



IBO

**Strategic Information for the
Life Science and Analytical
Instrument Industry**

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Fall 2018 Business Climate Review: Positivity Despite Uncertainties

For the fall installment of our Business Climate Review, **IBO** spoke with representatives from analytical instrument industry trade organizations around the world to learn from their general impressions of the current state of the analytical testing industry and the trends affecting the industry. Discussing issues such as Brexit, diagnostic markets and the M&A environment, the representatives provided a generally optimistic outlook for the industry for the coming year, despite the many economic uncertainties and changes taking place around the world.

IBO spoke with Francis Pithon, vice chairman of **EUROM II**, the Optical and Laboratory Technology division of the European Federation of Precision Mechanical and Optical Industries, and vice president of **Fabrilabo**, a French alliance between lab suppliers and purchasers; **Mathis Kuchejda**, president of Analytical and Laboratory Technologies at **SPECTARIS**, a German industry association representing medical, optical analytical, biological, laboratory, and ophthalmic technology companies and of German instrument suppliers, and president of instrument provider Schmidt+Haensch; **Mike Bähren**, head of Economics and Statistics at SPECTARIS; **Takeshi Kawamoto**, chairman of the International Affairs Committee at the **Japan Analytical Instruments Manufacturers' Association (JAIMA)**; **Tim Collins**, director of the Laboratory Technology Sector at **GAMBICA**, the UK trade association for instrumentation, control, automation and laboratory technology; and **Mike Duff**, president of US scientific instrument trade group, the **Analytical, Life Science and Diagnostics Association (ALDA)**.

Brexit Looms

All representatives from the global group of instrument trade organizations cited Brexit as a major issue in regards to analytical instrument and lab product sales growth in the coming year. Many uncertainties about the way in which the Brexit deal will pan out, such as a lack of a soft exit and border delays, remain. Speaking for UK-based companies, Mr. Collins indicated, "Some [companies] are already seeing the beginnings of a slowdown/delay in expenditure, which is likely to continue to impact next year, especially for larger-ticket items. The sales pipeline in most areas is good, but no one is committing to orders."

Additionally, UK government funding initiatives regarding replacement money for EU research are "too vague," said Mr. Collins. "This is affecting the scientific community with regards to future expenditure, and some customers are saying that they are not being considered as participants by other EU organizations," he explained. Discussing his views on the possible impact of Brexit on French instrument and lab product companies, Mr. Pithon agreed. Free trade has simplified

importing products across Europe, he noted, but with Brexit, this will likely be made more difficult. “If the UK leaves, afterwards, you will have to [complete] more paperwork concerning trade with the UK,” said Mr. Pithon. “Paperwork means time, money and price increases.”

“[Post-Brexit], the impact of the UK on standardization will be much smaller.”

Compliance may also be a pressing issue for instrument companies operating in the UK post Brexit, especially in regards to a specific product receiving internationally recognizable compliance designations. “Because of the big compromise made in order to introduce a European directive (for example, the Pressure Equipment Directive), there is the possibility that we may not be able to CE mark using the British equipment standard as some do now,” explained Mr. Collins. “Will UK companies be able to use different countries’ standards without manufacturing in that country? Will stating [British Standards’] standards internationally carry the weight that it did 20 or more years ago? Unless there is some clarity over the very immediate future, this may prove to be a very difficult area.”

Mr. Pithon echoed these sentiments. “A product sold in Europe must be CE marked for quality, which is recognized worldwide, [and] as part of the EU, Britain had a big influence on any European standards, such as CEN [European Committee for Standardization] standards,” he noted. “But after a ‘hard Brexit,’ Britain could perhaps leave the CEN organization and only attend ISO committees, where its weight will be less, as bigger countries (USA, India, China) are involved,” he continued. “The impact of the UK on standardization will be much smaller. This is true for many other international organizations.”

Trade Turbulence and Economic Doubts

China was also mentioned by the trade organization representatives as having a potentially uncertain effect on analytical instrument and lab product sales growth in the coming year, primarily in regards to Chinese competition and the trade friction between China and the US. In regards to ALDA members, Mr. Duff said, “Many companies are concerned how the trade dispute between the US and China will play out, the potential implications for the global markets and what international-focused companies can do to maintain their Chinese business in this environment.” Economic issues growth is also of concern to US instrument makers. “The US economy is currently in its 9th year of expansion and many economists and CFOs expect a recession to occur within the next 2–3 years,” he continued. “The US federal government’s debt is now in the \$21 trillion range with a \$780 billion budget deficit estimated for FY 2018, 17% higher than last year.”

“Nowadays, data management is about turning data into information.”

On the other side of the globe, Japanese instrument suppliers are also concerned about macroeconomic factors. Mr. Kawamoto echoed economic issues as a possible hindrance to instrument and lab product sales in the coming year. “Economic recession [is a factor], not only [between China and the US], but also in Asia, Europe and anywhere else that may be affected by the protectionist movement taking place in the US,” he said. “In addition, given the rising trend in long-term interest rates in the US, the future of developing economies, such as those in Asia and Central and South America, are also a concern.”

Likewise, German analytical instrument and lab product companies are also concerned about US-Chinese tensions. “The US and the Chinese market are the most important sales areas, accounting for 14% and 11%, respectively, of total German exports. The growing trade conflict between these two countries could result in a declining demand and an unfavorable development of the global economy,” explained Mr. Kuchejda and Mr. Bähren. The impact of trade issues has already been experienced by some German companies, according to them. “A first impression of the impact of trade barriers on business we actually witness in Iran: in the first half year of 2018, German exports collapsed by 41%. We anticipate a similar development for Russia.” Mr. Collins agreed about the negative effects of US and China’s trade dispute. “Business in the US is also suffering from uncertainty because of current US trade policy decisions. There is possibly an element of this in other parts of the world.”

In addition to the economic environment, regulatory compliance is also affecting lab instrument suppliers. Mr. Kuchejda and Mr. Bähren cited the increasing number of regulatory requirements around the world (such as RoHS, REACH, IVDD, California Proposition 65 [the Safe Drinking Water and Toxic Enforcement Act], F-gas regulation [the EU’s regulation limiting use of fluorinated greenhouse gases], etc.) as a hindrance for small- and medium-sized companies, as proper implementation requires “time, manpower and results in decreased productivity.” In the UK, Mr. Collins stated that there are also some concerns for companies that need to implement the EU’s new IVD Medical Device regulations and the related costs.

Digitization and AI: A Coming Revolution?

All trade industry group representatives cited AI as a major factor in the digital transformation of labs. A key question, though, is finding the best ways to implement big data and AI into company offerings. Companies in Japan are working to find the best methods to realize AI in the lab. “Some of

our member companies place great expectations on the new markets that will be created by the widespread use of big data and AI,” said Mr. Kawamoto. “They are also working on AI analysis of highly diverse information obtained from analytical instruments to be used for such purposes as the evaluation of drug therapies, proposing of new medical treatments and the discovery of new scientific knowledge driven by big data-based visualization,” he continued. “Their stance is to continue making active investments and to search out and refine these technologies, while watching how these technologies will structurally impact industries and markets over the mid-to-long term.”

“The US and the Chinese market are the most important sales areas, accounting for 14% and 11%, respectively, of total German exports.”

This sentiment is similar in the US, where companies are evaluating the potential future impact of such developments on how customers and vendors each operate. “Like many companies in our industry, the members of ALDA are trying to understand how big data, AI/machine learning, blockchain, IoT, etc. will be used by our customer markets in the future (especially the health care markets), the impact on their research/discovery activities, product development, manufacturing, clinical trials, etc., and the implications for our industry as suppliers of ‘tools’ and technologies,” explained Mr. Duff. “Also, what will customers/users need from our members to facilitate their use of AI, blockchain, etc.?”

Similarly, as Mr. Kuchejda and Mr. Bähren indicated, because AI is still in its beginning stages, many companies are still studying its development. “AI is not used extensively in the laboratory yet. There are initial projects and the German manufacturers are aware of the new possibilities and potential, but still a lot of work has to be done,” they explained. “Therefore, companies are highly anticipating the results of the AI strategy of the German government, which will be pronounced soon and which could have positive effects on the local R&D activities. It is crucial that within this process, data protection and data security issues are considered.” SPECTARIS has established a working group entitled “Connected Laboratory Devices,” in which the organization is working on a collaborative communication standard based on OPC Unified Architecture, an industrial automation communication protocol, developed by the [OPC Foundation](#).

One reason why digitization is still in its burgeoning stages is the changing landscape of data collection itself. “Nowadays, data management is about turning data into information,” said Mr. Pithon. He noted that AI will change data processing, specifically in the IVD and environmental markets, and that it can be extremely influential in application usage of analytical instruments. “Software is very important,” he continued. As an example, he noted how MS had been mainly used

for inorganic analysis, but is now it used for organic analysis, and software was key element in this transition.

“Over the past few years, many members of ALDA have expanded their presence in the diagnostics markets and prioritized investments in diagnostics companies, and this trend is expected to continue.”

The possible effects of such changes may be especially evident in certain markets. As Mr. Collins indicated, a major sector that will implement AI is the diagnostic market. “Health care markets are going to benefit the most from AI, big data and sensors,” he said. “Pharmaceutical companies will still be a source of new drugs/supplements and ongoing business, but the services side of well-being and online diagnostics by apps, computers, etc. will help customers take preventative action and drive more health-related activities. This could provide growth in sectors addressing the consumer health markets.”

Sights Set on Diagnostics Market

These consumer health markets are also providing opportunities for companies traditionally associated with research and preclinical applications for instruments. With new initiatives taking place in the medical community, companies are moving towards the diagnostics arena to diversify and address the age of personalized medicine. “Over the past few years, many members of ALDA have expanded their presence in the diagnostics markets and prioritized investments in diagnostics companies, and this trend is expected to continue,” explained Mr. Duff.

“From health care focused on treatment, inroads are being made worldwide in prevention, early diagnosis and treatment, and individualized medical care.”

This is true worldwide. “We see great market potential in [diagnostics] because of the growing demand for health care in general, the high speed of technological process which leads to new diagnostic possibilities, and the need for fast and efficient clinical tests to lower health care costs,” said Mr. Kuchejda and Mr. Bähren. “The more diagnostic tools focus on the stated market drivers, the higher their market potential will be. As an example, [take] Raman spectroscopy, which changed more and more to a point-of-care diagnostic tool,” they continued. “Another trend is the possibility of improved anamnesis through supported information systems like the electronic patient file and field analysis.”

In Japan, opportunities abound across many segments within the diagnostics sector, including genomics, pathology and pharmaceuticals. “Genomic panel testing markets are also experiencing a period of dramatic startup in Japan,” said Mr. Kawamoto, pointing to the 11 hub hospitals and 300 medical institutions in Japan that have begun genomic panel testing for early cancer detection. Prevention is a key trend, with companies combining digital capabilities with more traditional diagnostic technologies. “As pathology research markets undergo rapid change in response to advances in digital technologies, diagnostic technologies have in particular become a growth market due to the digital revolution,” explained Mr. Kawamoto. “From health care focused on treatment, inroads are being made worldwide in prevention, early diagnosis and treatment, and individualized medical care.”

Mr. Kawamoto indicated these inroads are converging, such as the accelerated development of breakthrough drugs and diagnostic technologies, as well as the streamlining of pharmaceuticals development. In addition, the effect of regulatory changes is ongoing. “Another trend with potential impact is the regulatory revision of the Medical Care Act and other such laws,” he continued. “With plans in place for legal revisions aimed at such issues as securing the accuracy of genomic testing and chromosome analysis, the response of medical institutions to legal reform is in the spotlight.”

Legal issues within the diagnostic sector were echoed by other members as well. Mr. Duff cited regulatory and reimbursement issues as pressing factors for ALDA members, while Mr. Pithon emphasized the need for greater analysis capabilities with the emergence of personalized medicine. Mr. Pithon also cited the rapid consolidation of IVD labs in France, due to more automated testing, as being a major trend in the diagnostics segment. “Twenty years ago, there were over 5,000 labs in France for IVD testing,” he said. “Now there are less than 1,500.”

The M&A Factor

A major opportunity for analytical instrument and lab product companies is M&A, and most representatives of the instrument trade organizations agree that M&A is likely to continue, driving profitability and encouraging competitiveness. Newly formed companies are also a major factor in M&A, according to Mr. Kuchejda and Mr. Bähren. “One relatively new but important element in the business strategy of our members is the cooperation with startups,” they said. “Our companies seek the contact with startups in order to increase innovation, specifically regarding digital solutions. Especially in the analytical and lab sector in Germany, this works out well and benefits both.” SPECTARIS is also providing startup pitches and plans to build a startup network, they added.

Generally speaking, however, Mr. Kuchejda and Mr. Bähren emphasized that there are two sides to M&A that are equally important. “Many of our members are well positioned and often hidden champions in their specific segments. Seen from this powerful position, we consider the M&A activities as an opportunity which allows our companies to broaden and strengthen their enterprise,” they explained. “On the other hand, we will have to observe what will happen in the mid-term, if Chinese companies will intensify their efforts to enter the European market and start with strategic acquisitions.”

“Against a background of ‘work-style reform’ currently underway in Japan, industries are seeking ways to improve work efficiency.”

According to Mr. Collins, Brexit is a major factor in delaying acquisition activity, but M&A is still expected to continue, especially with certain small- and medium-enterprises that have healthy revenues. “The market continues to consolidate leaving larger global players displacing smaller local and national businesses,” he explained. “Some SMEs are also relatively rich and are looking for suitable targets.”

Issues on the Horizon

In regards to future opportunities and risks that the instrument trade organization members are concerned about, Amazon was cited as a potential obstacle by both Mr. Collins and Mr. Pithon, specifically its effect on instrument and lab product distribution as well as larger distributors. Mr. Pithon explained that Amazon could provide new opportunities for small- and medium-sized companies looking for more efficient distribution as Amazon is well known for that. “They also master AI—the question is how they will use it.”

Separately, debates around the workplace are affecting companies in Germany and Japan. “In Germany, business is going well and we have full employment. Whereas this is a comfortable situation for the employees, it is a growing problem for the manufacturers,” explained Mr. Kuchejda and Mr. Bähren. “The national lack of skilled labor continues to increase and affects every kind of company level. For a small- or medium-sized business which is located outside the main cities, it is nearly impossible to recruit well-qualified employees for an adequate salary. In combination with rising commodity prices, this can seriously limit or even harm the economic development.”

Topics of Interest for Global Instrument & Lab Prod. Trade Org. Members		
New and emerging markets	Electric vehicles and clean fuel	International compliance issues
Skilled workforces	Eco-friendly consumer products	Trade tensions between the US and China
Changes in purchasing processes	Chinese environmental regulations	Impact of elections/new federal government
Government strategies and funding	Industrial and public infrastructure	Stock markets, potential recessions
Amazon's effect on distribution	Diversifying semicon. device applications	Recruitment and retention of HR and staff

In Japan, securing a proper workforce is also on companies' minds. "In the international expansion of business, developing and procuring human resources capable of working on globally valid solutions to issues [is important]," noted Mr. Kawamoto. But he also commented on how a cultural shift in Japan in perspectives toward work is creating business opportunities. "Against a background of 'work-style reform' currently underway in Japan, industries are seeking ways to improve work efficiency," Mr. Kawamoto said. "Associated with this are trending needs for analytical instrument labor saving and ease of maintenance."

Efficiency, productivity and new applications continue to be key factors for life science companies, as noted by representatives from analytical instrument and lab product organizations around the world. The outlook for the coming year is positive on the part of these organizations, as they continue to meet the challenges of a rapidly changing world.

ASHG 2018: 10x Genomics and Pacific Biosciences Announce Product Updates

The annual American Society of Human Genetics (ASHG) conference was held October 16–20 in San Diego, California. Total registration, including exhibitors, staff and press, rose 21.2% from last year, when the conference was held in Orlando, Florida, to 9,043. The number of scientific attendees increased 19.3% to 5,918. The number of exhibitors grew 9.4% to 856. In 2016, the last time the show was held in San Diego, it attracted 7,998 total attendees (see [IBO 10/31/18](#)).

Presentations

The presentations that **IBO** attended illustrated both the advancements and continued challenges in genomics research. The value of the results of population-scale genomic analyses was evident by the number of presentations involving samples collected as part of the UK Biobank. On Wednesday morning, Sara Rashkin, PhD, presented "Pan-cancer Analysis Detects Novel Genetic Risk Variants

and Shared Genetic Basis in the UK Biobank Cohort,” discussing her research finding a shared genetic basis of various cancer types based on an analysis of 18 cancer phenotypes. Results from GWAS for each phenotype and cancer outcome revealed 49 regions associated with multiple cancers, and 23 SNPs associated with both positive and negative cancer outcomes.

Introducing the session “Large-Scale Functional Annotation of Variants of Uncertain Significance,” Stan Letovsky, PhD, of LabCorp, highlighted the value of high-throughput functional assays for genomic analysis. As he stated, “Functional annotations are often the only information available regarding the clinical impact of rare variants.” In the future, such assays may be scaled up to whole-genome studies.

As part of this session, in the presentation “Understanding Tumor Heterogeneity from Single Cell Sequencing of Genomes, Transcriptomes and Epigenomes,” Eham Aziz, PhD, of Memorial Sloan Kettering Cancer Center described her work using single-cell RNAseq to characterize “a full range of phenotypic states occupied by immune cells in the breast tumor microenvironment.” In particular, she discussed her labs’ efforts to create bioinformatics solutions to address the challenges of normalizing scRNAseq data. Ideally, she said, there would be different normalization for each cell type, as normalization independent of cell type, does not adequately account for cellular variation.

Based on a collaboration with 10x Genomics, Monte Winslow, PhD’s presentation “Single-cell phenotypes and cancer genotypes” reviewed his work exploring the diversity of the response of single cells to cancer. Specifically, he listed the diversity of cell growth potential, the impact of the genotype of this potential and intratumor cancer cell heterogeneity, as well as using CRISPR/Cas9 to edit cells in mouse models to study lung cancer tumors. He noted the need for better methods for quantification of tumor sizes, which currently rely on histology and imaging. CRISPR/Cas9 was used to generate greater genomic diversity in the mouse models. Sequencing of integrated barcoded vectors enabled the quantification of cancer cell numbers.

Product Introductions

At the show, 10x Genomics launched an update to its Chromium Single Cell Gene Expression Solution, including a new version (v3) of the Chromium Single Cell 3’ Reagent Kit. With greater sensitivity, the v3 solution can now measure twice the number of genes in the same experiment, or the same the number of genes by sequencing only half the number of samples, according to Giovanna Prout, director of Strategic Marketing, Single Cell Genomics, at 10x Genomics.

10x Genomics also highlighted its Chromium Single Cell ATAC Solution (Assay for Transposase-Accessible Chromatin) for epigenetic research using single cells, building on its acquisition in August of Epinomics (see [*IBO 8/31/18*](#)). Compared to other approaches for examining chromatin accessibility such as ChIP-Seq, ATAC-seq has higher sensitivity, improving detection of accessible regions in rarer cells, and requires smaller sample amounts. The 10x Chromium Single Cell ATAC Solution works with as few as a hundred cells. Deliveries began next week.

The company also showcased its Feature Barcoding technology, available in December, with kits for measuring CRISPR perturbation and protein surface cells, each done in parallel with gene expression measurements. Feature Barcoding capability also enables single-cell immune profiling with cell surface proteins, part of the technology's ability to measure gene expression, receptor-pair full sequences, cell surface proteins and cell specificity in the same cell. The company is currently working with BioLegend and Immudex as non-exclusive partners, who are both members of the company's Compatible Partnership Program. The company also plans to partner with additional companies, including guide RNA suppliers for the CRISPR application.

At ASHG 2018, Pacific Biosciences announced a major leap for its SMRT sequencing technology. The company launched v6.0 software and v3.0 reagents for its Sequel long-read sequencing system. The product updates increase read length from up to 30 kb for gDNA and up to 100 kb for amplicons, according to Pacific Biosciences Chief Scientific Officer Jonas Korlach, PhD. The new enhancements are also a major development in that they increase single-molecule read accuracy to over 99%, on par with Illumina's short-read sequencing and Sanger sequencing, according to Dr. Korlach. The new v6.0 software update also provides faster analysis times, benefitting applications such as targeted sequencing and RNA transcript isoform sequencing. These developments will impact Pacific Biosciences' applications in the clinical markets. SMRT technology is already being used for clinical research, including research into genes of pharmacogenomic significance and to resolve structural variation.

Pacific Biosciences told *IBO* that SMRT sequencing will be able to compete directly with Illumina on price per whole genome as the company will next year release the 8M SMRT Cell, with eight times higher throughput. Dr. Korlach said that it will now be more cost effective for researchers to use Pacific Biosciences on all sample types as opposed to just high-value samples. The use of SMRT technology will allow access to structural variation at a price comparative to Illumina's for whole genomes. Other applications include studying rare diseases to further increase solve rates, and de novo assembly of population-specific reference genomes.

Other NGS product launches at the show included Roche's AVENIO Tumor Tissue Analysis Kits for research, consisting of the AVENIO Tumor Tissue Targeted Kit, Expanded Kit and Surveillance Kit. The Kits enable a single workflow for measurement of SNVs, indels, fusions and CNVs. This follows last year's introduction of the AVENIO ctDNA Targeted Kit liquid biopsy, providing a tissue equivalent to that kit. According to the company, it is the only supplier with such panels for both liquid biopsy and tissue analyses, enabling testing for similar results.

Among the products Agilent Technologies promoted at its booth was the Agilent XT HS and XT Low Input Enzymatic Fragmentation Kit. The Kit enables fragmentation of 10–200 ng of DNA. As Kamni Vijay, Vice President and General Manager, Agilent Genomics Division told **IBO**, the Kit is another example of Agilent providing its NGS customers with a full range of options for their workflows. She also emphasized the company's ability to offer customized solutions for NGS as a differentiating factor. Other differentiators from NGS competitors include Agilent's ability to offer its solutions with its own automation and its molecular barcoding IP, acquired with its purchase of Population Genetics Technologies (see [IBO 7/31/17](#)).

Mission Bio and NanoCelect were among the companies exhibiting products introduced within the last year. MissionBio's Trapestry system is a cell capture solution for targeted single-cell analysis using DNA. Up to twenty thousand cells can be analyzed at a time, resulting in a decreased cost compared to lower-capture techniques, such as FACS, according to the company. Applications include QC of CRISPR/Cas9 techniques. Addressing the need for low-cost cell sorting solutions, NanoCelect exhibited the WOLF Cell Sorter. Disposable chips guarantee a sterilized solution with 3-color, 5-parameter sorting at 300 cells per second. The base cost of the system is \$85,000. Applications include validity of CRISPR-modified human iPSC cells. At the show, the company also discussed an informal partnership with QIAGEN for single-cell RNAseq using the WOLF Cell Sorter and QIAGEN QIAseq UPX 3' Transcriptome kit.

Also exhibiting was TriLink BioTechnologies, part of the Maravai LifeSciences group of companies. The 170-person firm offers synthesis of modified nucleic acid products and NGS sample preparation kits, as a direct seller, as well as supplier of kit contents to both research and diagnostic tool companies. Specialties include customized offerings for complex applications, including synthetic RNA and DNA oligonucleotides for bioprocessing, and mRNA with the proprietary enzymatic capping technology, CleanCap. Growing markets for the company's products include gene editing and mRNA therapeutics.

ASHG 2019 will take place October 15–19 in Houston, Texas.

PerkinElmer Acquires GC Firm

Waltham, MA 10/31/18—PerkinElmer announced on its third quarter earnings call that it has acquired Italy-based DANI Instruments. Financial information was not disclosed. DANI's revenues total around \$10 million. On the call, Chairman, President and CEO Robert Friel stated, "Based in Milan, Italy, DANI brings advanced capabilities in gas chromatography to help accelerate our workflow solutions in food, pharma and environmental end-markets."

In the call, Mr. Friel cited DANI's headspace and auto sampling capabilities as particularly notable. DANI's instrument offerings include fast GC and GC/TOF-MS. For sample introduction, it offers static and dynamic headspace, as well as purge & trap and thermal desorption options.

Thermo Fisher Scientific Eyes Possible Divestment

New York, NY 10/30/18—According to [Bloomberg](#), Thermo Fisher Scientific is evaluating the possible sale of its anatomical pathology business. Citing anonymous sources, Bloomberg reports that the sale could be worth \$1 billion. Thermo Fisher provided no comment and has made no decision.

Thermo Fisher's anatomical pathology business, 1 of the 6 businesses that make up the company's Specialty Diagnostics unit, represented 9% of the unit sales in 2017, or over \$300 million, according to an investor presentation from earlier this year. Bloomberg reported that EBITDA for the business totaled \$85 million. Products sold by the business serve histology, cytology and hematology applications.

Merck Sells Flow Cytometry Business to Luminex

Darmstadt, Germany 10/18/18; Austin, TX 10/18/18—Merck has agreed to sell its flow cytometry business to Luminex for \$75 million. The business consists of the Amnis and Guava flow cytometers and associated reagents. "As innovators in flow-based technologies, we are excited to acquire the flow cytometry assets of our existing long-term partner Merck, thereby expanding our portfolio of detection systems to address researchers interested in cellular analysis," commented Luminex President and CEO Homi Shamir. Luminex expects the purchase to contribute \$40–\$50 million in revenue next year. The transaction is scheduled to close by year end. The price consists of \$69.9 million in cash and \$5.1 million in committed inventory purchase.

According to Luminex's conference call discussing the deal, the flow cytometry business is profitable with gross margins in the 50% range. This is Luminex's first acquisition in the research market and expands its offerings for this market beyond its xMAP bead-based multiplex technology. Currently, Luminex only participates in the life science research market through license partnerships with companies for product development and distribution.

As explained on the conference call, the purchase gives Luminex access to an adjacent flow-based technology as well as management, R&D, and sales and marketing expertise. Its flow cytometer business currently has 30 direct sales employees. In particular, Luminex noted the value of the Amnis imaging-based flow cytometry system and IP.

As Mr. Shamir stated on the call, "Nothing prevents Luminex from being closer [to its customers] and using the reputation we achieved with the end-user to introduce to them a new product." But he stressed that the company will not compete with its partners, which include Bio-Rad Laboratories, Merck Millipore and Thermo Fisher Scientific.

Miltenyi Biotec Steps into Microscopy Market

Bielefeld, Germany 10/12/18—Miltenyi Biotec has acquired LaVision BioTec for an undisclosed amount. LaVision BioTec provides light-sheet and multiphoton microscopy solutions for life science labs. LaVision BioTec's TriMScope is capable of simultaneous real-time and deep in vivo imaging. "By combining our expertise in cell analysis and innovative detection reagents with LaVision BioTec's imaging know-how, we will develop pioneering analytical tools for biomedical research," said Stefan Miltenyi, founder of Miltenyi Biotec.

*A Miltenyi Biotec spokesperson told **IBO** that LaVision BioTec has 55 employees. Asked for an example of a specific application or workflow that will benefit from the combination of Miltenyi Biotec's cell analysis systems and reagents and LaVision's microscopes, she provided an example in the field of immunotherapy. "Miltenyi Biotec has a large antibody portfolio to characterize, for example, T cells and tumor cells. The cells can be stained with these antibodies and then be analyzed by imaging with the LaVision BioTec Instruments."*

Teledyne Invests in GC Technology

Thousand Oaks, CA 10/16/18—Teledyne Technologies, a supplier of instrumentation, digital imaging products and software, electronics, and engineered systems, has purchased the assets of Falcon Analytical Systems & Technologies for an undisclosed amount. Based in West Virginia, Falcon is a manufacturer of the compact CALIDUS GC systems. The instruments are installed in 25 countries. Manufacturing will move to Teledyne Monitor Lab's facilities in Englewood, Colorado.

Stephen DeVita, vice president and general manager of Teledyne Advanced Monitoring Solutions, told IBO, "The acquisition of Falcon Analytical Systems & Technology adds to our current GC capabilities and expands our reach into process applications in the petrochemical and air separation industries." Discussing CALIDUS' capabilities, he said, "This fixed or portable GC solution contains advanced technology, protected by patent, which results in faster response times and makes it ideal for monitoring real-time processes."

UK Investigates Thermo Fisher Scientific Acquisition

London, UK 10/24/18—The UK's Competition and Markets Authority has commenced an investigation to determine if Thermo Fisher Scientific's planned acquisition of Gatan (see [IBO 6/30/18](#)) will lessen competition in the UK market. The Authority is currently accepting written comments and will decide by December 19 whether to advance the investigation to Phase 2.

Thermo Fisher Scientific owns FEI, one of the world's largest suppliers of electron microscopy systems (EMs). As a provider of accessories, enhancements and software for EM, Gatan supplies multiple EM companies and customers. Among the techniques that its products enable are electron backscatter diffraction and energy dispersive x-ray spectroscopy, two markets for which UK-based Oxford Instruments also provides detectors and software.

Twist Sets IPO Price

Santa Clara, CA 9/18/18; Washington, DC 10/17/18; Santa Clara, CA 10/29/18—Twist Bioscience, which filed for an IPO last month on the US NASDAQ (see [IBO 10/15/18](#)), has priced the offering at \$14–\$16 per share. With an expected sale of 5.75 million shares, the company is anticipated to raise \$103.5 million at a price of \$16 per share.

Agilent Technologies, which is suing Twist Bioscience (see [IBO 2/15/16](#)), announced that it has sent a letter to the SEC accusing Twist Bioscience of making mis-statements in its S-1 registration statement. Specifically, Agilent contends that Twist Bioscience did not disclose that CEO Emily Leproust was still an Agilent employee when she formed the company and that Twist Bioscience employees took confidential documents from Agilent.

In September, Agilent announced the filing of a second amended complaint against Twist Bioscience and Dr. Leproust, adding two new defendants and the additional facts discussed in the SEC letter (see [IBO 10/15/18](#)). Agilent's letter to the SEC states that although the S-1 notes that Dr. Leproust has served as CEO and president since April 2013, she had admitted under oath that she took the position in November 2011 and that she worked at Agilent until April 2013. The letter also states that Twist employees, including Dr. Leproust retained confidential Agilent documents, including descriptions of Agilent's oligonucleotide synthesis technology and "trade secrets."

Drug Maker Invests in Oxford Nanopore

London, UK 10/18/18—Biotech company Amgen has made a \$66 million equity investment in nanopore sequencing company Oxford Nanopore. deCODE Genetics, an Amgen subsidiary, uses Oxford Nanopore technologies for sequencing. "Oxford Nanopore's long-read sequencing capability creates a window into parts of the genome that have been out of reach, as well as giving us a much better handle on structural variants that confer risk of a wide variety of diseases," commented Kári Stefánsson, founder of deCODE Genetics, an Amgen company. "We have used Oxford Nanopore technology to sequence several hundred human genomes and continue to see the promise of this emerging technology."

The investment is equivalent to a 3% share of the company, according to the [Financial Times](#). The newspaper reported that deCODE Genetics utilizes Oxford Nanopore's desktop PromethION system. The latest funding follows more than \$100 million investments announced earlier this year (see [IBO 3/31/18](#)).

IBO Stock Indexes Fall Along with Markets' Selloff in October

After nine years of a bullish market, the US markets showed great volatility throughout the month of October. The month started off strong for the Dow Jones Industrial Average, S&P 500 and NASDAQ due in part to the revision of the NAFTA accord amongst the US, Mexico and Canada. Also,

investors were optimistic about the upcoming third quarter corporate earnings reports. But the market began to turn starting October 3, as investors sold off riskier assets such as technology stocks due to concerns about various geopolitical events and signs of a slowing US economy. These concerns caused many investors to be risk averse and buy more stable assets, such as defensive utility stocks and US Treasury Bonds. Even though the US major stock indexes experienced minor upswings during the weeks of October 12 and October 22 due to reported corporate earnings, the US market experienced its worst performance since May 2010.

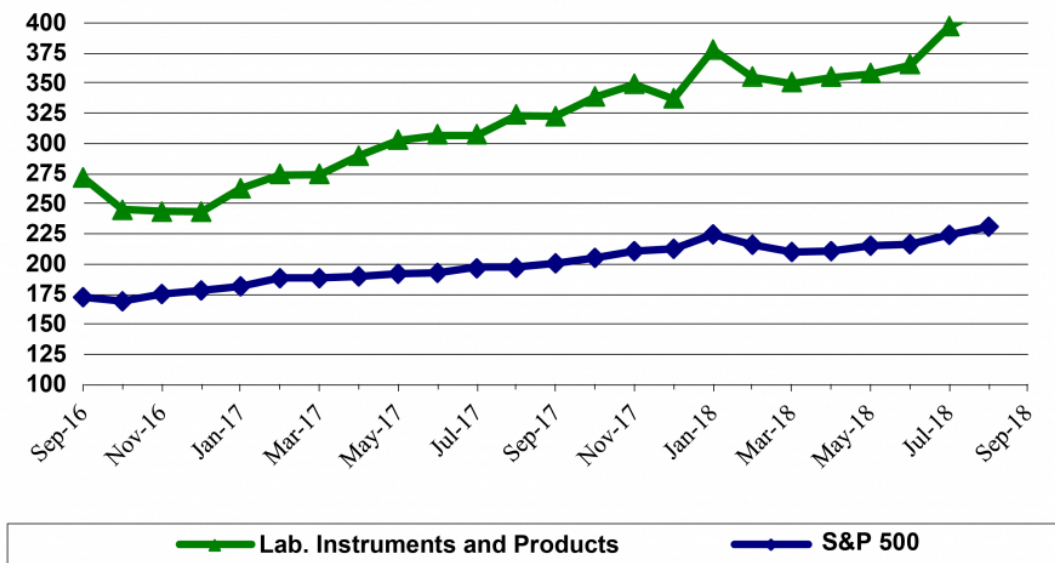
One of the major geopolitical concerns that made investors risk averse was the ongoing US-China trade issue. On October 1, an annual security meeting between the two countries scheduled for mid-October was canceled. The two nations are expected to discuss the trade issue at the upcoming G20 summit meeting. Other geopolitical and economic events such as Italy's populist government contending with the EU about its budget and the ongoing Brexit talks in the UK have majorly impacted foreign markets. Currently, Europe, Japan, Shanghai, Hong Kong, Argentina, and Canada are in correction territory—a drop of at least 10% from a recent high from earlier in the year.

Monthly US oil prices went down 12% because of investors' concerns about the upcoming Iran sanctions that could tighten the global oil supply. However, according to the US Energy Information Administration, inventory for the US is at 6.5 million barrels which is 2% above analysts' expectations.

On October 26, the Commerce Department announced the first estimate of the third quarter GDP, which increased 3.5%, a decline from the second quarter figure of 4.2%. Financial analysts state that despite the decline and other factors such as a low unemployment rate (4.2%), higher wages and rising government spending, there are no signs of accelerated inflation and an imminent recession. However, the Federal Reserve has stated that rising inflation could occur and it still plans to raise interest rates later in the year and in 2019.

For the month, all three major stock indexes experienced losses. The Dow Jones Industrial Average was down 5.1%, the S&P 500 was down 6.9% and the NASDAQ was down 9.2%. Year to date, the Dow is up 1.6%, the S&P 500 up 1.4%, and the NASDAQ up 5.8%.

IBO Laboratory Instruments and Products Stock Index vs. S&P 500



Laboratory Instruments and Products Stock Index

The *Index* declined 9% in October to 384.91, but is up 14.1% for the year. The *Index's* performance was poor with all companies experiencing losses. The worst performing company for the month was **Harvard Bioscience**, declining 24.6%. The company that experienced the least loss was **Waters**, with only a 2.6% decline.

In other news for **Waters**, on October 23, the company reported fiscal third quarter financials and forecast its fourth quarter EPS of \$2.55–\$2.65. For fiscal full-year 2018, the company decreased its earnings guidance by 0.63% of \$8.00–\$8.10.

Harvard Bioscience, on October 25, reported fiscal third quarter financials and forecast fiscal fourth quarter adjusted EPS guidance to be \$0.07–\$0.09. The company revised its fiscal full-year EPS guidance to \$0.20–\$0.22, compared to the previous guidance of \$0.20–\$0.23.

On October 14, **Enzo Biochem** reported fiscal fourth quarter financials. For the quarter, adjusted EPS decreased from \$94,000 to a loss of \$5.8 million. The company did not provide an adjusted EPS forecast for fiscal full-year 2019.

On October 23, **illumina** reported its fiscal third quarter financials. The company forecasted fiscal fourth quarter adjusted EPS of \$1.30–\$1.35 and fiscal full-year EPS guidance of \$5.70–\$5.75, a 52.8% upside. In analyst ratings news, UBS gave **illumina** a “neutral” rating and a \$340 analyst price target, a 4% upside from the October 9 price of \$323.86.

Reporting a consistently strong operational performance, on October 24, **Thermo Fisher Scientific** increased its fiscal full-year 2018 guidance to \$11–\$11.06 resulting in a 16%–17% growth. The guidance was adjusted to reflect a less favorable foreign exchange (a 1% headwind) and cover any potential impact of the US-China trade issue.

QIAGEN announced its third quarter results on October 29, posting an adjusted EPS of \$0.35, a \$0.01 decrease of its third quarter guidance. In addition, the company forecasted its fourth quarter adjusted EPS of \$0.39–\$0.40. For the fiscal full-year 2018, **QIAGEN** increased its guidance to \$1.33–\$1.34 because of the company's strong sales and revenue growth throughout 2018.

up 1.54 because of the company's strong sales and revenue growth throughout 2016.

2018								2017
Company	Date Rep.	Fiscal Quarter	Adj. EPS	Analyst Consensus	Vs. Estimate	YOY Growth	Adj. EPS	
Laboratory Instruments and Products Stock Index								
ENZ	15-Oct	4Q	(\$0.12)	(\$0.06)	⬇️ -\$0.06	NM	\$0.00	
HBIO	18-Oct	3Q	\$0.04	\$0.04	➡️ \$0.00	33.3%	\$0.03	
ILMN	23-Oct	3Q	\$1.52	\$1.25	⬆️ \$0.27	36.9%	\$1.11	
PKI	31-Oct	3Q	\$0.90	\$0.92	⬇️ -\$0.02	23.3%	\$0.73	
TECH	30-Oct	1Q	\$0.98	\$0.95	⬆️ \$0.03	8.9%	\$0.90	
TMO	24-Oct	3Q	\$2.62	\$2.55	⬆️ \$0.07	13.4%	\$2.31	
QGEN	29-Oct	3Q	\$0.35	\$0.33	⬆️ \$0.02	9.4%	\$0.32	
WAT	23-Oct	3Q	\$1.92	\$1.90	⬆️ \$0.02	8.5%	\$1.77	
Diversified Laboratory Stock Index								
DHR	18-Oct	3Q	\$1.10	\$1.07	⬆️ \$0.03	10.0%	\$1.00	
GLW	23-Oct	3Q	\$0.51	\$0.48	⬆️ \$0.03	27.5%	\$0.40	
HON	19-Oct	3Q	\$2.03	\$1.99	⬆️ \$0.04	16.7%	\$1.74	
ITW	6-Oct	3Q	\$1.90	\$1.89	⬆️ \$0.01	2.7%	\$1.85	
TDY	19-Oct	3Q	\$2.43	\$2.05	⬆️ \$0.38	27.9%	\$1.90	
ROP	26-Oct	3Q	\$3.09	\$2.94	⬆️ \$0.15	30.9%	\$2.36	
XYL	30-Oct	3Q	\$0.77	NA	NA	18.5%	\$0.65	

On October 30, **Bio-Techne** reported its fiscal first quarter 2019 results, posting a 9.0% increase in its adjusted EPS to \$0.98. The company did not provide forecast guidance for subsequent fiscal quarters. In rating news, on October 17, Goldman Sachs initiated coverage for **Bio-Techne** and set a “neutral” rating and a \$190 price target, a 4% upside from the current price of \$182.72.

On October 31, **PerkinElmer** announced its third quarter results, posting an adjusted EPS of \$0.90, a decrease of \$0.02 of its guidance. The adjusted EPS guidance was missed because of the negative impact of foreign exchange on the company's organic sales growth. For the fiscal full-year,

PerkinElmer forecasted an adjusted EPS of \$3.60. In ratings news, UBS gave **PerkinElmer** a “neutral” rating and a \$100 price target, a 10% upside from the October 9 price of \$90.87. In other analyst ratings news, on September 20, Morgan Stanley initiated coverage of **Bio-Rad Laboratories**. It set an “equal weight” rating and a \$335 price target, an 11.0% increase from the then current price of \$301.85. On October 17, Goldman Sachs also initiated coverage of **Bio-Rad Laboratories** with a “buy” rating and a \$350 price target, a 21.6% increase from the October 17 price of \$287.78.

On October 9, UBS initiated coverage for various life science companies. **Nanostring Technologies** was given a “buy” rating and a \$23 analyst price target, a 47% increase from the October 9 price of \$16.65. **Bruker** was given a “sell” rating and a \$30 analyst price target, a 10% downside risk of the October 9 price of \$32.49. On October 19, Cowen initiated coverage of **Pacific Biosciences** and set the company with an “outperform” rating and a \$6.50 price target, a 46.1% upside of the October 19 price of \$4.45.

On October 15, **Nanostring Technologies** entered a new \$100 million Term Loan Facility with CR Group (CRG). Proceeds of the term loan facility will be used to refinance the company’s earlier loan from CRG.

Diversified Laboratory Stock Index

The *Index* declined 10.7% in October to 257.96 and is down 5.1% year to date. All the companies in the *Index* experienced losses. **Roper Technologies** experienced the least, declining only 4.5%. In other news, on October 26, **Roper Technologies** increased its fourth quarter adjusted EPS guidance to \$3.10–\$3.14. The company’s fiscal full-year 2018 EPS guidance forecast is \$11.69–\$11.73, a 2.5% increase.

Xylem experienced the greatest loss for the *Index* during the month, declining 17.9%. In ratings news, Credit Suisse initiated coverage for **Xylem**, with an “outperform” rating and a \$86 analyst price target, a 24.7% increase of the October 12 price of \$68.96.

On October 6, **Illinois Tool Works** announced its fourth quarter and full-year 2018 guidance. For the quarter, the company forecasted a GAAP EPS range of \$1.78–\$1.88. The full-year 2018 GAAP EPS guidance expectations increased 15.0% to \$7.55–\$7.65.

On October 19, **Honeywell** increased its 2018 EPS forecast to \$7.95–\$8.00, a 5.3% increase from its previous guidance. This change reflects the strong operational performance of the company. In ratings news, on October 12, Credit Suisse Group AG initiated coverage for **Honeywell** with a “neutral” rating and analyst price target of \$170, a 10.1% increase from the then current price of

\$154.44. In addition, on October 22, Royal Bank of Canada gave **Honeywell** a “positive” rating with an analyst price target of \$156, a 1.4% increase from the October 22 price of \$153.81.

Teledyne Technologies reported its third quarter earnings on October 24. The company provided a fourth quarter GAAP EPS guidance of \$2.15–\$2.20. For the fiscal full year, **Teledyne** increased its GAAP EPS guidance by \$0.53 to \$8.71–\$8.76.

On October 18, **Danaher** reported third quarter financials and forecasted fiscal fourth quarter adjusted EPS of \$1.25–\$1.28. The company also raised its fiscal full-year EPS guidance by \$0.06 to \$4.49–\$4.52.

Corning reported its third quarter 2018 results on October 23. Adjusted EPS increased 28% due to expansion project investments and currency hedges. The company did not provide an adjusted EPS forecast for the fourth quarter and year end.

On October 30, **Xylem’s** narrowed its full-year 2018 EPS guidance of \$2.87–\$2.89 due to the company being impacted by a \$0.05 negative foreign exchange effect throughout the year.

International Stocks

For the month, the Asia Pacific markets were down. India’s Sensex was the least affected, down 4.26%, but Japan’s Nikkei was impacted the most with a 9.1% decline, respectively.

Prices for most of the Pacific region companies in the **IBO** Stock Table decreased this month with the most significant decline for **JEOL**, sliding 24.7%. In contrast, **Hitachi High-Technologies** is the only Japanese company in the Table with gains, rising 8.7%.

European equity markets were also down in October. Italy’s FTSE MIB experienced the biggest loss with an 8.1% decline. The indexes that experienced the least losses were London’s FTSE 100 and Spain’s IBEX 35 which each contracted 5.1% and 5.0% respectively.

Prices for the European stocks in the **IBO** Stock Table were mixed, with many companies showing declines in October. **Merck KGaA** was the biggest winner with a 7.3% increase. In contrast, **Abcam** was the biggest loser, registering a 16.2% decrease.

Sartorius announced its third quarter results on October 23, posting a 22% increase in adjusted EPS to €1.84 (\$2.13).

In ratings news, on October 15, Bank of America upgraded **Spectris** to a “buy” rating. It did not give a specific analyst price target. On October 29, Credit Suisse upgraded **Merck KGaA** from a “neutral” rating to an “outperforming” rating with no price target.

	Market Value	52-Week Range		Price	Change	Change	P/E	EPS
Company: Exchange	(US M)	Low (\$)	High (\$)	10/31/2018	1 Month	YTD	(ttm)	(ttm)
Laboratory Instruments and Products								
Agilent Technologies: n	\$20,730	60.42	75.00	\$64.79	-8.2%	-3.3%	24	2.65
Becton, Dickinson and Company: n	\$61,590	203.99	265.87	\$230.50	-11.7%	7.7%	22	10.44
Bio-Rad Laboratories: n	\$6,740	214.44	345.15	\$272.85	-12.8%	14.3%	52	5.22
Bio-Techne: o	\$6,328	121.27	206.04	\$167.72	-17.8%	29.5%	37	4.55
Bruker: o	\$5,025	28.13	36.53	\$31.33	-6.3%	-8.7%	24	1.29
Enzo Biochem: n	\$157	3.05	10.15	\$3.32	-19.4%	-59.3%	NM	-0.21
Fluidigm: o	\$211	4.45	8.62	\$7.20	-3.9%	22.2%	NM	-0.91
Harvard Bioscience: o	\$145	2.95	6.70	\$3.96	-24.6%	20.0%	21	0.19
Illumina: o	\$45,739	203.83	372.61	\$311.15	-15.2%	42.4%	53	5.84
Kewaunee Scientific: o	\$78	24.56	38.80	\$28.60	-9.2%	-1.4%	17	1.64
Luminex: o	\$1,279	18.62	35.37	\$28.77	-5.1%	46.0%	35	0.82
Mettler-Toledo: n	\$13,885	521.79	697.26	\$546.82	-10.2%	-11.7%	29	18.72
MTS Systems: o	\$844	42.00	57.50	\$47.35	-13.5%	-11.8%	26	1.79
NanoString Technologies: o	\$397	5.87	18.86	\$15.41	-13.6%	106.3%	NM	-2.34
Pacific Biosciences: o	\$587	2.02	5.82	\$4.45	-17.7%	68.6%	NM	-0.74
PerkinElmer: n	\$9,576	69.21	98.33	\$86.48	-11.1%	18.3%	25	3.41
QIAGEN: o	\$8,224	30.20	39.45	\$36.30	-4.2%	17.4%	26	1.37
Quanterix: o	\$418	13.00	24.81	\$17.51	-18.3%	-10.4%	NM	-8.30
Thermo Fisher Scientific: n	\$94,113	181.51	249.95	\$233.65	-4.3%	23.1%	22	10.66
Waters: n	\$14,619	167.94	220.20	\$189.69	-2.6%	-1.8%	24	7.97
Diversified Laboratory								
AMETEK: n	\$15,534	64.91	81.92	\$67.08	-15.2%	-7.4%	23	2.97
Corning: o	\$25,573	26.11	36.56	\$31.95	-9.5%	-0.1%	19	1.69
Danaher: n	\$69,670	91.65	110.13	\$99.40	-8.5%	7.1%	22	4.43
Honeywell	\$107,210	133.71	162.52	\$144.82	-13.0%	-5.6%	18	7.95
Illinois Tool Works: n	\$42,781	119.38	179.07	\$127.57	-9.6%	-23.5%	17	7.47
Roper Technologies: n	\$29,236	252.23	312.65	\$282.90	-4.5%	9.2%	25	11.29
Teledyne Technologies: n	\$7,947	166.68	250.87	\$221.28	-10.3%	22.2%	26	8.53
Xylem: n	\$11,779	63.71	82.44	\$65.58	-17.9%	-3.8%	25	2.65
Laboratory Instruments and Products				\$384.91	-9.0%	14.1%	29	
Diversified Laboratory				\$257.96	-10.7%	-5.1%	22	
Dow Jones Industrial Average				25,115.76	-5.1%	1.6%		
S&P 500				2,711.74	-6.9%	1.4%		
NASDAQ Composite				7,305.90	-9.2%	5.8%		
Region	Market Value	52-Week Range		Price	Change	Change	P/E	EPS
Company	(Local M)	Low (L)	High (L)	10/31/2018	1 Month	YTD	(ttm)	(ttm)
Pacific Shares								
GL Sciences: t	¥17,210	1,211	2,345	¥1,538	-11.2%	-28.3%	11	¥144.01
Hitachi High-Technologies: t	¥586,084	3,350	5,680	¥4,255	8.7%	-10.4%	6	¥765.18
HORIBA: t	¥225,409	4,825	9,590	¥5,300	-12.0%	-21.9%	5	¥1,032.02
JEOL: t	¥181,368	1,144	2,595	¥1,856	-24.7%	190.5%	40	¥46.90
Precision System Science: os	¥7,013	273	791	¥304	-23.2%	-54.0%	NA	¥50.51
Shimadzu: t	¥844,688	2,290	3,670	¥2,853	-19.9%	11.4%	26	¥107.81
Techcomp: hk	HKD 892	1.55	5.20	¥3	0.0%	81.0%	NM	(\$0.01)
European Shares (London)								
Abcam: l	£2,460	9.53	15.88	£12.00	-16.2%	13.7%	40	£0.30
Halma: l	£5,042	11.36	15.07	£13.28	-8.1%	5.4%	29	£0.45
Horizon Discovery: l	£280	1.28	2.64	£2.00	-4.8%	-16.7%	NA	-£0.14
Oxford Instruments: l	£539	6.76	11.16	£9.40	-5.1%	10.5%	17	£0.56
Scientific Digital Imaging: l	£35	0.12	0.47	£0.39	-8.8%	56.5%	22	£0.02
Spectris: l	£2,528	19.33	29.57	£21.44	-8.3%	-13.8%	22	£0.99
European Shares (Other)								
Biotage: st	SEK 7,765	66.50	136.80	SEK 120.00	0.7%	42.9%	48	SEK 2.50
Datacolor: s	CHF 133,592	784.00	900.00	CHF 795.00	-4.2%	-5.4%	30	CHF 26.49
Merck KGaA: g	€ 12,270	75.26	94.94	€ 94.94	7.3%	5.8%	18	€ 5.16
Sartorius: g	€ 4,156	72.96	140.50	€ 111.00	-11.9%	47.2%	20	€ 5.64
Tecan: s	CHF 2,670	178.60	256.00	CHF 227.20	-2.2%	12.1%	71	CHF 3.18

Thermal Desorption

Thermal desorption (TD) is a sampling technique used with GCs that concentrates volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) in order to improve sensitivity and provide better peak shapes on instrument chromatograms. Normally, these compounds would be extremely difficult or impossible to distinguish on instrument readouts through ordinary analysis, but TD allows users to analyze these compounds more easily in a streamlined process. TD offers several advantages over other sample preparation techniques due to its speed and automation. Most modern TD instruments can be integrated with GC or GC/MS systems to run continuously to reduce waste and improve sample throughput.

The basic principle of TD relies on the higher vapor pressure of VOCs. Depending on the application, soil, foods, polymers or other materials containing VOCs are placed in stainless steel or glass TD sample tubes. While sample tubes are commonly used for the technique, several sampling alternatives exist, including direct sampling from the atmosphere. First, the sample is heated to high temperatures, causing the volatile compounds to separate from the sample. An inert carrier gas, such as nitrogen, moves the volatile compounds to a sorbent tube to be collected and concentrated. This sorbent tube is then heated to release the volatile compounds into the inlet of a GC. This process is known as a single-stage operation, and has been in use since the 1970s when the technique was first utilized for GC.

Unlike older TD instruments that utilize a single-stage operation, most modern TD instruments utilize a two-stage operation. In a two-stage operation, instead of leading directly to the GC, the sorbent tube leads to a narrower focusing/cold trap to further concentrate the desired compounds. This trap can be packed or unpacked with sorbent and is often cooled below room temperature. The trap is then heated while a stream of carrier gas moves the collected compounds into the GC for analysis. This second step improves the sensitivity and peak shapes. Newer TD systems also allow users to collect the volatile compounds from an outlet just before the GC inlet for later analysis under different conditions.

The most common applications for TD involve intaking a set volume of air into a TD sample tube for analysis. Applications include occupational health monitoring, toxic emissions from manufacturing processes, and vehicle and environmental air quality testing. While air monitoring and testing is the

most common application for TD, many other applications exist, ranging from flavors and fragrances testing to residual chemical testing in pharmaceuticals.

PerkinElmer is a leading vendor for TD, and has been since the introduction of the technique in the 1970s. PerkinElmer's TurboMatrix line of TD instruments comes in a variety of configurations to meet users' needs. Markes is another prominent vendor of TD instruments with its UNITY and TD100 instruments. The company's partnership with Agilent Technologies allows its TD instruments to easily integrate with Agilent's line of GC systems. Shimadzu is also a top vendor for TD, with its new TD-30 series of TD systems released earlier this year, which can be equipped with up to 120 samples for large-volume automated analysis. Prices for TD vary, as sample tubes can be a few hundred dollars while instruments can cost a few thousand dollars.

Growth in demand for the TD market should follow a similar course as GC and GC/MS, both of which are expected to increase in the low to mid-single digits over the next several years. The largest area of growth will come from the applied sector for its use in environmental testing and applications in the food and beverage industry.

TD at a Glance:

Leading Vendors

- Markes
- Shimadzu
- PerkinElmer

Largest Markets

- Environmental Testing
- Cosmetics
- Agriculture and Food

Instrument Price

- \$4,000–\$35,000

Metals and Mining

Capital expenditure within the top 10 metals and mining companies is on the rise for the first time in 5 years. Expenditure is expected to reach approximately \$35 billion in 2018, as M&As rise and commodities prices fall.

M&A within the metals and mining sector has been at its highest levels since 2012, thanks in part to landmark deals such as Barrick Gold's acquisition of Randgold Resources at \$5.4 billion. Leading

companies in the industry have been unveiling growth options, raising annual exploration budgets and increasing their stakes in global projects. Company growth is imperative for providing value to shareholders, and by presenting advancement strategies, metals and mining companies are hoping to return cash to investors.

Some companies have a cautiously positive outlook, albeit short-term, as raw materials have fallen due to issues regarding the US-China trade conflict; however, there is still a demand for raw materials, as investments in exploration are continuing to take place. Weakening demand for industrial commodities is also affecting issues within the metals and mining sector.

Source: [*Bloomberg*](#)

R&D

According to data from the NSF, in 2016, US companies spent \$375 billion on R&D performance, an increase of 5.3%. The majority of R&D went towards applied research, totaling \$61.0 billion, up 8.1%. Basic research spending jumped 13.1% to \$24.6 billion in 2016, and general development grew 4.1% to \$289.0 billion, making up the majority, or 77%, of total R&D spending. Companies' internal sources of funding increased 7.1% to \$318 billion, while funding from other sources was \$57 billion in 2016, a 3.7% drop.

The chemicals and pharmaceuticals industries spent \$73.6 billion and \$64.6 billion on R&D in 2016, respectively, while professional, scientific and technical services' R&D performance spending totaled \$37.3 billion. Within that industry category, scientific R&D services totaled \$66.6 billion.

Micro-, small- and medium-sized companies, defined as organizations with between 5 and 249 domestic employees, conducted 11% of total US R&D in 2016, with an R&D-to-sales ratio, or R&D intensity, of 7.8%. In terms of sales, these companies represented 6% of all sales and staffed 9% of the 19.3 million employees that worked for R&D companies that perform or fund R&D. Large companies, defined as firms with 250 to 24,999 domestic employees, unsurprisingly, performed the vast majority of total US R&D in 2016 at 53%, with an R&D intensity of 4.4%. These companies represented 49% of sales and staffed 46% of workers at R&D performing or R&D funding organizations.

In regards to capital expenditures, the chemicals industry spent \$40.6 billion in 2016, while the pharmaceuticals and medicines industry had expenditures of \$16.6 billion. For professional, scientific and technical services, 2016 capital expenditures reached \$19.5 billion, with scientific R&D services spending \$1.6 billion of that figure.

Source: [NSF](#)

Pharmaceuticals

Many rare diseases lack effective treatments, despite the over 500 orphan drug therapies that have been approved in the US over the past couple decades. Between 25 million and 30 million people in the US are affected by 7,000 rare diseases. Thanks to an increased focus on these diseases on the part of scientists, researchers and the US FDA, there has been a large increase in new therapeutic options, especially in 2017 and 2018, with the FDA approving 80 new orphan indications in 2017 and 57 in the first 8 months of 2018. These approvals mark the highest annual numbers of approved orphan indications since the Orphan Drug Act was established in 1983.

Advances in genetics, biomarker discovery and next generation therapeutic approaches to treatment have fast-tracked precision medicine and, therefore, the number of potentially life saving orphan drugs. Since August, 503 orphan drugs have been approved in the US, with 78% having solely orphan indications and 22% having both orphan and non-orphan indications.

Total 2017 drug spending in the US was \$451 billion, with 56% of the total for non-orphan traditional drugs, 35% for non-orphan specialty drugs and 10% for orphan indications of approved orphan drugs. While these drugs account for a small portion of the overall budget for medicine, orphan indication spending has slightly increased as a share of overall spending within the US pharmaceutical industry.

Source: [IQVIA](#)

South Africa

In 2016–17, South Africa's gross domestic expenditure on R&D (GERD) totaled ZAR 35.7 billion (\$2.4 billion), an increase of 10.4%. As a percentage of GDP, GERD grew two basis points to 0.82%. Although GERD is increasing, year over year, GERD is slowing down in real terms, now 1.5 percentage points lower than in 2015–16 at 3.5%.

The higher education sector accounted for the fastest increase in overall GERD, growing 18.0% to ZAR 11.7 billion (\$797 million), while the business sector's R&D spending increased 7.0% to ZAR 14.8 billion (\$1.0 billion). Government expenditure on R&D moderately increased 4.2% to ZAR 2.1 billion (\$142.5 million) and nonprofit spending spiked 14.3%, totaling ZAR 1.0 billion (\$69.6 million).

While most industries' R&D expenditures are on the rise, R&D spending for manufacturing and mining has been continuing its steady decline. The category of natural sciences, technologies and engineering had a solid 13.7% increase in R&D spending, with ZAR 4.42 billion (\$306.6 million) spent in 2016–17. Energy resources R&D surged over 200%, jumping from ZAR 178.4 million (\$12.2 million) to ZAR 556.1 million (\$38.0 million), while mineral resources R&D expenditure dropped a hefty 24.5% to ZAR 1.3 billion (\$90.0 million). Biotechnology R&D spending dropped 0.7 of a percentage point to represent 5% of GERD at ZAR 1.8 billion (\$122.3 million), while nanotechnology R&D expenditure similarly fell 0.3 of a percentage point to account for 2% at ZAR 853.1 million (\$58.4 million).

Geographically, most R&D activities continue to take place in Gauteng, while R&D spending is rising in the Western and Eastern Cape. While the business and government sectors comprise the vast majority of R&D expenditures, foreign funding has also increased, representing 12% of GERD in 2016–17 at ZAR 4.2 billion (\$285.4 million). Applied research accounted for 48% of GERD, while basic and experimental research represented 27% and 26%, respectively.

Source: [*Department of Science and Technology, Republic of South Africa*](#)

Saudi Arabia

Saudi Arabia is making efforts to finance refining and petrochemicals in order to diversify its multi-decade dependence on crude oil. Saudi Aramco, a state-owned oil company, has invested in over \$100 billion in refining and chemical projects, and is investing in a complex with Total SA valued at \$9 billion. The efforts are being led by the crown prince of Saudi Arabia, with Saudi Aramco preparing for an IPO to help fund the region's economic transformation.

According to data from the International Energy Agency, the demand for petrochemicals are on a growth streak that will spike faster than any other segment of the oil industry. Chemicals that are produced from crude oil are expected to represent approximately 33% of the jump in oil use by 2030, according to the Agency, and 50% of growth in demand by 2050.

A method to help facilitate the move from crude oil to refined and petrochemicals is by integrating refining with petrochemicals, as Saudi Aramco is planning. The company will use both gases and fuels from its refineries to optimize output of chemicals that are of higher value. Likewise, its collaboration with Total SA will accelerate production of raw materials and plastics for multiple industries, such as medical, construction and automotive.

Source: [*Bloomberg*](#)

EU

In a survey of over 2,500 business leaders in France, Germany, Spain and the UK to gauge reactions to the March 2019 Brexit deadline, 68% of respondents indicated that they are “prepared” for Brexit, despite political and economic uncertainties. Businesses are primed for whatever may come, with 83% of organizations having some kind of Brexit “taskforce” in place. This confidence lies more in the impact that Brexit will have on respondents’ businesses, however, for 64% of respondents across Europe are apprehensive about the UK’s exit from the EU, with most respondents stating that remaining within the EU is more preferable for the UK.

More than half of companies surveyed, or 65%, stated their belief in tariff-free goods for the UK. Around the same percentage of respondents also expect an increase in employees post-Brexit. But 88% forecast their companies’ sales to either increase or remain the same in the first year after the UK’s departure. UK businesses tend to have more anxiety over the potential impact of Brexit, with 74% expressing concern compared to an average of 61% for French, German and Spanish businesses.

Approximately 85% of respondents’ companies in the UK have response teams for Brexit, as do 82% in France, 80% in German and 84% in Spain. At the same time, just 40% of respondents have strategies to deal with supply chain issues, and less than a quarter are planning outreach efforts to policymakers.

Source: [*FTI Consulting*](#)

MS & LC/MS

Company Announcements

Elementar announced in September that its Japanese isotope-ratio MS customers will now be directly supported by the company. These customers were previously supported by **JASCO**.

In September, proteomics CRO and product provider **MRM Proteomics** partnered with nonprofit **Exactis Innovation** to develop and validate a clinical proteomic test to identify immune signatures and tumor mutation profiles to better match patients with the most effective treatments. The company calls the test the first immuno-MALDI test to measure the activity of multiple cancer-associated proteins in patients’ tumors.

Thermo Fisher Scientific announced in September its intent to open multiple Global Customer Solution Centers serving food, beverage, pharmaceutical and biotechnology laboratories, by developing critical workflows and integrated solutions that help advance chromatography and MS. One collaboration will be between the Delhi, India-based Center and the **Food Safety and Standards Authority of India**. The inaugural phase of the new global strategic initiative will be marked by multiple Customer Solution Center openings in locations across the world including India and China, followed by additional centers in the US and Europe.

In October, **Thermo Fisher Scientific** entered into a two-year collaboration with **Symphogen**, an oncology-focused clinical-stage antibody company, to deliver validated, platform workflows for simplified characterization and quality monitoring of complex therapeutic proteins. It builds upon a decade-long relationship. Symphogen will use the Thermo Scientific Q Exactive Plus Orbitrap LC-MS/MS system. The collaboration will feature an additional focus on the development of automated multi-attribute method workflows for monitoring critical quality attributes of proteins using high-resolution accurate-mass MS in a QC environment.

In October, **Bruker** expanded its relationship with **Bioinformatics Solutions**, developer of *PEAKS* software, to include reselling. *PEAKS* can efficiently analyze *timsTOF Pro* data for ID, label-free quantitation, and quantitation with isotopic labeling such as TMT, iTRAQ and SILAC. *PEAKS* can now also use all four dimensions of *timsTOF Pro* data to deconvolute spectra from species that overlap in two or more dimensions.

In October, **IonSense** announced that its collaboration with **Cayman Chemical** has resulted in a validated mass spectral database of one thousand compounds for the rapid screening of drugs of abuse using Direct Analysis in Real Time (DART) MS.

Agena Bioscience and **DaRui Biotechnology** announced in October the formal registration of Agena Bioscience's AgeMassARRAY with the **Guangdong Food and Drug Administration**, stating it is the first China FDA-approved MALDI-TOF MS system to directly detect nucleic acids for IVD in China. It is commercially branded in China as the DR MassARRAY.

Product Introductions

In September, **Thermo Fisher Scientific** launched the Thermo Scientific VetDrugs Explorer Collection, a single-provider LC/MS/MS-based solution for quantitation of multi-residue veterinary

drugs in complex animal-derived sample matrices. The Collection, which includes a QuEChERS kit, LC column, LC/MS/MS, triple quadrupole MS and compound database, can currently meet current regulatory standards of more than 160 veterinary drugs in analytically challenging sample matrices.

Thermo Fisher Scientific introduced in September the Thermo Scientific ISQ EM single quadrupole MS system, featuring a mass range of 10–2000 m/z. The system's heated electrospray ionization (HESI) and dual HESI/APC probes facilitate the measurement of polar and non-polar analytes, enabling application flexibility.

In October, **Bruker** introduced updates to its timsTOF Pro system, including large-scale, reproducible, accurate collision cross section (CCS) values for tryptic peptides and a CCS-based lipidomics workflow that includes CCS prediction using machine learning. The new *FastPro* method enables higher peptide and protein group ID rates with better sequence coverage and enhanced detection of post translational modifications.

Waters introduced in October the RenataDx Screening System, a flow-injection tandem MS (FIAMS-MS) system for clinical research labs. It provides rapid high-throughput analysis of extracted dried blood spots and other human biological matrices. It can run any suitable FIAMS/MS LDT or ready-to-use reagent kit. The System consists of the Xevo TQD IVD MaMS, the ACQUITY UPLC I-Class IVD Binary Solvent Manager and the 3777C IVD Sample Manager. The RenataDX Screening System is manufactured as an US FDA Class I medical device and is CE marked.

908 Devices added in October a novel predictive fentanyl classifier to its MX908 multi-mission trace chemical detection device. The classifier can recognize the molecular structure of more than two thousand previously undetectable fentanyl analogs.

Molecular Spectroscopy

Company Announcements

This spring, **mut** changed its name to **Nynomic**.

In August, **HORIBA** relocated the HORIBA New Jersey Optical Spectroscopy Center, its New Jersey-based development and production center for optical analysis and measurement instruments, from Edison to Piscataway. The new ¥1.2 billion (\$10.9 million), 505,301 ft² (46,944 m²) Center is 1.9

times larger than the previous one, houses 210 employees and includes an application lab. The new facility consolidates previous sites.

Modern Waters, which makes the Microtox toxicity test systems, announced in August that Chinese firm **Hangzhou Shangtuo Environmental Technology** has acquired a 5% share in the company for £552,349 (\$704,899).

In September, **Photothermal Spectroscopy** named **Blue Scientific** as a distributor for its mIRage IR microscope for the UK, Ireland and the Nordic region.

OndaVia, a manufacturer of portable Raman tools, has opened a European division based in the Netherlands.

Applied Photophysics, a provider of systems for biophysical characterization of biomolecules, signed a distribution agreement in October with **Particular Sciences** for Ireland and Northern Ireland.

In October, **Endress+Hauser** announced plans to build a new 100,000 ft² (9,290 m²) Gulf Coast Regional Center Campus in Pearland, Texas. Construction is scheduled to begin in 2019 with completion by the end of 2020. The campus will include areas for calibration, repair and training space and a Process Training Unit. It will also house the Global Marketing and Applications group for the **SpectraSensors'** Gas Analysis business and contain space for approximately 110 employees including Endress+Hauser's sales and service provider **Vector Controls & Automation**.

In October, **GemmaCert**, a developer of NIR-based potency testing solutions for cannabis testing, partnered with **Ethnic World**, **Phytolite** and **Yair Technologies** for distribution in Switzerland, Italy and Israel, respectively.

Product Introductions

BUCHI Labortechnik launched in June the cost effective, at-line-ready ProxiMate NIR Instrument for the food and feed industries. The wavelength range allows for measurement of parameters that are independent of NIR such as color, and degree of bake or roast.

In September, **Rigaku Analytical Devices** introduced the Rigaku ResQ CQL analyzer, its next generation 1064 nm handheld Raman system designed for use by first responders, border protection and law enforcement. It features improved ergonomics and analytical performance.

HORIBA Scientific launched in September the Lumetta, a compact, fixed grating spectroscopy system. The imaging spectrograph enables multitrack spectroscopy and fast hyperspectral imaging. It features a signal-to-noise of 1200:1.

In September, **Field Forensics** released the HandyRam II handheld Raman spectrometer, featuring a simple user interface.

Agilent Technologies debuted in October the Agilent 8700 Laser Direct Infrared chemical imaging system. The load-and-go system combines quantum cascade laser technology with rapid scanning optics and Agilent Clarity software.

Bruker released in October the Honey-Profiling 2.0 method for its NMR FoodScreen platform, developed in collaboration with **QSI** and **Alnumed**. It features an expanded reference database of 18,000 honey samples.

Sales and Orders of Note

In September, **PerkinElmer** announced that its Spotlight 200 FT-IR Microscopy System is being used by the UK's **Royal Botanic Gardens** to analyze plant and fungal specimens.

JEOL announced in September that the **University of Houston**'s chemistry department has purchased 2 additional NMR systems, bringing its total number of JEOL NMRs to 4, including the pharmacy department's system.

In October, **JEOL** was awarded a contract by the **US Drug Enforcement Agency's Office of Forensic Sciences** for nine **JEOLJNM-ECZ500R** 500 MHz NMR spectrometers as well as Royal HFX Probes. The contract allows for replacement of the existing instruments over the next five years.

Informatics

Company Announcements

Cheminformatics firm **ChemAxon** announced in May a strategic partnership with **SciBit**, a semantic analytics company.

ChemAxon and **Bio-ITech** announced in July the integration of their respective Marvin JS chemical drawing browser component with the eLABJournal ELN.

In October, **ChemAxon** integrated its Marvin JS tool with **ONTOFORCE**'s DISCOVER for semantic searches for medicinal chemistry.

In September, **Riffyn** announced the integration of its platform with **OSIsoft PI** Server software, which many customers rely on as a primary data source for fermentation performance and analysis using the Data Agent software.

In September, **Optibrium**, **Intellegens** and **Medicines Discovery Catapult** received a grant from **Innovate UK** to fund a \$1.3 million (£1 million) project to work with UK's **Medicines Discovery Catapult** over the next two years to apply machine learning in drug discovery, specifically ADMET.

In September, **Enigma Biomedical Group** announced a collaboration agreement with **Invicro**, a **Konica Minolta** company, to develop Synaptic Density Biomarker Imaging for understanding neurodegenerative diseases. Enigma will hold the various commercial and distribution licenses and be responsible for development and global tracer access. Invicro will focus on informatics solutions for better interpretation.

Linguamatics, a natural language processing text analytics provider, and data management firm **LabKey** announced in September an integrated solution designed to streamline the extraction and curation of valuable insights from large volumes of unstructured clinical notes and reports.

In September, LIMS provider **LabVantage Solutions** named John Heiser as CEO, replacing President Ram Velidi. Most recently, Mr. Heiser was president and COO of **Magnetrol**, a manufacturer of advanced process control solutions.

LIMS firm **Accelerated Technology Laboratories** (ATL) entered into a strategic partnership in September with **Sequence**, a provider of quality and compliance solutions. Sequence has become an ATL Certified Delivery Partner.

In October, **PerkinElmer** partnered with **Elemental Machines**. The companies introduced the Asset Genius system for Laboratory Monitoring, the latest addition to PerkinElmer's OneSource Laboratory Services and analytical solutions. The Asset Genius solution continuously monitors lab and asset conditions' advanced analytics to provide utilization data 24/7. Wireless sensors monitor lab and

asset parameters, such as temperature, humidity, air pressure and light, plus utilization of equipment like freezers, refrigerators, ovens and incubators, to ensure that potential problems are addressed quickly.

Xconomy announced in October that **Elemental Partners** this summer raised \$9 million as part of a Series A round led by new investor **Digitalis Ventures**. Total outside investments are now around \$11.5 million.

In October, chemistry software firm **Cresset** integrated its platform with **Elixir Software's** cloud-based chemTraX platform for real-time workflow tracking for managing, analyzing and reporting all processes within and between drug discovery projects.

LabArchives partnered with **OpenStax** in October to integrate their respective digital lab notebooks and textbooks.

In October, **Schrödinger**, which conducts drug discovery through advanced computational methods and enterprise software solutions, and **WuXi AppTec**, a pharmaceutical and medical device R&D enabling platform company, formed **Faxian Therapeutics**. The new venture will leverage the precision molecular design platforms developed by Schrödinger and accelerate them through partnership with the lead optimization services provided by WuXi AppTec.

Product Introductions

In September, **Genestack** released the Expression Data Miner for interrogating and visualizing transcriptomics data at scale. It also announced the Omics Data Management app, to be released in spring 2019, for loading, curating and processing of large volumes of public and private multi-omics datasets.

Riffyn, a provider of research design, data capture, and analytics software, launched in October Riffyn Open Access, providing free use of its Scientific Development Environment to any members of a nonprofit organization.

In October, **Abbott Informatics** debuted v11 of the STARLIMS Life Sciences Solution, its LIMS platform for pre-clinical, clinical, biorepository, molecular and academic research. A partnership between Abbott Informatics and **Data Innovations** enables STARLIMS Life Sciences Solution to be

directly connected with a wider range of third-party instrumentation. In addition, STARLIMS Life Sciences Solution has now been converted to HTML5.

Genedata debuted in October the Genedata Imagenex, calling it the first commercial and instrument-agnostic software that automates the analysis of HCS images. Currently available in an early access program, the software is scheduled to begin licensing in early 2019.

In October, **Advanced Chemistry Development (ACD/Labs)** released ACD/Spectrus v2018.1, which includes updated LuminataMetaSense features, new additions for NMR and MS dereplication, and the new ACD/Method Selection Suite for chromatography.

Elemental Machines launched in October Element-D (Data), an IoT data collection device that connects OEM instruments to the cloud to automate the collection of scientific data and metadata, such as maintenance and calibration records, and critical performance and utilization metrics.

Sales and Orders of Note

In September, **Genedata** announced an extension of its long-term partnership with **Bayer**. Genedata currently supports Bayer's Crop Science division. This extends the partnership to include a license to the Genedata Selector. Genedata will support Bayer in the processing, storing, analysis and evaluation of genomic data for the development of new fungicides against field fungi.

In October, **Certara** announced that the **FDA** has renewed, and in many cases increased, its number of Certara software licenses for reviewing new drug and biologics applications. The increase includes the use of Certara's Phoenix software platform to nearly four hundred users. The FDA has also renewed its licenses for the physiologically based pharmacokinetic Simcyp Population-based, Pediatric, Animal and Cardiac Safety Simulators.

Cresset announced in October that **Cancer Research UK Manchester Institute** has licensed its Flare platform for insights into structure-based drug design. The Institute currently uses Cresset's Spark, Forge and Torch ligand-focused applications.

Bioprocess Analysis

Company Announcements

Penn State announced in April a collaborative partnership with **Sartorius Stedim Biotech** to advance multidisciplinary teaching and research in biotechnology. Part of Sartorius' investment will be to enhance the Fermentation Facility that will play a significant role in Penn State's Center of Excellence in Industrial Biotechnology. Sartorius will provide state-of-the-art fermentation technologies, and a central laboratory within the Fermentation Facility will be named the Sartorius Fermentation Gallery.

In September, **Sartorius Stedim Biotech** entered into a collaboration agreement to integrate **Repligen**'s XCell ATF cell retention control technology into its BIOSTAT STR large-scale single-use bioreactors to create novel perfusion-enabled systems. This enables a single control system for 50–2,000 L bioreactors used in perfusion cell culture applications. The companies will further collaborate to equip Sartorius' ambr 250ht perfusion single-use mini bioreactor system with Repligen's KrosFlo hollow fiber filter technology. The bioreactor system will be sold by Sartorius as a complete single-use assembly.

Pall announced in September a strategic partnership with **Celltheon**, a cell line and expression technology platform development company, involving Celltheon's SMART Expression Platform.

In September, **Pall Biotech** entered into a strategic partnership with **Aetos Biologics**, a biosimilar cell line development company.

In September, **Pall** entered into a collaboration with **G-CON Manufacturing**, a provider of prefabricated, prequalified cleanroom solutions. The companies will supply turnkey continuous bioprocess or viral vector production facility solutions, including mobile, prefabricated cleanroom units.

In October, **Pall** progressed a strategic partnership with the **University College London (UCL) Biochemical Engineering department** with the creation of the UCL-Pall Biotech Centre of Excellence (CoE) for research and training. The CoE will be operational from September 2018 through 2024. The investment in the UCL Biochemical Engineering's industrial research collaboration program with Pall Biotech is valued at \$3.5 million (£2.7 million).

In September, **EBERS**, a maker of bioreactors and sensors, named **AR Brown** as a distributor for Japan.

Genedata announced in October the out-of-the-box integration of the Genedata Bioprocess platform with **Sartorius'** ambr mini-bioreactor systems.

Merck officially opened in October its M Lab Collaboration Center in Brazil, serving the Latin America region. One of nine centers, the 10,764 ft² (1,000 m²) lab facility includes non-GMP pilot and bench-scale labs. Each year, more than 1,500 customers visit Merck's M Lab Collaboration Centers.

In October, **Aglaris**, maker of a platform cell expansion technology, appointed Steven Docksey as CEO. Most recently he was adviser and nonexecutive director at **Puridify**.

Process Analysis

Company Announcements

In September, **ABB** named **EverMark** as the exclusive distributor for its process analytical products in Ontario and Manitoba, Canada.

Planetary Emissions Management signed a memo of understanding in October with **ABB Measurement & Analytics** to explore commercial manufacturing of its cavity enhanced absorption technology-based portable iRIS-III radiocarbon IR spectrometer system for the measurement of radio-carbon dioxide.

Ametek Process Instruments appointed **Novatech** as its exclusive distributor in Eastern Canada in September.

In October, **Applied Analytics** named **Suwaidi Engineering** (SEG) as its exclusive agent for the United Arab Emirates. **Tyco UAE**, a joint venture partner of SEG, will maintain its role as a distributor and continue to offer technical support.

Reported Financial Results

\$USD in Millions	Period	Ended	Sales	Chg.	Op. Prof.	Chg.	Net Prof.	Chg.
Bio-Techne	Q1	30-Sep	\$163.0	12.7%	\$25.8	\$26.0	\$17.4	9.7%
Bio-Techne (Protein Science)	Q1	30-Sep	\$126.4	16.9%	\$54.6	\$46.2	NA	NA
Bio-Techne (Diagnostics and Genomics)	Q1	30-Sep	\$36.7	0.4%	\$2.5	\$7.3	NA	NA
Corning (Life Sciences)	Q3	30-Sep	\$231.0	3.6%	NA	NA	\$30.0	20.0%
Danaher	Q3	30-Sep	\$4,853.1	7.2%	\$830.7	9.4%	\$663.7	16.0%
Danaher (Life Sciences)	Q3	30-Sep	\$1,596.7	14.7%	\$312.8	26.7%	NA	NA
Danaher (Environmental & Applied Solutions)	Q3	30-Sep	\$1,074.4	8.2%	\$254.3	14.1%	NA	NA
Datacolor	H1	31-Mar	\$41.0	17.5%	\$3.1	-8.8%	\$2.3	-32.4%
Enzo Biochem	Q4	31-Jul	\$24.5	-13.2%	(\$5.7)	-1221.8%	(\$5.8)	NM
Honeywell (Perf. Materials & Tech.)	Q3	30-Sep	\$2.6	2.7%	\$0.6	-0.5%	NA	NA
Illinois Tool Works	Q3	30-Sep	\$3,613.0	-0.1%	\$889.0	-7.4%	\$638.0	-0.3%
PerkinElmer	Q3	30-Sep	\$674.3	21.7%	\$80.2	2.8%	\$76.5	-16.0%
Qiagen	Q3	30-Sep	\$377.9	3.8%	\$77.0	20.5%	\$60.3	24.3%
Teledyne Technologies (Instrumentation)	Q3	30-Sep	\$256.2	10.2%	\$35.7	3.2%	\$90.3	30.9%
Thermo Fisher Scientific	Q3	30-Sep	\$5,920.0	15.7%	\$912.0	43.8%	\$709.0	32.8%
Thermo Fisher Scientific (Life Science Solutions)	Q3	30-Sep	\$1,504.0	8.8%	\$495.0	9.5%	NA	NA
Thermo Fisher Scientific (Analytical Instruments)	Q3	30-Sep	\$1,333.0	12.1%	\$294.0	14.4%	NA	NA
Thermo Fisher Scientific (Specialty Diagnostics)	Q3	30-Sep	\$894.0	5.9%	\$223.0	2.3%	NA	NA
Thermo Fisher Scientific (Laboratory Products and Services)	Q3	30-Sep	\$2,470.0	27.8%	\$299.0	23.0%	NA	NA
Waters	Q3	30-Sep	\$578.0	2.2%	\$171.7	8.0%	\$141.0	3.6%
Xylem	Q3	30-Sep	\$1,287.0	7.7%	\$176.0	15.8%	\$130.0	25.0%
Other Currencies in Millions								
Sartorius	Q3	30-Sep	€ 1.15	€ 0.11	€ 0.29	15%	€ 0.13	€ 0.22
Sartorius (Bioprocess Solutions)	Q3	30-Sep	€ 0.84	€ 0.12	€ 0.24	17%	NA	NA
Sartorius (Lab Products & Services)	Q3	30-Sep	€ 0.31	€ 0.07	€ 0.06	10%	NA	NA

NA = not available, NM = not material