optimize production of therapeutic antibodies. It combines 12 or 24 single-use perfusion mini bioreactors (100-250 mL working volumes) with associated single-use perfusion components, all controlled by one automated workstation.

In April, **Sartorius Stedim Biotech** introduced a new mini bioreactor vessel for the ambr 250 ht system for cost

effective, scalable process development of vaccines in cell culture.

Aquila biolabs released in March the Cell Growth Quantifier BioR (CGQ BioR), which allows for noninvasive online biomass monitoring in all scales and types of bioreactors. It attaches to the outside of the bioreactor and uses backscatter measurements.

In April, **aquila biolabs** debuted the is LIS (liquid injection system) Software for the wireless control and monitoring of feeding experiments.

Process Analysis

Company Announcements

Earlier this year, **Gasera** expanded its operations in Germany, opening a local sales office in Nürnberg.

In March, **Keit** joined **CAMO Software**'s OEM Partner Program. CAMO's chemometric software can now be integrated with Keit's IRmadillo on-line sensor for real-time process monitoring.

In May, **Princeton Instruments** and the **Center for Structured Organic Particulate Systems (C-SOPS)** entered into six-month collaboration on a novel pharmaceutical technology that enables close monitoring and control of drug manufacturing processes. The project will use Raman spectroscopic measurements to monitor the formation of thin oral films, which contain medicine and dissolve in the mouth without the need for water, including in the drying process during manufacturing, in order to determine drug amount, uniformity and form. In addition, it will investigate the degradation processes of APIs in solid dose drugs.

Picarro announced in June a partnership with **Challentech International** to distribute its latest gas analyzers, the SI2000 analyzer series, in China and Taiwan.

Product Introductions

In February, **Modern Water** debuted the Microtrace OVA 7100 Series for on-line trace-metal monitoring. It can be configured to measure up to 23 different metals with detection limits as low as 0.1 µg/L.

In March, **In-Situ** released the wireless-enabled Aqua TROLL 500 multiprobe for both surface-water spot checks and long-term monitoring.

Picarro added in March new capabilities to all of its cavity ringdown spectroscopy-based SI2000 Series gas analyzers. For hydrogen fluoride, ammonia and hydrogen chloride, the new SI2000 Series analyzers provides extended measuring range from mid-ppb to ppm concentration levels.

In April, **Thermo Fisher Scientific** introduced the new Thermo Scientific SOLA iQ total sulfur analyzer. The online analyzer offers an updated modular design that eases routine maintenance and features measurement ranges from 2 ppm to 100% and limits of detection as low as 25 ppb.

Schneider Electric released its new FXI Series 7 Process GC in June. The FXI Series 7 GCs enable multiple detectors and ovens to be utilized simultaneously to decrease analysis time, and are geared towards petrochemical, refining and chemical plant applications.

Materials Characterization

Company Announcements

In a quarterly SEC filing, **Entegris** disclosed that it paid \$37 million in cash for **Particle Sizing Systems** (see [IBO 1/31/18](#)).

In April, **Biolin Scientific** named **Nanoscience Instruments** as a distributor for North America. In Canada, Attension products will continue to be distributed by **Spectra Research**.

In May, **MTS Systems** appointed **Quantarad Technologies** and **Quantum Technologies Global** to support its MTS Materials, Vehicles and Structures market segments in Malaysia and Singapore, respectively.

Fluence Analytica entered a distribution agreement in May with **Nihon Rufuto** for Japan.

Product Introductions

Perten Instruments, a **PerkinElmer** company, released a new version of the Rapid Visco Analyzer 4800, featuring an extended temperature range up to 140°C. This enables new applications such as ingredient performance (under conditions relevant to ultra-high-temperature pasteurization of dairy and food products, retorting, pressure cooking, extrusion and other aseptic processing conditions).

In April, **Mettler-Toledo** launched the RC1mx reaction calorimeter for the chemical and pharmaceutical industries. The temperature range of 70°C-300°C is covered with just 1 thermostat and there are 2 different stirrer motors to choose from.

In May, **Mettler-Toledo** introduced the Flash DSC 2+, calling it the only commercially available chip calorimeter. Ideally designed for polymer analysis, it is capable of performing measurements from a wide temperature range of -95°C to 1000°C.

Malvern Panalytical debuted in May the Zetasizer Pro and Zetasizer Ultra for particle and molecule size and zeta potential analysis. Both systems offer dynamic light scattering and electrophoretic light scattering. A disposable capillary sizing cell holds sample volumes from 3 µL to 10 µL.

In May, **Anton Paar** launched the ViscoQC 100 rotational viscometer, available in three versions. The L version covers a measuring range from 1 mPa·s (milli Pascal second) to 6000 Pa·s, the R unit for medium viscosities covers from 10 mPa·s to 40,000 Pa·s, and the H version covers a measuring range from 60 mPa·s to 320,000 Pa·s. Four measuring spindles are available.

Reported Financial Results

\$ in Millions USD	Period	Ended	Sales	Chg.	Op. Prof.	Chg.	Net Prof.	Chg.
Enzo Biochem	Q3	30-Apr	\$25.6	-5.5%	(\$2.8)	-833.3%	(\$3.0)	NA
Other Currencies (in Millions)								
Halma	FYE	31-Mar	£1,076.2	11.9%	£181.3	8.5%	NA	NA
Halma (Environmental & Analysis)	FYE	31-Mar	£259.0	18.3%	NA	NA	NA	NA
Oxford Instruments	FYE	31-Mar	£348.5	9.0%	£65.5	NM	NA	NA
Oxford Instruments (Materials & Characterization)	FYE	31-Mar	£118.1	11.7%	£20.10	64.8%	NA	NA
Oxford Instruments (Research & Discovery)	FYE	31-Mar	£112.1	-10.5%	£13.80	0.0%	NA	NA
Oxford Instruments (Service & Healthcare Sector)	FYE	31-Mar	£66.8	-3.6%	£12.60	5.0%	-£0.3	NA

NA = not available, NM = not meaningful

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