
Strategic Directions International, Inc.

INSTRUMENT BUSINESS OUTLOOK



Strategic Information for the Analytical & Life Science Instrument Industry

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Volume 26, Issue 12
September 30, 2017

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Tackling Phthalates: Preparing for Phthalate Testing Amidst Changing Regulations

Phthalates are chemical plasticizers, commonly used to soften plastics and make them more pliable. Over the past decade, numerous phthalates have come under scrutiny for their potential harmful effects on human health, especially the reproductive system, resulting in the bans of many phthalates. Various techniques can be used to test phthalates, such as GC/MS and LC/MS, and using chemical ionization in the testing techniques has proven to ensure extremely accurate results. Companies like Hitachi High-Technologies have developed instruments incorporating chemical ionization that are designed for phthalate testing, as firms around the globe prepare for the changing

regulations on phthalates that affect a huge portion of the production of consumer goods.

In 2015, as per the Registration, Evaluation, Authorization and Restriction of Chemicals regulation in Europe, the EU announced a ban on the use of four phthalates: butylbenzyl phthalate (BBP), di(2-ethylhexyl) phthalate (DEHP), dibutyl phthalate (DBP) and diisobutyl phthalate (DIBP). These phthalates are used in numerous consumer products, such as toys, coated fabrics, flooring, cosmetics, shampoo, mattresses and footwear. As per the 2015 ruling, companies were still able to receive continued-use authorizations if they could prove that they had no other safer substitutes for the phthalates.

However, earlier this year, the European Commission made a final ruling that identified the four phthalates as toxic to human health, which is likely abolish the option for continued-use authorizations for products containing the phthalates in question in quantities greater than 0.1% (by weight). The ban is to be implemented in summer 2019.

In Europe, the first step in banning a substance is its addition to the Candidate List of the European Chemical Agency (ECHA), and after undergoing review by the Member State Committee (MSC) of the ECHA, it is placed on the Authorization List. "However, even if a substance is eventually included in the Authorization List, this does not mean that the substance is banned," an ECHA spokesperson said. "The use can continue after the sunset date [the date from which the placing on the market and use of a substance is prohibited, unless an authorization is granted], provided a use-specific and applicant-specific authorization is applied for and granted. The authorization process does not trigger any further testing requirements."

In 2008 and 2010, the MSC unanimously agreed that the four phthalates (BBP, DEHP, DBP and DIBP) be added to the Candidate List. As the ECHA told **IBO**, the phthalates were later listed in the Authorization List due to their reprotoxicity, as they have harmful effects to the human endocrine system. In 2014, after reviewing additional proposals on the four phthalates, the MSC deliberated classifying them as Substances of Very High Concern (SVHC). "While the MSC did unanimously agree on the endocrine disrupting properties of DEHP with effects on the environment, they were not able to unanimously agree on the four proposals with respect to their endocrine disrupting properties affecting human health," said the ECHA. "As a result, MSC opinions on each of the four cases were sent to the European Commission for final decision making."

In summer 2017, the European Commission made a final ruling that BBP, DEHP, DBP and DIBP indeed had endocrine-disrupting properties, resulting in the phthalates being officially classified as SVHCs. The ban will be implemented beginning July 22, 2019, for all electrical and electronic equipment, excluding medical devices, and monitoring and control equipment. Companies will have an additional two years (until July 22, 2021) to comply.

Testing Techniques

The ECHA has not recommended a specific technique for testing phthalates, as the possibilities are numerous—MS, GC/MS, LC/MS, GC/MS/MS, LC/MS/MS, GC-FID are some of the more frequently used techniques for phthalate testing due to their sensitivity as GC/MS can detect down to 50 ppb of the phthalates and LC/MS can detect down to 1 ppb.

According to the spokesperson from the ECHA, generally, GC-FID methods are commonly used for quantification, although they are required to be used in accordance with standards. "MS methods are commonly used for identification purposes—for quantification purposes, they are usually coupled with other specific techniques," the ECHA further explained.

As the ECHA told **IBO**, researchers first must determine what conditions the testing and analysis require. "The choice of an appropriate technique may depend on the amount of analyte expected to be present in a substance/mixture/article," he said. "Analyzing very low concentration levels of analytes may require the use of specific techniques or the development of suitable analytical methods. When choosing an analytical procedure, it should also be considered that different matrices may require the use of different extraction techniques."

"Demand has grown for screening instruments that allow easy phthalates detection because such instruments can be useful from upstream to downstream business."

As there are many techniques to conduct phthalate testing, the ECHA suggests using the most appropriate technique according to the circumstances under which analysis is to be performed. “Analyses can be carried out on the basis of the available known techniques, including standard methods and taking into account that analytical techniques are in continuous development,” he stated.

Many companies sell LC/MS or GC/MS systems for phthalate testing, such as Agilent Technologies, which incorporates the techniques for phthalate testing in food, and Shimadzu’s Py-Screener, which is designed to screen phthalate esters in polymers through pyrolyzer GC/MS. Thermo Fisher Scientific developed a method using FT-IR spectroscopy, while XOS sells the HD Prime, an instrument with analytical techniques in accordance to ASTM standards that uses high-definition XRF for phthalate testing.

Of the systems Hitachi High-Technologies sells for phthalate testing, the HM1000 thermal desorption MS shows the highest demand, as the instrument is specifically designed for screening phthalates. As Yu Nakamura, engineer for the International Sales and Marketing Department at Hitachi told **IBO**, instruments such as the HM1000 offer various functionalities that can target customers throughout the supply chain. “Demand has grown for screening instruments that allow easy phthalates detection because such instruments can be useful from upstream to downstream business,” he said.

The HM1000 uses Atmospheric Pressure Chemical Ionization (APCI), to increase the sensitivity and selectivity of the ionization process. “Using this ionization method, soft ionization is possible without destroying the phthalate ester structure,” Mr. Nakamura explained. “In other words, mass analysis on the original structure becomes possible, and it is possible to inspect the phthalate without GC.”

Using APCI as opposed to GC lowers operational costs, as an APCI-based instrument does not require expensive helium gas and separation columns. It also produces higher throughput, according to Mr. Nakamura. “Conventional methods like GC/MS have a number of drawbacks when it comes to [use] on the factory floor,” he said. “The HM1000 requires only 10 minutes to measure the phthalate content per sample, while GC/MS needs approximately 60 minutes.”

According to the ECHA, single quadrupole MS and triple quadrupole MS are used for testing phthalates depending on the intricacy of the matrices. “Single quadrupole mass spectrometers are commonly chosen for identification and quantification purposes in relatively simple matrices,” he explained. “Triple quadrupole mass spectrometers allow high selectivity and lower detection limits, especially in complex matrices.”

Hitachi’s HM1000, however, takes advantage of the APCI function to tests the sample with greater precision, so that triple quadrupole MS becomes less necessary for various types of matrices. Using single quadrupole MS, the HM1000 directly heats the sample to vaporize the phthalates from it, and the precision of the sample’s temperature conditions ensures that the vaporizing process does not damage the sample, thus eliminating the need for triple quadrupole MS in many cases. “By precisely controlling the sample heating temperature, only the phthalate ester is vaporized without decomposing the main component,” Mr. Nakamura said.

As there are still 2 years before the EU’s ban on 4 additional phthalates is implemented, Hitachi has not yet seen an increase in sales for the HM1000 for phthalate testing. Like many other firms, Hitachi is “assessing the situation,” as Mr. Nakamura stated, waiting to see what moves other companies make. “Historically, sales leads start to increase a year before such a regulation goes in effect,” he explained. “It takes time to build the structure [for] how to manage the phthalates and, therefore, many companies (typically major corporations and end-product manufacturers) start to introduce a testing system a year earlier. So we expect that the sales leads be in a full scale.”

Hitachi expects that sales for the HM1000 will increase with the EU ban going into effect, especially since the HM1000 is used for first screening purposes. As Mr. Nakamura explained, the market is focusing on environmental concerns, which is likely to positively influence the sales of phthalate testing instruments. Moreover, there may be a “ripple effect,” as he put it, on the phthalate testing process that may affect sales. “It is often the case that leading companies will build the structure on how to manage the phthalates (e.g., first screening by the HM1000, second screening by GC/MS for the items that were 700 ppm or more by the first screening),” he said. “Then they tend to request their suppliers to adopt the same way.”

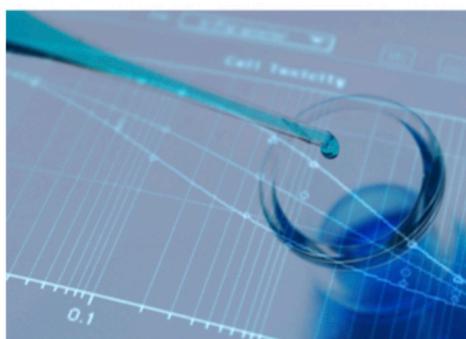
Another factor predicted to increase the sales of phthalate testing instruments in relation to the regulation is the multitude of products that can be tested with the instruments, which subsequently increases sales volume. “There are so many items you may possibly test under the regulation, and that could give an incentive to improve efficiency

in operation while minimizing costs," said Mr. Nakamura.

Whether an APCI-based instrument like Hitachi's HM1000 becomes an industry standard and replaces techniques like GC/MS is yet to be seen, but instrument companies like Hitachi are working to develop the proper resources and methods required to prepare for the likely increase in sales for phthalate testing instruments. As Mr. Nakamura stated, "The challenge we have is that we really need to structure a robust service infrastructure before the restriction goes into effect."

The 2018 Global Security Market for Analytical Instrumentation

The report provides a strategic perspective on the current situation, the historical period and the projected potential for analytical instrumentation designed to detect threats.



The emphasis of this report is on specific instrumentation designed to be on the front lines of threat detection. The report covers seven major technology categories in detail:

- PCR
- Other Biochemical Techniques (e.g., ELISAs)
- Chemical Sensors (e.g., Gas Chromatography)
- Spectroscopy (e.g., IR, NIR, FTIR, Raman)
- Ion Mobility Spectrometry
- Mass Spectrometry (e.g., GC/MS)
- Radiation Detection

This report explores the utilization of these technologies across ten different end-markets, including aviation, cargo and shipping, the military and first responders.

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Bruker Introduces a New Trapped Ion Mobility System

To tackle the challenge of discovering and analyzing low-abundance proteins in complex samples, Bruker recently launched the timsTOF pro MS system, an update of its timsTOF system, which was launched last year (see [IBO 6/15/16](#)). The system is currently shipping at a list price of \$899,000.

The timsTOF pro employs dual TIMS (Trapped Ion Mobility Spectrometry) funnels to trap ions in the first section, while simultaneously eluting them from the second section. The system is designed for Parallel Accumulation Serial Fragmentation (PASF), a method developed by Matthias Mann, PhD, of the Max Planck Institute of Biochemistry, for

shotgun proteomics. PASF allows the collection of MS/MS spectra from multiple ion precursors.

As Rohan Thakur, PhD, executive vice president at Bruker Daltonics, who heads the company's Life Science MS business, told **IBO**, "The dual TIMS allows us to do parallel accumulation and serial fragmentation, enabling very high scan rates at high MS resolution. It's the only technology out there that allows you to separate ions in the gas phase, after chromatographic separation and before they enter the mass analyzer." To chromatography, MS and MS/MS, this adds a new dimension for analysis. "On the timsTOF Pro, this additional dual TIMS separation mechanism allows you to separate the co-eluting species in the ion mobility dimension. So it's like a fourth dimension of separation before triggering mass analysis."

The result is close to 100% duty cycle and a fast scan rate, with a resolution of 50,000, according to Bruker. Asked how this compares to other advanced MS systems, Dr. Thakur noted, "The best Orbitraps' published scan rate is <30 Hz, with resolution of R=7,500 in the MS/MS mode. QTOFs without TIMS capability cannot be fairly compared."

These capabilities specifically address challenges facing quantitative proteomics. "If you do bottom-up proteomics, the peptide mixtures are still extremely complex, and the elution of peptides is unpredictable. So you needed something that would scan very fast, is sensitive and would acquire data at high resolution," explained Dr. Thakur. This allows greater characterization and quantification of low-abundant peptides.

As Dr. Thakur told **IBO**, "We are not wasting ions due to the very high duty cycle of the dual TIMS funnel, allowing the timsTOF Pro to uncover more ions; for example, biologically significant low-level peptides in bottom-up proteomics." The fast scan rate is key. "So we get one extra opportunity to sort through the complex mixture of ions coming in, and that's key. And we do it at R=50,000 resolution in the mass analyzer, so we're not compromising on mass resolution, resulting in a scan rate faster than any mass spec out there."

Applications include PTM research and large cohort studies.

Lab Distributor Thomas Scientific Sells Majority Stake to the Carlyle Group

Washington, DC 9/1/17—The Carlyle Group, an alternative asset manager, has acquired a majority of Thomas Scientific, a provider of lab supplies and equipment. Thomas Scientific distributes 700,000 products from over 800 suppliers to 9,000 customers. Financial details were not disclosed. Family-owner Rob Patterson will retain a "significant" ownership stake. Charles Simmons will continue as president and CEO. "We believe in the Thomas Scientific brand and the value and service it provides its customers," stated Carlyle Managing Director Adam Glucksman. "We are pleased to join with Rob Patterson and management to further grow the business."

Based in New Jersey, Thomas Scientific is one of the largest private lab distribution companies in the US. This acquisition follows the announced sale of major publicly held distributor VWR to private equity firm New Mountain Capital earlier this year (see [IBO 5/15/17](#)). Thermo Fisher Scientific dominates lab distribution but new entrants can be expected to increase their investments with new funding and revised business objectives.

Bruker Further Grows Microbial Business

Bremen, Germany 9/26/17—Scientific instrument firm Bruker has acquired MERLIN Diagnostics, a provider of products and services for Antibiotic Resistance Testing (ART) and Antibiotic Susceptibility Testing (AST). MERLIN's MICRONAUT system enables phenotypic detection of microbial growth inhibition in the presence of antibiotics, and includes AST plates for IVD use. MERLIN's MICRONAUT software has been available as an interface to Bruker's MALDI Biotyper. "MERLIN adds expertise and an impressive portfolio of flexible specialty products for antibiotic

susceptibility testing to Bruker's clinical and applied microbiology business," stated Dr. Wolfgang Pusch, executive vice President for Microbiology & Diagnostics at Bruker Daltonics. "Over time, we expect that MERLIN will further expand our selected, high-value ART and AST assay portfolio for the MALDI Biotyper." MERLIN will continue its collaborations, distribution partnership and OEM business.

As Bruker has found success for its MALDI Biotyper MS system for pathogen identification, it is now expanding into new applications such as ART and AST. MERLIN provides plates, software and automation for such testing to create a automated workflow for MALDI-TOF MS from sample preparation through reporting. Advantages of MALDI-based ART and AST compared to other techniques include speed, direct detection and throughput.

Preclinical Imaging Software Provider Acquired

Tokyo, Japan & Boston, MA 9/25/17—Digital technology firm Konica Minolta has agreed to acquire Invicro, a CRO that also sells the VivoQuant and iPACS software for preclinical imaging. Invicro's generates \$106 million in annual revenues. Konica Minolta currently offers healthcare technologies, such as pathology products. Earlier this year, it acquired genetic testing firm Ambry Genetics. "Konica Minolta is the ideal partner to accelerate the impact of the informatics platform we have developed and deployed over the past decade," commented Invicro co-founder and CEO Jack Hoppin. "The prospect of working with Konica Minolta and their recently acquired Ambry team on the translation of precision medicine innovations from research trials to clinical offerings is truly inspiring." Invicro management will remain with the company. InVicro has more than 200 employees.

Although Invicro's primary business is imaging services for discovery and clinical phase research, the company's VivoQuant and iPACS software are used by labs for the analysis of in vivo animal imaging from MRI, PET, SPECT, CT and optical techniques. Among the providers of preclinical in vivo imaging systems are Bruker and PerkinElmer.

UK Lab Equipment Supplier Sold

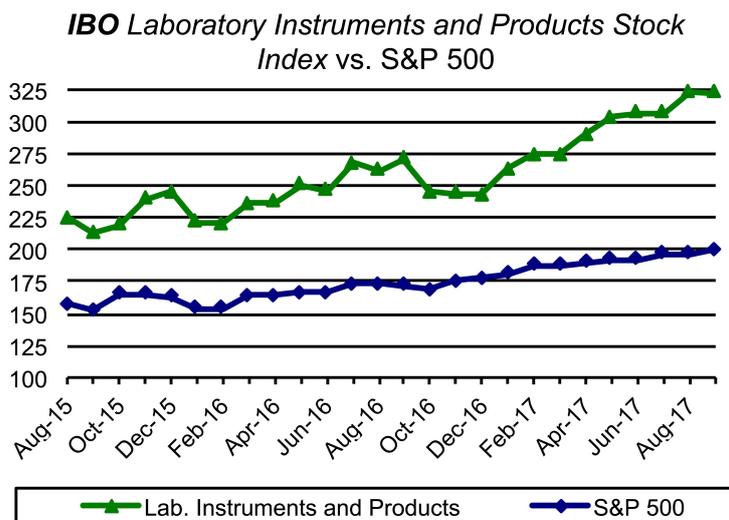
Waterford, WI 9/15/17; Minneapolis, MN 9/17—Edstrom Industries, a provider of products to research labs, has acquired Triple Red for an undisclosed amount. Triple Red manufactures and sells lab equipment and services, including water purification equipment, biological safety cabinets, autoclaves and freezers. "By expanding global access to Triple Red's unique portfolio of water purification solutions, the acquisition supports Edstrom's objective of becoming a more valuable partner for our customers in achieving their research objectives, both from a product and service perspective," said Edstrom CEO Doug Lohse.

Edstrom provides products for water purification and delivery, and environmental monitoring as well as service. The acquisition expands its portfolio to routine lab products, including products for life science and health care labs. According to the [Milwaukee Business News](#), Edstrom has 200 employees, and Triple Red has 60.

IBO Stock Indexes March Forward in September

In September, the US economy remained vigorous as US economic output surpassed previous projections. The US GDP grew 3.1% in the second quarter, versus last month's upward revision of 3.0%, signifying the fastest US economic growth in more than two years. Overall, for the first half of 2017, US GDP rose 2.1%, supported by strong consumer spending. For the third quarter, US GDP is expected to grow 2.2% but may see an upgrade due to increased retail and wholesale inventories. Starting from October, the US Federal Reserve plans to unwind its \$4.5 trillion balance sheet by collecting and erasing \$10 billion in principal per month. This means that the Fed will not be using the collected proceeds to reinvest in treasury and mortgage bonds. Also, the Fed left its lending rate unchanged at 1%-1.25%.

US equity markets finished the month in strong form as the Dow Jones Industrial Average (DJIA) climbed 2.1% to 22,405.09, followed by the S&P 500's solid increase of 1.9%, closing at 2,519.36. The NASDAQ Composite grew slightly by 1.0% to close at 6,495.96. Year to date, the DJIA and S&P 500 have risen 13.4% and 12.5%, respectively. The NASDAQ composite has gained the most, advancing 20.7% for the year.



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Laboratory Instrumentation Stock Index

For September, this *IBO Index* fell slightly by 0.1% to 322.96 and has advanced 32.8% year to date. A majority of the companies in the *Index* finished in positive territory, with **Fluidigm**, **Harvard Bioscience** and **Kewaunee Scientific** share prices growing double digits. The trio led the *Index* in percentage growth, increasing 10.3%, 21.0%, and 14.6%, respectively, for the month.

In contrast, **Agilent Technologies** remained essentially flat, dipping slightly below last month's close. The company declared a quarterly dividend of 0.80%, or \$0.132 per share, to be paid on October 25. Similarly, **Becton**, **Dickinson** share prices slipped 1.7% for the month, dropping to \$195.95. On September 22, Wells Fargo initiated an "outperform" rating for the stock, setting its target price at \$225.00. Since then, the stock price has risen slightly.

Bio-Rad Laboratories' share price grew 2.0% to \$222.22 in September and is up 21.9% year to date. On September 18, Deutsche Bank reiterated its "buy" rating on the stock, keeping its price target of \$255.00. Shares initially increased to \$233.97 on September 20, the month's highest price, after the stock's rating update but fell back down.

Enzo Biochem's shares fell 7.0% despite beating analysts' EPS estimates, along with a 6.0% increase in revenues (see Bottom Line). On September 27, share price peaked at \$11.47 for the month but has fallen to \$10.46 since. Year to date, share prices are up 50.7%, right behind **Illumina**, which has a 55.6% year-to-date price increase. However, Illumina share prices decreased 2.6% for the month. On September 26, Goldman Sachs reiterated its "neutral" rating for the stock, prompting share price to dip slightly for the month.

Company	Date Rep.	Fiscal Quarter	2017 Adj. EPS	Analyst Consensus	Vs. Estimate	YOY Growth	2016 Adj. EPS
Laboratory Instruments and Products Stock Index							
ENZ	27-Sep	Q4	\$0.00	(\$0.02)	↑ \$0.02	100%	(\$0.04)

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Diversified Instrumentation Stock Index

The Diversified **IBO Index** grew 4.1% to 249.35 in September, as every company in the *Index* closed in positive territory. **Illinois Tool Works (ITW)** advanced 7.6% for the month, leading the *Index* in percentage growth. Year to date, the *Index* has risen 21.3%, with **AMETEK** advancing the most, at 35.9%. **Xylem**'s share prices saw the least amount of growth among *Index* stocks, edging upwards by just 0.9%.

Danaher's shares increased 2.8% for the month, and rose nearly 2% since JP Morgan Chase reiterated its "overweight" rating on September 8, along with a \$95.00 price target, for the stock. Year to date, share prices have recorded 10.2% growth.

Illinois Tool Works (ITW) closed out the month at \$147.97 and received two ratings updates. On September 13, Royal Bank of Canada reiterated its "hold" rating with a price target of \$143.00 for the stock. Since the ratings update, ITW share prices rose about 3%. On September 26, Citigroup also reiterated its previous rating of "buy", with a price target of \$162.00. However, Citigroup's update minimally impacted share price, as ITW climbed just 0.4% since then.

Roper Technologies' share price grew 5.6% for the month and is up 33.0% for the year. On September 20, JP Morgan Chase upgraded its ratings from "neutral" to "overweight", setting a new price target of \$275.00. **Xylem** shares were given a "buy" rating from Cowen and Co. on September 21, with a price target of \$70.00.

International Stock Index

Asia Pacific equity markets traded modestly, as growth averaged around the low single digits for the month. Japan's Nikkei 225 and the Thailand's SET Index advanced 3.6%, leading the APAC *Indexes* in growth. GL Sciences grew in the double digits this month, leading the *Index* in percentage growth. **GL Sciences** advanced 11.5% to ¥1,702 (\$15.12 at ¥112.54=\$1) for the month and 92.3% year to date. **JEOL** finished with double-digit percentage growth as well, to close at ¥572 (\$5.08). The company advanced 10.2% for the month and 12.2% for the year.

Shimadzu finished the month with a high-single digit gain, increasing 9.6% in share price to ¥2,216 (\$19.69) and rising 19.0% for the year. **Hitachi High Technologies** grew 3.9% but has fallen 13.5% year to date to close at ¥4,080 (\$36.25). Hong Kong's **Techcomp** decreased 3.7% for the month, closing at HKD 1.82 (\$0.23 at HKD 7.81=\$1). Similarly, **Horiba** and **Precision System Science (PSS)** both decreased for the month, dropping 5.6% and 7.1%, respectively.

European equity markets traded mostly higher this month, with Germany's XETRA DAX and Sweden's OMX Stockholm 30 up 6.4% and 5.9%, respectively. **Tecan** shares gained the most for the month, climbing 4.5% and 26.1% year to date, before closing at CHF 200.40 (\$207.00 at CHF 0.97=\$1). Sweden's **Biotage** closed at SEK60.75 (\$7.47 at SEK 8.14=\$1), increasing 3.0% for the month. Germany's **Merck KGaA** share price grew 2.1% for the month to €94.40 (\$111.59 at €0.85=\$1) but is down 4.8% year to date. The company's shares rose to a monthly high of €100.06 on September 27, before finishing the month with a 5.6% slide from the peak.

The UK's FTSE 100 traded lower, down 0.8% from last month. London shares in the *Index* decreased overall, with **Oxford Instruments** dipping the most, by 7.6%. Oxford Instruments closed at £9.70 (\$13.00 at £0.75=\$1) for the month, increasing 32.4% year to date. Conversely, **Spectris** gained the most, up 4.1%, to close at £24.10 (\$32.29) for the month. **Horizon Discovery**'s shares fell 7.0% to £2.27 (\$3.04) for the month in accordance with its most recent quarterly earnings report (see Bottom Line). The company's operating profit, along with net income, continued to slide for the fiscal half-year, prompting a 4.6% decrease in share price since the earnings release on September 26.

Company: Exchange	Market Value (US M)	52 Week Range		Price 9/30/17	Change 1 Month	Change YTD	P/E (ttm)	EPS (ttm)
		Low (\$)	High (\$)					
Laboratory Instruments and Products								
Agilent Technologies: n	\$20,865	42.92	61.84	\$64.20	-0.8%	40.9%	32	1.99
Becton, Dickinson and Company: n	\$42,691	161.29	206.63	\$195.95	-1.7%	18.4%	57	3.44
Bio-Rad Laboratories: n	\$6,647	143.39	239.91	\$222.22	2.0%	21.9%	444	0.50
Bio-Techne: o	\$4,533	95.68	117.42	\$120.89	-2.3%	17.6%	65	1.86
Bruker: o	\$4,775	19.59	27.85	\$29.75	2.3%	40.5%	30	1.00
Enzo Biochem: n	\$485	4.88	9.68	\$10.46	-7.0%	50.7%	15	0.71
Fluidigm: o	\$147	4.31	11.05	\$5.04	10.3%	-30.8%	NM	-2.46
Harvard Bioscience: o	\$130	2.25	3.90	\$3.75	21.0%	23.0%	NM	-0.13
Illumina: o	\$29,282	119.37	189.48	\$199.20	-2.6%	55.6%	40	4.99
Kewaunee Scientific: o	\$81	16.38	27.60	\$29.50	14.6%	20.7%	18	1.60
Luminex: o	\$874	17.64	23.75	\$20.33	5.2%	0.5%	64	0.32
Mettler-Toledo: n	\$16,651	343.61	582.20	\$626.30	3.5%	49.6%	86	7.32
MTS Systems: o	\$1,021	41.53	59.00	\$53.45	10.4%	-5.7%	42	1.27
NanoString Technologies: o	\$349	11.89	23.45	\$16.16	4.6%	-27.5%	NM	-2.11
Pacific Biosciences: o	\$488	3.46	10.40	\$5.25	6.1%	38.2%	NM	-0.91
PerkinElmer: n	\$7,602	45.35	63.03	\$68.98	3.0%	32.3%	21	3.31
QIAGEN: o	\$7,399	20.73	33.06	\$31.50	-2.1%	12.4%	98	0.32
Thermo Fisher Scientific: n	\$74,564	139.07	173.64	\$189.20	1.1%	34.1%	33	5.74
VWR: o	\$4,371	24.42	37.25	\$33.11	0.3%	32.3%	31	1.08
Waters: n	\$14,496	131.35	179.07	\$179.48	-2.2%	33.6%	27	6.63
Diversified Laboratory								
AMTEK: n	\$15,253	43.28	61.37	\$66.03	4.4%	35.9%	29	2.28
Corning:	\$27,996	18.88	29.72	\$29.91	4.0%	23.2%	14	2.20
Danaher: n	\$60,528	73.42	88.01	\$85.77	2.8%	10.2%	27	3.13
Honeywell	\$108,185	105.25	135.00	\$141.77	2.5%	22.4%	22	6.45
Illinois Tool Works: n	\$51,642	98.32	142.82	\$147.97	7.6%	20.8%	24	6.18
Roper Technologies: n	\$25,097	159.28	228.21	\$243.48	5.6%	33.0%	36	6.68
Teledyne Technologies: n	\$5,747	92.52	137.00	\$159.19	6.1%	29.4%	29	5.43
Xylem: n	\$11,317	42.52	54.99	\$62.63	0.9%	26.5%	40	1.55
Laboratory Instruments and Products				322.96	-0.1%	32.8%	69	
Diversified Laboratory				249.35	4.1%	21.3%	28	
Dow Jones Industrial Average				22,405.09	2.1%	13.4%		
S&P 500				2,519.36	1.9%	12.5%		
NASDAQ Composite				6,495.96	1.0%	20.7%		
Region	Market Value	52 Week Range		Price	Change	Change	P/E	EPS
Company	(Local M)	Low (L)	High (L)	9/30/17	1 Month	YTD	(ttm)	(ttm)
Pacific Shares								
GL Sciences: t	¥17,076	557	1,494	¥1,702	11.5%	92.3%	12	¥144.19
Hitachi High-Technologies: t	¥540,625	3,360	5,040	¥4,080	3.9%	-13.5%	17	¥245.97
HORIBA: t	¥286,671	4,305	7,440	¥6,360	-5.6%	17.6%	17	¥375.69
JEOL: t	¥50,714	356	648	¥572	10.2%	12.2%	79	¥7.21
Precision System Science: os	¥13,077	334	1,011	¥585	-7.1%	43.7%	NA	-¥71.44
Shimadzu: t	¥598,358	1,394	2,254	¥2,216	9.6%	19.0%	25	¥87.56
Techcomp: hk	HKD 521	1.07	3.21	HKD 1.81	-3.7%	40.3%	23	¥0.01
European Shares (London)								
Abcam: l	£2,168	7.14	10.34	£10.20	-4.1%	33.0%	49	£0.21
Halma: l	£4,144	8.79	11.82	£11.20	2.5%	24.8%	33	£0.34
Horizon Discovery: l	£231	1.05	2.71	£2.27	-7.0%	57.6%	NA	-£0.12
Oxford Instruments: l	£601	6.10	11.39	£9.70	-7.6%	32.4%	NA	-£0.44
Scientific Digital Imaging: l	£22	0.13	0.31	£0.23	-6.1%	24.3%	20	£0.01
Spectris: l	£2,757	18.40	28.69	£24.10	4.1%	4.2%	90	£0.27
European Shares (Other)								
Biotage: st	SEK 3,818	33.90	67.50	SEK 60.75	3.0%	32.4%	33	SEK 1.83
Datacolor: s	CHF 124	538.00	800.00	CHF 762.00	1.6%	17.2%	18	CHF 41.39
Merck KGaA: g	€ 11,946	88.20	115.20	€ 94.40	2.1%	-4.8%	26	€ 3.68
Sartorius: g	€ 6,028	65.01	90.12	€ 78.20	-2.9%	7.4%	46	€ 1.70
Tecan: s	CHF 2,159	148.80	187.30	CHF 200.40	4.5%	26.1%	41	CHF 4.84

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Single-Molecule Localization Microscopy

Over the last few centuries, light microscopes have helped laboratories across the globe push the boundaries of science by revealing the fine structures of life and matter. However, as the resolution of these instruments is limited to distances on the order of half the wavelength of light (~200 nm), there has been a pressing need for microscopes with greater resolution.

New types of microscopy such as confocal, multi-photon and super-resolution, all fluorescence based, have been developed to address that need. Among them, a subset of super-resolution microscopy, called Single-Molecule Localization Microscopy (SMLM), currently offers the highest resolution achievable on the market (down to ~10 nm-20 nm). For their seminal discovery of the localization-based imaging techniques, three investigators, Eric Betzig, Stefan W. Hell and William E. Moerner, received the Nobel Prize in Chemistry in 2014.

Broadly, in fluorescence microscopy, a sample is first labeled by fluorescence-emitting moieties, so-called fluorophores. A light source then illuminates the probe, exciting all the fluorophores at the same time. A camera collects all outgoing fluorescent signals to construct the image. Regarding the diffraction limit, the main resolution-limiting problem of this approach is the overlap of the fluorescent dots on the camera.

SMLM solves this problem by breaking the excitation process into hundreds or thousands of smaller steps, and illuminating only a tiny fraction of the fluorophore population, which is ensured to be stochastically distributed and sparse by using photo-switchable fluorophores at each step. After recording images of all the steps, the final super-resolved image is constructed by overlaying the images. Depending on the type of the photo-switchable fluorophore used, the technique is called PALM (PhotoActivated Localization Microscopy), which uses fluorescent proteins; STORM (Stochastic Optical Reconstruction Microscopy), which uses a pair of synthetic dyes, and dSTORM (direct STORM).

The public sector is the largest application sector for these highly advanced microscopes. While there are certainly applications in private and commercial laboratories, the majority of these instruments are primarily found in academic and government laboratories, conducting cutting-edge life sciences research in areas such as molecular biophysics and biochemistry, cell biology, cancer biology, developmental biology, reproduction, infectious diseases, virology, immunology and neuroscience. The next largest segment is the pharmaceutical and biotechnology sector.

In 2016, the total market for SMLM microscopy amounted to approximately \$65 million per year, and is forecasted to grow annually in low- to mid-teens over the next few years. The growth is mainly fueled by research groups seeking to gain access to the most sophisticated instruments available, or to enhance their current systems to have even greater capabilities, as well as the overall healthy growth of biomedical research in the biotech and pharmaceutical industries.

Given the novelty, and thus the intellectual properties issues associated with these technologies and their complexity, only a handful of vendors commercially manufacture SMLM systems, including Bruker, Leica Microsystems, Nikon and ZEISS. Leica's SR GSD 3D product line is based on Ground State Depletion (GSD) technology and utilizes a fully automated TIRF system. Nikon recently unveiled its newest SMLM microscope, the N-STORM 5.0, featuring a fast temporal resolution at 0.6 sec/frame. Bruker and ZEISS offer their SMLM customers the Vutara 352 and PALM-based Elyra P1 systems, respectively.

Single-Molecule Localization Microscopy at a Glance:

Leading Suppliers:

- Leica Microsystems (Danaher)
- Nikon
- ZEISS

Largest Markets:

- Academia
- Government
- Biotech

Instrument Cost:

- \$1 million-\$4 million
-

Genomics

Due to technological advancements resulting in plummeting costs and quicker techniques for sequencing DNA, investments in genomics startup companies are on the rise. In 2016, approximately \$1.7 billion was invested in genomics companies, while in 2017, investments are on track to reach \$3.2 billion.

In 2001, it cost almost \$3 billion to sequence a single genome; currently, the cost is less than \$1,000, and according to Illumina, the company will soon be able to bring the price down to \$100. Because of this, companies that focus on intelligent data analytics and data mining that provide clinical diagnoses based on sequencing results are attracting venture funds.

In 2013, an estimated \$500 million was invested in genomics around the world, while in 2017, investments have increased to approximately \$3.3 billion. Genomics companies such as Wuxi NextCode, Color Genomics and Sophia Genetics received substantial investments from venture capital firms of \$240 million, \$80 million and \$30 million, respectively, earlier this year. Although technological challenges remain, health care systems like the National Health Service in England are focusing on customizing services to patients according to their distinctive genetic codes.

Source: [Financial Times](#)

Government

Earlier this month, the Trump administration signed a bipartisan Democratic proposal to raise the federal debt ceiling and extend US government spending at its current level through December 8. This gives the government three additional months to negotiate agreements for fiscal appropriations in 2018. In appropriation bills proposed by the House and Senate Appropriations Committees, spending propositions exceed the caps of 2017. In order to meet these spending proposals without activating a default sequestering of agency funds, the discretionary spending caps established through a 2011 budget control law must be modified.

The newly signed legislative package also includes emergency funds for Hurricane Harvey and wildlife relief, as well as legislation barring the NIH from making changes to its reimbursement rates for facilities and administrative costs through December 8. These rates, or indirect costs, can comprise the vast majority of a grant, as universities and labs depend on reimbursements in order to continue hosting research. The NIH commonly negotiates these rates with universities, representing other science funding organizations. As the provision is now a law, the government cannot make any changes to the NIH's reimbursement rates process unless new legislation is proposed.

Source: [American Institute of Physics](#)

Clinical

According to new data from the Centers for Medicare and Medicaid Services (CMS), in 2018, Medicare reimbursement for 75% of clinical labs will be cut by approximately \$670 million, not the original estimated figure of \$390 million. This is due to the CMS' efforts to ensure that labs are paid the same amount by the CMS for tests as by private payers.

Based on the current system, each lab has the freedom to determine its own rates based on market data, and

according to CMS, this process has been largely unchanged since 1984. However, last year a rule on reimbursement strategy change was finalized and is scheduled to go into effect in January 2018. This change is expected to slash reimbursement costs, disrupting lab services and patient access, especially for Medicare beneficiaries. The cut may negatively impact the outbreak detection of infection diseases as well.

Stakeholders are also concerned that the CMS' data is inaccurate, with the HHS Office of Inspector General estimating that 12,000 labs potentially meet the definition of applicable labs affected by the cut, but only 2,000 labs reported data. Other labs, such as physician office-based labs, are in the dark as to whether they qualify for the decrease in reimbursements, as they have yet to receive word from the CMS.

The CMS plans to publish the finalized rates in November. Public comments are due October 23.

Source: [Modern Healthcare](#)

Australia

In 2015-16, Australian business expenditures on R&D (BERD) decreased 12% in current price terms to AUD 16.7 million (\$13.2 million) from 2013-14. Human resources in businesses also decreased 11% for the same time period to 70,467 people. The declines are attributed to the second successive decrease in BERD in the mining and manufacturing industries. The mining industry's share of BERD fell 54.3% to AUD 1.9 million (\$1.5 million), while the manufacturing industry's BERD contribution dropped 19.3% to AUD 3.9 million (\$3.1 million). As a share of GDP, BERD declined from 1.19% in 2013-14 to 1.01% in 2015-16.

Total business capital expenditures, which includes spending on land and infrastructure, fell 30% to AUD 861 million (\$680.7 million), while current expenditure, which includes labor costs, dropped 10.7% to AUD 15.8 million (\$12.5 million). Manufacturing made up the majority of BERD, representing AUD 3.9 million (\$3.1 million), or around 23%, followed closely by professional, scientific and technical services' contribution of AUD 3.6 million (\$2.8 million), also approximately 23%. Along with mining as well as financial and insurance services, these four industries represented 77% of total BERD, with the largest decrease in BERD in the mining sector.

Regionally, New South Wales and Victoria had the highest levels of BERD, representing 39% and 26% of the nation's total, respectively. The largest decrease in BERD took place in Queensland, which was down 28%, as well as Western Australia, in which BERD decreased 24%.

Source: [Australian Bureau of Statistics](#)

Poland

The Polish government is working on revamping its higher education system to better optimize innovation in the country. With a low ranking on the European Innovation Scoreboard, Poland lacks an international reputation for scientific research and innovation and has "modest" scientific output, as only 5% of Polish scientific publications are amongst the 10 most frequently cited papers worldwide. The country has healthy public R&D investments, yet is underperforming in its R&D output. This is likely due to Poland keeping its scientific outputs on a national level instead of participating in international collaborations, creating a fragmented science industry. This is evident with the lack of cohesion amongst Polish universities, as R&D projects are distributed to institutions that are higher ranked. However, although higher education R&D expenditure (HERD) is low in Poland, it is steadily increasing, as HERD totaled PLN 4.7 million (\$1.3 million) in 2014, a 21.7% increase from 2010. Business expenditure in R&D (BERD) has also increased, especially corporate R&D, though it is sluggish in international comparison. In 2015, Polish BERD was 0.44% of GDP, a 0.22% increase from 2011; however, this is far below the 1.3% average of the EU. Poland has the lowest rate, at 10%, in the EU of small- to medium-sized enterprises innovating in-house. In regards to ease of business between government and corporate enterprises, Poland has increased its World Bank ranking from 76th in 2009 to 25th in 2016.

Poland is developing better links between business and science, but currently, only 10% of innovative companies collaborate with higher education institutions. By reforming the higher education system, developing better research priorities, focusing on international networking and collaboration, and establishing stronger and more easily accessible associations between science and industry, Poland is working on implementing a sustainable strategy to create a more comprehensive science system.

Source: [European Commission](#)

South Korea

The South Korean biopharmaceutical industry is on the upswing, ranking second to Singapore in innovation and competitiveness among emerging countries. Globally, the Korean biopharma industry is valued at \$17 billion and represents 2% of the market, with a 0.1% annual growth rate. The reason for the slow but steady growth is due to South Korean companies mostly focusing on the production of generic and slightly modified drugs, as well as limited control over pricing, since the government regulates drug costs.

In order to accelerate growth, the Ministry of Science and ICT, Ministry of Trade, Industry and Energy, and Ministry of Health and Welfare have steadily increased R&D in biopharma. In 2016, the federal government invested \$206.5 million in biopharma R&D. The government has also established programs to increase drug development over the past decade, such as the Ministry of Health and Welfare's Korea National Enterprise for Clinical Trial in 2007 and the Korea Clinical Trials Global Initiative in 2016. Since 2000, clinical trial numbers have grown 20 times, with 56% of the trials carried out by domestic pharmaceutical firms. There have been 675 clinical trials in total in Korea, with domestic pharmaceutical companies conducting 379 and multinational pharmaceutical firms overseeing 296. As of July 2016, the Korea Drug Development Fund, a federal program fostering drug R&D, has signed licensing agreements for 21 drug pipelines valued at \$3.5 billion and has funded 116 research projects worth \$130 million.

Source: [Korea Biomedical Review](#)

Life Science Instruments

General Life Science Instruments

Company Announcements

In July, the **UK Centre for Mammalian Synthetic Biology** announced the receipt of a £1 million (\$1.3 million) award from **Innovate UK** to develop a desktop genome editing platform for cell lines. Partners in the project are **Sphere Fluidics**, **Horizon Discovery** and **Twist Bioscience**. The technology will also explore the delivery of synthetic transcription factors at single-cell level to program stem cell differentiation.

In August, **BioTek Instruments** opened a Middle Eastern office in Dubai, UAE. The office will serve the Middle East and North Africa.

NanoString Technologies announced in September that **Anthem** has issued a positive coverage decision for its Prosigna Breast Cancer Gene Signature Assay. According to the company, the assay is now covered by every national commercial plan in the US. The assay runs on the nCounter Dx Analysis System.

In September, **PerkinElmer** and China's **State Key Laboratory of Biochemical Engineering** announced the opening of the Transitional Medical Engineering Demonstration Laboratory in Beijing, China. The lab includes an extensive array of PerkinElmer instrumentation and software, including the Opera Phenix and Operetta CLS high-content screening systems, and the EnVision multilabel plate reader.

Scientific Digital Imaging announced the resignation of Ann Simon from its Board, effective September 27.

Product Introductions

BioTek Instruments introduced in August the 800 TS Absorbance Reader and ELx50 Washer, its next generation legacy reader and washer. The 800 TS features temperature control and shaking to expand its applications to kinetic assays. The 50 TS Washer features easy programming.

Azure Biosystems launched in August the Sapphire Biomolecular Imager, a laser scanner offering fluorescent imaging in the NIR and visible wavelengths, as well as chemiluminescent imaging and scanning of storage phosphor screens. It enables resolution down to 10 µm. It replaces two or three separate instruments. Shipping began this month.

Quanterix announced in August that it plans to launch the SR-Plex multiplex digital biomarker detection benchtop instrument, based on the company's Simoa single-molecule measurement technology. The platform will be capable of measuring both proteins and nucleic acids. It will be part of a complete solution that also includes a menu of more than 70 protein-detection assays as well as a new series of multiplex assays.

In August, **BMG LABTEC** released a gas ramping function for its CLARIOstar microplate reader, the CLARIOstar with Atmospheric Control Unit, calling it the first plate reader to rapidly return to physiological gas conditions upon active modification of oxygen and carbon dioxide tensions within the reader. The function mimics in vitro hypoxia and ischemia/reperfusion.

In September, **Syngene** debuted the G:BOX, a compact, upgradeable, multi-application system for all types of gel and Western blot imaging. It features a motorized stage and super-cooled camera.

Tecan launched in September the Spark-Stack integrated microplate stacker for its Spark multimode reader. It provides walkaway processing for up to 50 assay plates per run.

Cell-based Instruments

Company Announcements

Molecular imaging firm **Sophie Biosciences** announced in May plans to acquire **Zevacor Pharma** (formerly **IBA Molecular North America**) from **Illinois Health and Science**. Zevacor develops, manufactures and distributes PET radiopharmaceutical products and related services. The company completed the acquisition in September.

In August, **RareCyte**, a provider of tools and reagents for rare-cell detection and liquid biopsy, received a \$30 million investment, led by **5AM Ventures**. In conjunction with the funding, Joe Victor, 5AM venture partner, joined the company as CEO. Current CEO Ron Seubert transitioned to CTO.

LumaCyte, a provider of single-cell analysis and sorting instrumentation, joined the **National Institute for Innovation in Manufacturing Biopharmaceuticals**, which is sponsored by the US **NIST**, in September.

In September, **Berkeley Lights**, maker of a platform for single-cell tracking and monitoring, announced a strategic project with **Bayer** for cell line development, antibody discovery and research.

Molecular Devices announced an agreement in September to launch **Cytene's** CloneSelect Single-Cell Printer in North America. The system allows automated isolation of single cells into standard well plates.

Cellular Dynamics, a **FUJIFILM** company, announced in September a joint marketing agreement with **Nanon Technologies** to offer their respective iPSC-derived tissues cells and CardioExcyte 96 instrument.

In September, **IsoPlexis**, which is developing a product to detect cellular responses at single-cell resolution, announced the final closing of a Series B round, raising \$13.5 million. The round was led by **Spring Mountain Capital**.

Product Introductions

In September, **Yokogawa Electric** debuted the CellVoyager CV8000, a high-throughput cytological discovery system with enhanced functions. New features include an improved incubation environment, the ability to accommodate 4 instead of 3 cameras, and the CellPathfinder software for analyzing images of unlabeled cells and 3D images of samples.

Beckman Coulter Life Sciences unveiled in September the CytoFLEX LX Blue-Red-Violet-Yellow-Green-Ultraviolet-Infrared series, calling it the first flow cytometer to offer excitation sources across the visible spectrum in a standard configuration. It features a new ultraviolet laser, opening up research into cell-cell interactions under both normal and abnormal conditions.

In September, **PerkinElmer** launched the IVIS Lumina S5 and Lumina X5 system for high-throughput, benchtop, 2D optical in vivo imaging systems. The systems provide bioluminescence and fluorescence imaging with spectral unmixing. The Lumina X5 integrates x-ray imaging.

BD (Becton, Dickinson and company) introduced in September the BD Rhapsody single-cell analysis platform, which utilizes the company's unique molecular index technology. It is designed for RNA expression analysis of tens of thousands of individual cells. The product was previously in limited commercial release under the name Resolve (see [IBO 3/31/17](#)). BD will offer application-specific targeted panels and enable customers to design their own custom, targeted panels. Also available will be a multiplexing kit. The platform is expected to expand to protein detection, with commercial availability in the first half of 2018.

In September, **Axion Biosystems** launched the next generation MEA (MicroElectrode Array) technology, the Maestro Pro and lower-cost Maestro Edge. The system captures live-cell activity from electroactive cells in real time. New features include one-button setup.

Miltenyi Biotec introduced in September the benchtop MACSQuant X flow cytometer, which can process 384-well plates in less than 60 minutes and 96-well plates in 15 minutes. It features 10 parameters and analyzes uptake volumes as small as 5 µL per sample.

In September, **Lonza** debuted the CytoSMART 2 System for live-cell imaging. It features an advanced optical system and more powerful camera unit compared to the previous generation instrument.

Sales/Order of Note

PerkinElmer announced in August that **M2**, a collaboration between **Monash University** and Australia's **Commonwealth Scientific and Industrial Research Organization (CSIRO)** to advance medical technologies, will utilize its cell::explorer robotic workstation for cell cultivation and phenotypic screening. The system has been installed at CSIRO's Biomedical Materials Translational Facility.

Gene-based Instruments

Company Announcements

In July, **Bio Molecular Systems**, maker of the MIC qPCR Thermocycler, named **Resnova** as its exclusive distributor for Italy.

In August, **Advanced Analytical**, which makes CE-based solutions for nucleic acid analysis, opened an office in the UK, its third international office.

Hygiena announced in August the acquisition of **Pruebas Microbiologicas Rapiidas**, its Mexico City-based distributor.

In September, **Molecular Biology Systems** announced new distributors for its NEXTGENPCR thermal cycler: **PreMed Lab** for China; **Pronto Diagnostics** for Israel; **YBUX** for the Czech Republic; **Albiogen** for the Russian Federation; **Isogen** for Benelux and Spain; and **CAMLAB** for the UK.

Product Introductions

In July, **Fluidigm** debuted the Advanta Immuno-Oncology Gene Expression Assay for interrogation of tumor immunology, designed for use with the Biomark HD system. It can detect 170 gene expression markers involved in checkpoint therapeutic response from FFPE and fresh frozen tumor samples. Available as a 2-panel set, the first panel includes 91 key markers of tumor immune response. The second panel contains 74 markets and 17 open assay inlets for customization. The panels can be purchased together or separately.

In August, **Canon BioMedical** introduced the Novallele HRM Analyzer, a free, web-based HRM (High Resolution Melt) analysis software for use with any thermocycler and different well-plate formats.

ExcitePCR announced that its FireflyDX-Portable pathogen detection system will be available in summer 2018, with the release of the FireflyDx-Handheld targeted for 2019.

Sales/Orders of Note

In August, **SGI-DNA**, a **Synthetic Genomics** company, announced that Belgian life science research institute **VIB** is the first institute in Europe to adopt its BioXp 3200 System as part of its Technology Watch Initiative.

Protein-based Analysis

Company Announcements

In August, **CibusDx** acquired **Pronucleotein Biotechnologies**, a developer of DNA aptamer assay technology, and licensed **ApolloDx**'s diagnostic platform to create a food safety testing platform for detecting pathogens onsite, anywhere in the supply chain, within 30 minutes. Product launch is expected in late spring 2018.

InDevR announced in September an exclusive licensing agreement for monoclonal antibodies developed by the **Icahn School of Medicine at Mount Sinai**. The license provides the company with a unique set of anti-neuraminidase monoclonal antibodies for rapid, subtype-specific quantification of neuraminidase by its VaxArray system.

Product Introductions

In August, **Nanomedical Diagnostics** introduced a new NHS Agile Biosensor Chip, which has pre-activated amine-linker chemistry that enables rapid immobilization of any molecule with a free amine group, allowing for flexible, fast kinetic characterization using a wide range of target classes. It is designed for use with the Agile R100 label-free personal assay system.

AYOXXA Biosystems released in September the LUNARIS system, a low-volume beads-on-a-chip multiplex protein analysis system. The system is comprised of a dedicated reader, automated analysis software and a portfolio of multiplex protein assay kits for the detection and quantification of soluble inflammation and immune-response markers.

In September, **ProteinSimple**, a **Bio-Techne** brand, expanded its Ella immunoassay platform with the launch of the 32 x 4 Simple Plex cartridge. The cartridge simultaneously measures up to 32 different samples from serum, plasma, cell culture supernatants and other bodily fluids against 4 different analytes of interest. This doubles the current sample throughput while maintaining a total immunoassay time of 85 minutes.

Sales/Orders of Note

In September, **Aushon BioSystems** announced that **ABL**, a biomedical contract research and manufacturing organization, has adopted its Cira platform for biomarker analysis.

GC & GC/MS

Company Announcements

Shimadzu announced in July that its high-end Nexis GC-2030 and HS-20/HS-10 headspace sampler can now be controlled by **Agilent Technologies'** OpenLAB CDS.

INFICON's second quarter Security & Energy market sales declined 14.5% to \$4.6 million, which was mainly due to the security market.

In September, **Ellutia** opened a dedicated training center, the GC Excellence Academy, at its facility in Ely, UK.

Product Introductions

In August, **Thermo Fisher Scientific** launched Fisher Chemical Optima and GC Resolv Methylene Chloride, ultrapure methylene chloride for enhanced trace analysis.

Markes International introduced in August the CIA *Advantage-xr* thermal desorption instrument for the automated analysis of trace-level air toxics and other pollutants in canister air and gas, and whole-air samples. Features include cryogen-free operation, up to 27 channels, and the ability to run high- and low-concentration samples in the same sequence.

In September, **Shimadzu** released a trace moisture analysis system utilizing a GC method, developed in collaboration with the **University of Texas at Arlington** and **MilliporeSigma**. The system consists of the Nexis GC-2030 equipped with the Barrier Ionization Discharge detector and MilliporeSigma's Watercol capillary column. The system provides precise analysis of parts-per-million levels of water.

AGC Instruments introduced in September the AGC NovaCHROM GC system to monitor nitrogen per the **European Medicines Agency** standard. The system is comprised of the NovaCHROM 400 GC with a TCD, TrendVision PLUS chromatography software and solenoid control unit.

PerkinElmer debuted in September the Clarus 590 and 690 GC instruments, expanding its Clarus GC platform, for analyses of a wide range of samples. Features include a high-performance oven, wide-range FID and capillary injector.

Surface Science

Company Announcements

In August, **DataDirect Networks** announced a strategic partnership with **Gatan** for solutions for microscopy research environments and workflows, combining their respective high-performance data storage platform and cameras.

JEOL established in September the JEOL-**Nikon** CLEM Solution Center at a JEOL facility in Tokyo, Japan.

In September, **ZEISS** announced the **ADAMOS** (ADaptive Manufacturing Open Solutions) joint venture, an alliance to establish an open IIoT (Industrial Internet of Things) platform for machine and plant building. The partners are **DMG MORI**, **Dürr**, **Software AG** and **ASM PT**. ADAMOS and ADAMOS App Factory will launch with 200 experts starting October 1.

ZEISS announced in September plans to build a shared €30 million (\$33 million), 12,000 m² (129,000 ft²) innovation hub on the campus of Germany's **Karlsruhe Institute of Technology**. The organizations also entered into a strategic partnership. Construction will begin early next year and should be completed by the end of 2019. 3D printer developer **Nanoscribe**, in which ZEISS holds a stake, will be located at the hub. The facility will also house

high-tech and digital startups.

In September, **Nearfield Instruments**, which is developing an ultrafast high-throughput AFM, announced investments by **Samsung Venture Investments** and Dutch investment fund **Innovation Industries**.

Optiscan announced in September a 3-year exclusive distribution agreement with **China Gate Scientific** for China. There is an option to extend the agreement for an additional 2 years.

Leica Microsystems and Canada's **CHU Sainte-Justine Research Center** partnered in September to establish a microscope facility in Montreal. Leica has provided eleven high-end microscopy systems.

In September, **Leica Microsystems** announced that **Rick Hirsché** and **ICMAS** will be the company's exclusive distributors for life science and industrial EM sample preparation solutions in the US states of Alabama, Florida and Tennessee.

Product Introductions

Nanopsis announced in June the introduction of the SMAL (Super-resolution Microsphere Amplified Lens) optical nanoscope, a lower-cost alternative for super-resolution microscopy. It has a resolving limit of sub-100 nm across the X, Y and Z planes, and a working distance of 35 nm.

In July, **JEOL** launched the 4D Canvas STEM detector, a multi-channel STEM detector with 264 x 264 channels. It features a signal-to-noise ratio as high as 300:1, and image acquisition of 1,000 fps or higher.

JEOL debuted in September the JSM-7610Plus FE-SEM, an upgraded model of its ultrahigh-resolution Schottky FE-SEM, featuring an improved electron optical system.

Andor Technology, an **Oxford Instruments** company, released in July a cost effective solution for the SRRF (Super-Resolution Radial Fluctuations)-Stream technique, a real-time super-resolution microscopy functionality that operates exclusively on its iXon Life and iXon Ultra EMCCD cameras. The technique can be used with standard widefield, TIRF (Total Internal Reflection Fluorescence) and spinning disk confocal modalities.

According to the **Universidad Carlos III de Madrid (UC3M)**, **4D Nature**, a UC3M spinoff, introduced the Qiscope, an ultra-fast 3D confocal microscope for live-cell imaging. The system is assembled, marketed and distributed by **PlaneLight**. Up to six different cells or cell types can be monitored in the same specimen. Measurements are taken at 200 images per second.

In September, **Anton Paar** launched the Tosca 400 AFM, which is specifically designed for industrial users. It features automation for ease of use.

Laboratory Products

Lab Equipment

Company Announcements

In July, **C. Gerhardt** named **Pensalab** as its exclusive distributor for Brazil.

In August, private investment firm **Summit Park** announced the sale of **Control Company**, a provider of thermometers, timers, tools, humidity gauges, hygrometers and conductivity tools, to **Cole-Parmer**.

BIOBASE established in August a branch office and warehouse in the Hamriyah Free Zone, close to Dubai, UAE.

In September, **VWR** opened a new 35,000 ft² kitting center in Skalice, Czech Republic, to support its Therapak business and add to its VWRCATALYST offering. The facility will be fully operational on October 2.

Product Introductions

In July, **OHAUS** launched a new line of Extreme Environment Shakers, which can be used in CO₂ incubators. It features a remote controller. The company also launched five new models of its rocking and waving shaking models for applications in a variety of environmental conditions, including two analytical 16 lb rocking shaker models in 1 and 2-tier options.

OHAUS released in August a new line of digital reciprocating shakers, featuring a RS232 interface for two-way data logging and unit control.

Thermo Fisher Scientific unveiled in July the Thermo Scientific TSX505 Series undercounter refrigerators, calling them the only lab-grade undercounter refrigerators using thermoelectric drives in place of compressor technology for variable speed control. They feature energy savings and whisper-quiet operation.

In September, **Panasonic Healthcare** released the 165 L MCO-170AICD, the latest addition to its IncuSafe incubator line. The MCO-170AIC(UV)D is certified as a Class IIa Medical Device.

Uniqsis introduced in September the FlowLab Column, an optimized flow chemistry system. It offers the potential to replace conventional stirred batch reactors for continuous, heterogeneously catalyzed liquid phase reactions.

In September, **Baker Ruskinn** debuted the VelO₂x rapid oxygen-control chamber for fast oxygen transition studies, ideal for use with animal research models.

Laboratory Automation

Company Announcements

In August, **Labcyte** and **SEngine Precision Medicine** announced a collaboration to employ Labcyte's Echo acoustic liquid handling solutions with SEngine's functional drug testing approach that matches cancer patients to available toxic therapies. SEngine is also using Labcyte's Access Laboratory Workstation.

HighRes Biosolutions and **Titian Software** completed a joint effort in September combining their respective automation and sample tracking system to provide a flexible and fully auditable sample management workflow. Seven systems are now in production.

Product Introductions

In August, **Tecan** released new clear Liquid Handling (LiHa) disposable tips for use with its Air LiHa, Air FCA and Cavro ADP pipetting options. It includes 50 µL tips, available in Tecan Pure, and 200 and 1,000 µL tips, currently available in Tecan Standard and soon available in Tecan Pure.

Labcyte introduced in September the Echo Qualified 384 LDV Plus Microplate, a 384-well low dead volume microplate for its Echo 525 Liquid Handlers. It reduces the amount of sample or reagent required in a well for transfer by 75% or more.

In September, **Epson Robots** released the T-Series All-in-One robots with built-in controller. The first product in the line, the T3, offers a cost effective and simple-to-integrate and install solution. Applications include lab automation.

Sales/Orders of Note

In September, **Hamilton Storage** announced the use of its Hamilton BiOS automated storage system by the **Biobank for Microbiome Research in Massachusetts** project. The system is expected to be installed and operational by early 2018, and will store 3.5 million samples.

Hudson Robotics and **John Hopkins University** announced in September the receipt of an **NIH** grant to develop a commercially viable high-throughput screening system for in vivo studies of zebrafish as a primary screening method.

Electrochemistry

Product Introductions

In August, **DKK-TOA** introduced the WQC-30 portable water quality analyzer, the successor to the WQC-22A. Up to six parameters can be measured simultaneously.

Cole-Parmer released in September the Oakton pocket testers for water quality: pHTestr 50, pHTestr 50S Spear-Tip, ORPTestr 50, CTSTestr 50 and PCTSTestr 50 Multiparameter. They stand upright due to a new cap design that also works as a sample cup and stores solution.

Chemicals and Reagents

Company

Merck KGaA announced in June a collaboration with **Elsevier** under which it will add an additional 43,000 life science compounds and chemicals with data directly from the supplier into Elsevier's Reaxys chemistry database.

In September, **Spectrum Chemical Mfg.** signed a US distribution agreement with **Cole-Parmer**.

Reported Financial Results

\$US	Period	Ended	Sales	Chg.	Op. Prof.	Chg.	Net Prof.	Chg.
Enzo Biochem	Q4	31-Jul	\$28.2	6.0%	\$0.1	-99.8%	\$0.1	-99.7%
Enzo Biochem (Life Science)	Q4	31-Jul	\$7.5	-6.9%	\$0.8	-20.0%	NA	NA
Enzo Biochem	FYE	31-Jul	\$77.4	9.2%	(\$2.4)	NM	(\$2.5)	NM
Enzo Biochem (Life Science)	FYE	31-Jul	\$30.4	-4.6%	\$2.6	-95.7%	NA	NA
MaxCyte	H1	30-Jun	\$6.2	13.6%	(\$4.0)	-317.1%	(\$4.3)	-239.5%
MOCON	Q1	31-Mar	\$15.5	5.2%	\$0.8	7.2%	(\$0.0)	NM
Neogen	Q4	31-May	\$98.8	9.7%	\$19.0	21.6%	\$12.7	28.7%
Neogen	FYE	31-May	\$361.6	12.5%	\$64.9	15.2%	\$44.0	20.3%
Pressure BioSciences	Q2	30-Jun	\$0.5	5.8%	(\$1.2)	-13.5%	(\$0.6)	NM
Roka Bioscience	Q2	30-Jun	\$2.1	17.4%	(\$17.4)	-143.5%	(\$17.8)	-134.8%
Other Currencies (in Millions)								
Horizon Discovery	H1	30-Jun	£12.1	18.6%	(£ 8.2)	-29.6%	(£ 8.2)	-36.4%
Jiangsu Skyray Instrument	Q2	30-Jun	CNY 152.0	60.0%	CNY 26.0	52.9%	CNY 25.0	13.6%
Judges Scientific	H1	30-Jun	£32.7	19.8%	£2.3	NM	£1.8	NM
Olympus (Scientific Solutions)	Q1	30-Jun	¥20.0	7.3%	(¥ 0.6)	45.3%	NA	NA
Pfeiffer Vacuum Technology	Q2	30-Jun	€139.3	23.0%	€14.6	3.6%	€10.0	2.7%
Pfeiffer Vacuum Technology	H1	30-Jun	€276.2	23.9%	€35.9	33.3%	€24.8	32.9%
ReproCELL	Q1	30-Jun	¥211.0	-20.7%	(¥ 274.6)	-11.8%	(¥ 200.8)	42.0%

NA = Not Available, NM = Not Meaningful

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