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Agilent Technologies: Growing Through Change

Agilent Technologies is one of the world's largest providers of laboratory solutions, serving more than 86,000 customers with $4.5 billion in annual revenues. Agilent is the second largest supplier of analytical and life science instruments, according to ***IBO***'s list of the top 30 industry companies in 2016 (see ***IBO*** 4/15/17).

Agilent FY17 Customer Numbers by Business Segment	
Agilent CrossLab	49,000
Life Sciences and Applied Markets	26,000
Diagnostics and Genomics	11,000

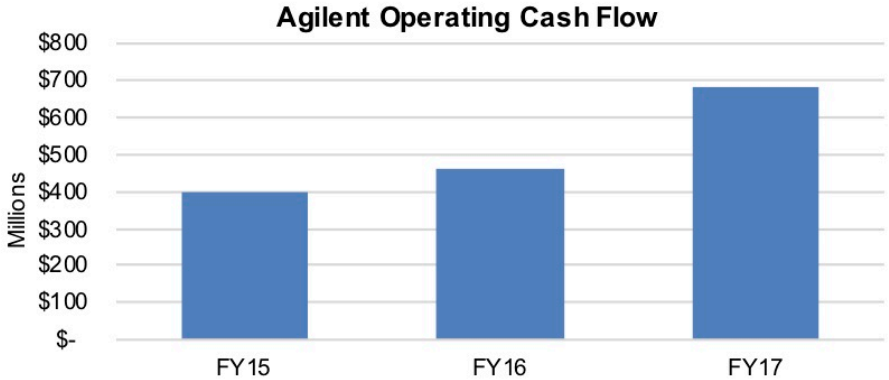
IBO named Agilent its Company of the Year for 2017 (see ***IBO*** 1/15/18) based on the company's financial, strategic and product achievements during the year. The results were the outcome of a fundamental reorganization, operational review and cultural change that began at the company in 2014. Among the major undertakings: the creation of three new divisions, the consolidation of sales channels, and the restructuring of the company's central research lab to focus on life science and diagnostics.

Informing the change process were two initiatives: Agile Agilent, described as a cost reduction and rationalization program, and One Agilent, designed to change the company's culture to better align with its customers, including a greater external focus.

One Agilent was a particular challenge, according to Patrick Kaltenbach, senior vice president of Agilent and president of the Life Sciences and Applied Markets Group. Asked about the most important lessons Agilent learned as a result of its three-year transformation, he told ***IBO***, "The first was how best to work together as One Agilent, across groups and functions. This was and is a cultural transformation." This was a widespread change, he explained. "We had to learn how to shift our mindset and approach, from operating in a largely siloed or group-only mindset, to looking for better ways to work together across the company to leveraging expertise and innovation, and ultimately drive good business solutions for our customers."

> *"Initially, as one might expect, there was quite a bit of skepticism whether the ´One Agilent´ approach would drive results."*

This cultural change was also a surprise in terms of the challenges the company faced in completing the transformation. "As in many mature companies, there were pockets of the organization who had always had the limited perspective of operating within an isolated product line or division," said Mr. Kaltenbach. "Initially, as one might expect, there was quite a bit of skepticism whether the ´One Agilent´ approach would drive results. Once we could show the success of this approach, like with our efforts in the corporate-wide Biopharma program, this sentiment began to change and continues to do so."



In addition to One Agilent, the restructuring itself, which spanned many operations and functions, was also a lesson learned from the transformation. "The second lesson is really based on the theme 'structure follows strategy'. For LSAG, for example, we reorganized the Mass Spec organization into one group, and with the realignment of the sales team, we were able to unleash real innovation and momentum to drive growth," highlighted Mr. Kaltenbach. "This allowed us to treat our customers´ businesses holistically and support their operations more effectively/efficiently."

Congruent with these changes was a portfolio review, and realigned product and end-market investments. As Mr. Kaltenbach stated: "Lastly, but by no means less importantly, the third lesson we learned, was that although it was a difficult decision for us to shut down unprofitable and underperforming parts of the business, like the NMR group,

this action released more funding opportunities for us to focus our investments on high-growth areas, bring new technology into play and focus on where we could make the biggest difference to customers in our key markets." Targeted areas include clinical diagnostics, LC/MS and food safety.

Product development is also designed to address all of the company's core markets. "Using the company's technologies across markets enables Agilent to enjoy growth broadly, and without the limitations of success in only one or two," explained Agilent President and CEO Mike McMullen. "Having this breadth of application also allows Agilent to leverage development and production investments across a much larger scale. Greater growth and profitability also gives us the opportunity to reinvest more back into the business to serve our customers even better." As example of this leverage he pointed to the company's LC and MS product lines. "Both generate revenue across all of Agilent's markets (pharmaceutical, academia and government, diagnostics and clinical, food, environmental, and chemical and energy)."

At this month's JP Morgan Healthcare Conference, Mr. McMullen highlighted three areas of emphasis for future sales growth: cancer diagnostics, biopharma and cancer research, each of which utilize multiple Agilent technologies. In the cancer diagnostics markets, the expectation is that further research techniques will migrate to the market.

> *"Being the leader in metabolomics, Agilent is also in a great position to capture the evolving opportunity of omics-based diagnostic testing,"*

By participating in both the research and diagnostics markets, Agilent joins many of its peers. Regarding how Agilent differentiates its strategy for this growth opportunity, Mr. Kaltenbach told ***IBO***, "Agilent has a much broader portfolio of solutions, from sample prep to analysis and reporting, that allows us to build differentiated and complete solutions for our customers worldwide." The company's current participation in evolving markets is also significant. "Being the leader in metabolomics, Agilent is also in a great position to capture the evolving opportunity of omics-based diagnostic testing," he said. As he emphasized, Agilent currently has a foothold in diagnostics. "With the former Dako organization, acquired in 2012, we have a very strong diagnostics business already, and are well positioned to leverage that knowledge for our analytical product lines."

For fiscal 2018, ending October 31, Agilent forecasts core revenues to grow approximately 4.3% to between $4.72 billion and $4.74 billion.

Thermo Fisher Scientific Launches Ion GeneStudio S5 Series

Since the emergence of sequencing in the 1980s, the field has seen an immense number of improvements in techniques, speed and cost. A report from the National Human Genome Research Institute (NHGRI) noted that technological improvements and automation have increased speed and lowered costs to the point where individual genes can be routinely sequenced and some labs have the capabilities to sequence well over 100 trillion bases each year. In addition, an entire genome can be sequenced for just a few thousand dollars. Given the speed of technological improvements, as you are read this there may be new improvements being used.

In January, a new line of NGS systems and the Ion 550 chip was introduced by Thermo Fisher Scientific. The Ion GeneStudio S5 Series consists of three systems: the Ion GeneStudio S5, S5 Plus and S5 Prime Systems, which each offer different turnaround times. The Ion GeneStudio S5 Plus and S5 Prime Systems can be used with the new Ion 550 chip. Thermo Fisher announced that within the first week of the Systems' launch, it had received over 30 orders for multiple Systems.

Selected Thermo Fisher Scientific/Life Technologies NGS System Introduction Announcements	
Announcement Date	**System**
December 2010	Ion Personal Genome Machine (PGM)
January 2012	Ion Proton Sequencer
September 2014	Ion PGM Dx System Listed with the FDA as a Class II Medical Device
October 2014	Ion PGM Dx System CE-IVD Registered
September 2015	Ion S5 and Ion S5 XL and Ion 520, 530 and 540 Chips

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A key differentiator, according to Thermo Fisher, is the ability to use multiple chips with one system, enabling the same instrument to be used for different applications that may have varying requirements for the number of reads and data output. This also allows users to run reads as needed without batch sample requirements.

Output ranges from 0.5 Gb to 50 Gb, while the number of reads is between 2 million and 260 million. Depending on the system and chip combination, the read lengths available are 200 bp, 400 bp and 600 bp. Thermo Fisher noted that this ability aligns with its custom-designed Ion AmpliSeq On-Demand Panels, which can be created to suit a particular Ion Chip.

> *Among the applications suitable for the Ion 550 Chip are exome sequencing, targeted transcriptome sequencing and whole transcriptome sequencing.*

As with the Ion 540 Chip, the Ion 550 chip can complete two runs in 24 hours. The latest chip provides 40–50 Gb of data in the two runs, while the Ion 540 provides 20-30 Gb. Among the applications suitable for the Ion 550 Chip are exome sequencing, targeted transcriptome sequencing and whole transcriptome sequencing.

One of the medical areas that has seen quite a bit of improvement with the use of sequencing is oncology. Physicians are increasingly able to utilize sequencing to detect the specific type of cancer that a patient has, thus allowing for the selection of more effective treatments. In addition, researchers have been able to use sequence data to identify genetic causes for rare diseases, and they are also looking at sequencing as a potential way to screen newborns for diseases and disease risk.

At some point in the near future, we may see the use of routine DNA sequencing in the doctor's office, but in the meantime the technology is being used more routinely at large medical centers to detect and treat a number of diseases. Researchers are better able to compare large sections of DNA to the tune of one million bases or more from many people more quickly and less expensively.

Spectris Adds Service Business

London, UK 1/26/18; Manchester and Egham, England 1/26/18; London, UK 1/26/18—Instrumentation and controls supplier Spectris has acquired Concept Life Sciences from Equistone Partners and management. The purchase price totaled £163 million ($233 million = £0.70 = $1) on a debt- and cash-free basis. Concept Life Sciences provides consultancy services, primarily to the pharmaceutical, biotechnology, agricultural and environmental sectors. In 2017, the firm recorded pro-forma revenues of £48.7 million ($69.6 million) and pro forma EBITDA of £9.3 million ($13.3 million). Concept Life Sciences joins Spectris' Materials Analysis business. "Concept is a high-quality services business, which further strengthens our portfolio and enhances our ability to provide customers within the pharmaceutical, life sciences and advanced materials sectors with a combined product and service proposition," stated Spectris Chief Executive John O'Higgins.

A contract research and testing organization, Concept Life Sciences provides discovery and development services as

well as analytical services. Concept Life Sciences has 700 full-time employees and operates 11 labs. This is the first dedicated service business to be part of Spectris' Materials Analysis division, which consists of Malvern PANalytical and Particle Measuring Systems. The acquisition supports division's efforts to increase its software and services offerings, as described in a 2017 investor presentation.

Harvard Bioscience Sells Denville Scientific to Thomas Scientific

Holliston, MA 1/22/18; Swedesboro, NJ 1/22/18—Harvard Bioscience, a life science manufacturer and marketer, has sold its Denville Scientific business to Thomas Scientific for $20 million, including a $3 million earn-out. A distributor of consumables for life science research, Denville Scientific generated 2017 revenues of $24.5 million. Harvard Bioscience also announced the acquisition of Data Sciences International (DSI), which provides products for physiologic monitoring with a preclinical focus, for $70 million. "With the sale of Denville, and upon the closing of the DSI acquisition, we will have transformed our company into a pure play life science instrumentation company with competitive advantages across our portfolio," commented Harvard Bioscience President and CEO Jeffrey A. Duchemin. "This strategic shift will make Harvard Bioscience a larger company, less susceptible to fluctuations in academic research funding, with improved profitability on day one." Thomas Scientific stated on its website, "Thomas, Phenix and now Denville remain committed to building the largest high-quality brand-centric distribution company serving science."

With this divestment, Harvard Bioscience exits the distributor business. Denville Scientific offers a variety of life science products and consumables for instruments ranging from pipettors to reagents to microscopy and histology products. DSI sells telemetry and pulmonary solutions.

This is Thomas Scientific's second acquisition in two months (see **IBO** *12/31/17). The purchase price is $17 million in cash with a two-year earn-out provision, according to a Harvard Bioscience conference call. Also, according to the call, Denville Scientific's gross margins have been 32%–36%.*

Metrohm Announces Further Investments in Raman

Herisau, Switzerland 1/14/18—Metrohm, a provider of instruments for chemical analysis, has acquired US-based Innovative Photonic Solutions (IPS) for an undisclosed amount. IPS produces OEM diode-based light components for Raman spectroscopy. "I've been very impressed with the exceptional values and can-do spirit of both Metrohm's technical and business executives and I am looking forward to working with the Metrohm team," stated IPS CEO John Connolly. IPS will continue to operate from its location in New Jersey.

Metrohm offers both lab-based and handheld Raman spectrometers. In recent years, the company has invested in handheld solutions, with the purchase of Snowy Range (see **IBO** *3/15/16) and Diagnostic anSERS (see* **IBO** *11/15/17). Additionally, the purchase gives the company greater control over its supply chain for such products.*

Particle Sizing Firm Acquired

Billerica, MA 1/22/18—Entegris, a publicly held supplier of specialty chemicals and advanced materials solutions to the microelectronics industry, has acquired Particle Sizing Systems for $37 million in cash. Particle Sizing Systems provides particle sizing instrumentation for liquid applications in the semiconductor and life science industries. Based in Florida with 40 employees, Particle Sizing Systems is expected to have 2018 revenues of less than $15 million. "To stay competitive, our advanced-node customers need tools that allow them to shorten process times while maintaining accuracy and consistency in order to meet the high-quality standards of the manufacturers they partner with," commented Entegris COO Todd Edlund. "PSS technology is unique in that it measures every particle

in the slurry, making it more accurate than commonly used methods that employ averaging techniques. As a result, this technology eliminates the need for manual sampling and intervention, which is less efficient and runs a higher risk of slurry excursions." The deal is expected to be accretive to Entegris' 2018 earnings.

Mr. Edlund told **IBO** *that the company plans to continue selling the life science product lines, and that the company will be fully integrated with Entegris. The Particle Sizing Systems brand will be phased out, but no company employees will be affected by the transaction, according to its website.*

Abcam Licenses New Antibodies from Roche

Cambridge, UK 1/22/18—Reagent and tool provider Abcam has exclusively licensed rights to the RUO–only product portfolio of Spring Bioscience, a Roche company. The 760 unique products consist of 243 recombinant rabbit monoclonal antibodies as well as Spring Proprietary Clones, optimized for IHC, and monoclonal and polyclonal antibodies. In addition, Abcam gained exclusive rights to all future RUO products developed by Spring Bioscience for which Roche requests commercialization. "This agreement represents an exciting step in the ongoing collaborative and long-term relationship between Abcam and Roche," said Abcam Chief Executive Alan Hirzel. "Abcam is excited to partner with Spring Bioscience, commonly recognized as a leading manufacturer of immunohistochemistry antibodies, furthering Abcam's mission to provide customers with the highest-quality recombinant antibodies for their research." The products will be available under the Abcam brand starting February 21.

Roche retains the rights to the antibodies for internal research, companion diagnostics and IVDs. The agreement enhances Roche's antibody offerings by adding an exclusive supplier and bolstering its IHC business. The IHC business is part of Abcam's expansion outside the antibody business. (For more on Abcam, see Abcam and Tecan Present at JP Morgan Conference).

QIAGEN to Acquire Platform for Syndromic Testing

Germantown, MD and Hilden, Germany 1/31/18—Life science solutions firm QIAGEN has agreed to buy STAT-Dx for $147 million and an earnout of up to $44 million. STAT-Dx's DiagCORE technology provides one-step, multiplex real-time PCR testing for common syndromes. Sales of the system are expected to total $7 million in 2018, as the system received a CE-IVD mark this month. Respiratory and gastrointestinal panels will be launched in Europe in the latter half of the year and in the US in 2019. QIAGEN will brand the system as QIAstat-Dx.

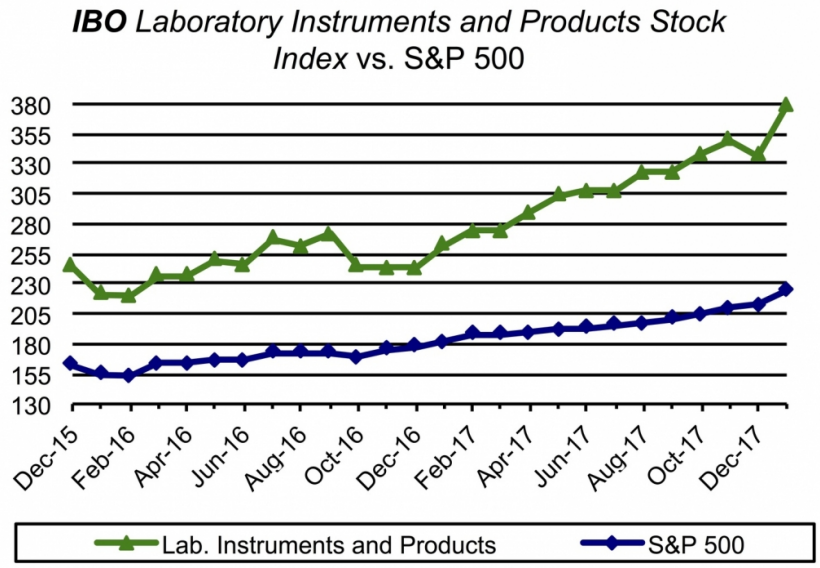
The companies have been partners with the system's cartridge utilizing QIAGEN chemistries. "QIAstat-Dx represents the next generation of innovation for multiplex syndromic testing, using powerful QIAGEN technologies and a real-time PCR technology that will allow for a much broader range of applications and drive the dissemination of molecular testing," stated QIAGEN CEO Peer M. Schatz. "The system is designed for significantly more cost-efficient test processing as required by the current reimbursement environment. Additional application areas for this system include companion diagnostics, quantitative analysis and immunoassay tests, offering customers a new level of flexibility and accurate diagnosis designed to support better outcomes for patients and healthcare systems." The acquisition is anticipated to be dilutive to full-year 2018 adjusted EPS by around $0.05 per share and to be neutral in 2019. The transaction is scheduled to close in the second quarter.

According to QIAGEN, advantages of the DiagCORE technology include simultaneous testing for up to 48 molecular targets, speed, an easy-to-use cartridge-based workflow, the ability to use other real-time PCR tests on the system, and flexible panel design. All sample preparation is performed on the cartridge. QIAGEN's presence in molecular diagnostics lab and in the PCR market suggests that it can capitalize on a newly launched technology with clear benefits to existing methods.

Strong Start to 2018 for IBO Stock Index

The US economy started off 2018 in strong fashion as US equity markets continued their surge into January. The Dow Jones Industrial Average (DJIA) climbed 5.8% to 26,150.63, while the S&P 500 similarly rose 5.6% to 2,824.12 for the month. The NASDAQ composite increased 7.4%, the most of the three, to finish at 7,411.48.

US GDP increased at an annual rate of 2.6% in the fourth quarter of 2017, falling behind third quarter GDP growth of 3.2%. However, the Bureau of Economic Analysis (BEA) announced that a more complete estimate will be reported next month. US GDP growth in fourth quarter 2017 was primarily driven by increased residential and non-residential fixed investments, exports, government spending and personal consumption. Relatedly, disposable personal income rose 3.9% to $139.0 billion, contributing to the economic expansion.



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Laboratory Instruments and Products Stocks

In January, ***IBO**'s Laboratory Instruments and Products Stock Index* leaped 12.2% to 378.60. A majority of the *Index* finished the month in positive territory, with **Harvard Bioscience** delivering the fastest monthly growth, up 42.4%. Harvard Bioscience closed the month at $4.70, delivering significant year-over-year growth as well, rising 56.7%. On January 23, Benchmark Capital raised the stock's target price from $6.00 to $10.00. Conversely, **Enzo Biochem**'s share price fell the most in January, down 9.7% to close at $7.36. For Enzo Biochem, this represents a five-month consecutive decline, starting from September of last year.

Also gaining double digits were **Becton, Dickinson**, **Thermo Fisher Scientific** and **Waters**. **Agilent Technologies**' share price closed at $73.44, nearly reaching double-digit growth at 9.7%. Agilent shares received a "buy" rating, along with a target price of $76.00 from Robert W. Baird on January 18.

Becton, Dickinson shares rose 13.5%, closing at $242.98. On January 19, Bank of America reiterated its "buy" rating for the company's stock, with a target price of $260.00.

On January 16, **Fluidigm** registered one million shares of common stock, with a proposed price of $6.46 per share, amounting to an aggregate offering price of $6.5 million. For the month, Fluidigm's share price advanced 4.1%, closing at $6.13. Relatedly, **Nanostring Technologies** entered into a sales agreement with Cowen and Co., selling the company's shares of common stock. The aggregate sales proceeds amount to $40 million.

Illumina shares grew moderately, up 6.5%, to close the month at $232.64. On January 16, Deutsche Bank set a

“buy” rating, along with a target price of $275.00 for the stock. On January 30, the company reported adjusted fourth quarter 2017 net income of $212 million, a 68.2% increase. Adjusted EPS for the quarter amounted to $1.44, a significant leap of 69.4%. As for full year 2017, adjusted EPS grew 20.1% to $4.00. The company expects 2018 adjusted EPS to be between $4.50 and $4.60

Thermo Fisher Scientific reported its fourth quarter 2017 earnings on January 31. Adjusted fourth quarter 2017 EPS grew double digits, up 15.8% to $2.79. For the full year 2017, adjusted EPS rose 15.0% to $9.49, driven by higher operating margins. Additionally, the company announced an increase in quarterly dividends. Thermo Fisher reported a quarterly cash dividend payout of $0.17 per share, payable on April 16, representing a 13.0% increase. For the month, Thermo Fisher’s share price jumped 18.0% to $224.13.

Waters delivered adjusted fourth quarter 2017 EPS growth of 13.6%, announced on January 23. Fourth quarter 2017 adjusted EPS amounted to $2.51, as compared to $2.21 in 2016. For the full year, adjusted EPS increased 13.0% to $7.49. Share price for the month climbed 11.6%, finishing at $215.68. On January 24, Citigroup boosted the stock’s target price from $190.00 to $223.00.

Company	Date Rep.	Fiscal Quarter	2017 Adj. EPS	Analyst Consensus		Vs. Estimate	YOY Growth	2016 Adj. EPS
Laboratory Instruments and Products Stock Index								
ILMN	30-Jan	Q4	$1.44	$1.18	↑	$0.26	69.4%	$0.85
TMO	31-Jan	Q4	$2.79	$2.66	↑	$0.13	15.8%	$2.41
WAT	23-Jan	Q4	$2.51	$2.44	↑	$0.07	13.6%	$2.21
Diversified Laboratory Stock Index								
GLW	23-Jan	Q4	$0.49	---		NA	-2.0%	$0.50
DHR	30-Jan	Q4	$1.19	$1.15	↑	$0.04	13.3%	$1.05
HON	26-Jan	Q4	$1.85	$1.84	↑	$0.01	6.3%	$1.74
ITW	24-Jan	Q4	$1.70	$1.62	↑	$0.08	22.3%	$1.39

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Diversified Laboratory Stocks

***IBO**’s Diversified Laboratory Stocks Index* advanced 4.5% to close the month at 284.24. The *Index* grew steadily in January, increasing at an average rate of mid-high single digit growth. **Danaher** grew the fastest of all the stocks in the *Index*, rising 9.1% to close at $101.29. On January 30, Danaher reported its fiscal 2017 earnings, for which the company delivered an adjusted EPS of $4.03, up 11.5%. Adjusted EPS for the fourth quarter of 2017 grew similarly, up 13.5% to $1.19, beating analysts’ expectations of $1.15. The company expects its first quarter 2018 adjusted EPS to be between $0.90 and $0.93. As for the full year, Danaher projects adjusted EPS of $4.25–$4.35.

Similarly, **Roper Technologies** was up, growing 8.1% to end the month at $279.89. On January 18, Wells Fargo set a “buy” rating for the stock, along with a boosted price target of $310.00. The new price target signifies a price increase of $15, or 5.1%.

Honeywell reported its full-year 2017 earnings on January 26, delivering strong profitability. Fourth quarter 2017 adjusted EPS grew 6.3% to $1.85, exceeding analysts’ expectations. For the full year 2017, adjusted EPS advanced 10.0% to $7.11, driven by stronger margins. Throughout 2017, Honeywell increased dividends by 12%. The company also spent $2.9 billion in share repurchases in 2017, $1.6 billion alone in the fourth quarter. For 2018, the company expects its adjusted EPS to be $7.75–$8.00, an increase over the previously projected $7.55–$7.80. With the new guidance, adjusted EPS is expected to show a 9%–13% increase. On January 26, Bank of America set a “buy” rating and boosted the stock’s target price from $117.12 to $168.00 for the stock. For the month, Honeywell shares climbed 4.2% to close at $159.74.

Illinois Tool Works (ITW) shares also grew at a similar pace, advancing 4.1% to $173.73 for the month. The

company reported its fourth quarter and full-year 2017 earnings on January 24, delivering strong growth results. Fourth quarter 2017 adjusted EPS increased 22.3% to $1.70, while full-year adjusted EPS grew 16.0% to $6.59. For the first quarter of 2018, **ITW** expects its EPS to be between $1.80 and $1.90. For the full year, the company projects EPS to be $7.45–$7.65. Additionally, **ITW** plans to increase its dividend pay-out ratio from 43% to around 50% of free cash flow starting in August. The following day, on January 25, Wells Fargo raised the stock's target price by $10 to $200.

Corning was the only company in the *Index* to have experienced a decrease in share price for the month. Corning shares fell 2.3% to $31.25, despite Citigroup's price target boost from $33.0 to $35.0. The company reported its full-year 2017 earnings on January 23, delivering an adjusted EPS of $0.49, down 2.0%. However, adjusted EPS rose sequentially, increasing 13.9% from the third quarter. For the entire year of 2017, Corning reported adjusted EPS of $1.72, an 11% increase.

International Stocks

Asia Pacific market indexes remained solid as most ended January in positive territory. Hong Kong's Hang Seng advanced nearly double digits, up 9.9% to finish at 32,887.27. China's Shanghai Composite, along with India's Sensex 30 both delivered mid-single digit growth, up 5.3% and 5.6%, respectively. However, Australia's All Ordinaries fell slightly, sliding 0.4% to 6,146.60.

For ***IBO**'s S*tock Index, shares in the Asia Pacific ended the month in green, with the exception of **Precision System Science**, for which its share price fell 5.4% to ¥625.0 ($5.71 at ¥109 = $1). **Techcomp** increased the fastest among the Asia Pacific shares, soaring 27.9% to close at HKD 2.29 ($0.29 at HKD 7.8 = $1). The remainder of the Asia Pacific shares expanded on average in the mid-high single digits.

In the European region, market indexes that ***IBO*** tracks showed moderate growth, as most increased by low to mid-single digits. Italy's FTSE MIB advanced the fastest, increasing 7.6% to 23,507.06. Conversely, UK's FTSE 100 slipped the most, down 2.0%. Similarly, Switzerland's SMI fell slightly, declining 0.5%.

European shares in the ***IBO*** Stock Table grew at notable rates, with **Scientific Digital Imaging** vaulting 29.9% to £0.32 ($0.46 at £0.70 = $1). Similarly, **Sartorius**' share price also increased significantly, up 18.0% to €89.0 ($111.2 at €0.80 = $1). The company reported its preliminary 2017 earnings on January 31, delivering 9.3% revenue growth. Furthermore, **Sartorius** reported an increase of 8.5% in earnings, amounting to €353.2 million ($441.6 million). The company expects profitability to increase even further in 2018.

Abcam also reported its preliminary earnings this month, on January 5. Abcam announced its half-year results, for which sales were estimated to have grown at around 11%. For the month, Abcam's share price advanced 16.6% to £12.30 ($17.55). The remaining European shares performed modestly, with just **Horizon Discovery** and **Merck KGaA** experiencing a decline in share price, down 3.8% and 1.9%, respectively.

Company: Exchange	Market Value (US M)	52 Week Range Low ($)	52 Week Range High ($)	Price 1/31/18	Change 1 Month	Change YTD	P/E (ttm)	EPS (ttm)
Laboratory Instruments and Products								
Agilent Technologies: n	$20,865	48.01	75.00	$73.44	9.7%	9.7%	35	2.10
Becton, Dickinson and Company: n	$42,691	174.13	248.39	$242.98	13.5%	13.5%	53	4.60
Bio-Rad Laboratories: n	$6,647	184.97	273.87	$258.80	8.4%	8.4%	328	0.79
Bio-Techne: o	$4,533	95.68	143.64	$140.29	8.3%	8.3%	72	1.95
Bruker: o	$4,775	21.83	36.53	$35.61	3.8%	3.8%	38	0.94
Enzo Biochem: n	$485	6.27	12.04	$7.36	-9.7%	-9.7%	NM	-0.05
Fluidigm: o	$147	2.52	7.05	$6.13	4.1%	4.1%	NM	-2.22
Harvard Bioscience: o	$130	2.25	4.85	$4.70	42.4%	42.4%	NM	-0.09
Illumina: o	$29,282	156.50	248.97	$232.64	6.5%	6.5%	44	5.25
Kewaunee Scientific: o	$81	20.95	31.20	$29.00	0.0%	0.0%	18	1.60
Luminex: o	$874	17.68	22.42	$20.19	2.5%	2.5%	31	0.66
Mettler-Toledo: n	$16,651	420.03	697.26	$673.22	8.7%	8.7%	41	16.45
MTS Systems: o	$1,021	44.65	58.70	$51.85	-3.4%	-3.4%	41	1.27
NanoString Technologies: o	$349	7.03	20.70	$7.52	0.7%	0.7%	NM	-2.05
Pacific Biosciences: o	$488	2.51	5.74	$2.84	7.6%	7.6%	NM	-0.90
PerkinElmer: n	$7,602	50.59	84.49	$80.17	9.6%	9.6%	22	3.60
QIAGEN: o	$7,399	30.20	35.00	$33.60	8.6%	8.6%	105	0.32
Thermo Fisher Scientific: n	$74,564	146.08	220.10	$224.13	18.0%	18.0%	38	5.88
Waters: n	$14,496	140.93	220.20	$215.68	11.6%	11.6%	32	6.78
Diversified Laboratory								
AMETEK: n	$15,253	50.44	78.16	$76.36	5.4%	5.4%	32	2.38
Corning: o	$27,996	25.97	35.10	$31.25	-2.3%	-2.3%	14	2.31
Danaher: n	$60,528	78.97	104.82	$101.29	9.1%	9.1%	30	3.38
Honeywell	$108,185	117.13	165.13	$159.74	4.2%	4.2%	24	6.60
Illinois Tool Works: n	$51,642	125.96	179.07	$173.73	4.1%	4.1%	27	6.52
Roper Technologies: n	$25,097	189.58	284.57	$279.89	8.1%	8.1%	41	6.89
Teledyne Technologies: n	$5,747	119.74	201.40	$191.05	5.5%	5.5%	32	5.88
Xylem: n	$11,317	46.67	75.16	$72.26	6.0%	6.0%	42	1.72
Laboratory Instruments and Products				**378.60**	**12.2%**	**12.2%**	**64**	
Diversified Laboratory				**284.24**	**4.5%**	**4.5%**	**30**	
Dow Jones Industrial Average				26,150.63	5.8%	5.8%		
S&P 500				2,824.12	5.6%	5.6%		
NASDAQ Composite				7,411.48	7.4%	7.4%		
Region Company	Market Value (Local M)	52 Week Range Low (L)	52 Week Range High (L)	Price 1/31/18	Change 1 Month	Change YTD	P/E (ttm)	EPS (ttm)
Pacific Shares								
GL Sciences: t	¥17,076	900	2,345	¥2,184	1.9%	1.9%	15	¥144.19
Hitachi High-Technologies: t	¥540,625	3,710	5,680	¥5,120	7.8%	7.8%	21	¥245.97
HORIBA: t	¥286,671	5,750	7,830	¥7,010	3.2%	3.2%	19	¥375.69
JEOL: t	¥50,714	488	699	¥656	2.7%	2.7%	91	¥7.21
Precision System Science: os	¥13,077	346	1,011	¥625	-5.4%	-5.4%	NA	-¥71.44
Shimadzu: t	¥598,358	1,722	2,919	¥2,751	7.4%	7.4%	31	¥87.56
Techcomp: hk	HKD 521	1	3	HKD 2.29	27.9%	27.9%	30	¥0.01
European Shares (London)								
Abcam: l	£2,168	7.99	12.26	£12.30	16.6%	16.6%	59	£0.21
Halma: l	£4,144	9.13	13.41	£12.77	1.3%	1.3%	37	£0.34
Horizon Discovery: l	£231	1.62	2.95	£2.31	-3.8%	-3.8%	NA	-£0.12
Oxford Instruments: l	£601	7.00	11.74	£9.20	8.1%	8.1%	NA	-£0.44
Scientific Digital Imaging: l	£22	0.19	0.34	£0.32	29.9%	29.9%	27	£0.01
Spectris: l	£2,757	22.25	28.69	£26.09	4.9%	4.9%	97	£0.27
European Shares (Other)								
Biotage: st	SEK 3,818	38.80	94.60	SEK 87.30	3.9%	3.9%	48	SEK 1.83
Datacolor: s	CHF 124	640.50	899.50	CHF 845.00	0.6%	0.6%	20	CHF 41.39
Merck KGaA: g	€ 11,946	87.23	115.20	€ 88.00	-1.9%	-1.9%	24	€ 3.68
Sartorius: g	€ 6,028	65.20	90.79	€ 89.00	18.0%	18.0%	52	€ 1.70
Tecan: s	CHF 2,159	148.80	217.80	CHF 206.20	1.7%	1.7%	43	CHF 4.84

The ***IBO*** *Stock Indexes* are weighted by marked capitalization. The *Indexes'* averages for the financial ratios presented are also weighted statistically to reflect the relative sizes of the constituent companies. *Laboratory Instruments and Products Index*: 12/30/11 = 100. *Diversified Laboratory Index*: 12/30/11 = 100. Exchanges: n = NYSE; o = NASDAQ; t = Tokyo; hk = Hong Kong; l = London; g = Germany; s = Switzerland; st = Sweden; no = Nordic Market; os = Osaka Securities. N/A = not available; NM = not meaningful.

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Third Quarter Results: BD, Bio-Rad, Biotage and Shimadzu

FY Q3 2017 Results								
	Revenues			Rev. Growth Summary			Adj. Operating Profit	
Company	Rev. ($M)	% of Co. Rev.	Growth	Curr.	Acq./Div.	Org. Growth	($M)	% Growth
Becton, Dickinson (BD Biosciences)	$314.0	10%	6.1%	0%	0%	6%	NA	NA
Bio-Rad Laboratories (Life Science)	$193.6	36%	8.7%	-1%	0%	9%	$7.8	NM
Biotage	SEK 177.7	100%	6.4%	-3%	0%	10%	SEK 29.3	7.7%
Shimadzu AMI	¥104,045.0	60%	11.0%	3%	0%	8%	¥14,356.0	1.3%

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Becton, Dickinson Finishes Strong for FY17

Fiscal 2017 fourth quarter revenue for Becton, Dickinson's Bioscience segment (BD Bioscience) advanced 6.1% to $314.0 million, driven by increased sales to developed markets. On a constant currency basis, BD Bioscience sales rose 5.8%, to which currency effects added 0.3% to segment sales growth. Fourth quarter organic sales growth for the segment was strongly driven by continued strength in research reagents. BD Bioscience's newer research instruments, the FACSMelody and FACSymphony, also added to segment sales growth. Overall, BD Bioscience sales accounted for 10% of total company revenues.

BD Biosciences Revenue Comparison			
	Rev. ($M)	% Rev. Growth	CER %
2017	$1,139.0	1.8%	2.4%
2016	$1,119.0	-1.1%	1.5%
2015	$1,132.0	--	--

Click to enlarge

For fiscal year 2017, BD Bioscience sales increased 1.8% to $1,139.0 million. In constant currencies, segment sales grew 2.4%, driven by a solid second-half performance. The strong sales of the segment's newer research and clinical instruments added to the total revenue as well.

Geographically, fiscal 2017 BD Bioscience sales in the US increased 4.9% to $455.0 million. Segment sales were largely driven by strong growth in research instruments, along with robust sales for reagents.

For fiscal year 2018, the company expects revenues to increase around 5.0%–6.0%. On a constant currency basis, sales are projected to grow 4.0%–5.0%.

Third Quarter LS Sales Persistent for Bio-Rad Laboratories

Third quarter sales for Bio-Rad Laboratories' Life Science segment (LS) rose 8.7% to $193.6 million. Currency effects added 1.1 percentage points to segment sales. On a constant currency basis, segment sales increased 7.6%.

LS sales for the quarter were strongly driven by growth for the Droplet Digital PCR and gene expression products. Sales from recently acquired RainDance Technologies also added to LS sales by around $5 million. Cell biology and food safety products faced particularly strong demand, as both experienced double-digit growth. Geographically, LS sales grew in all regions, with particular strength in North America, Europe and Asia Pacific.

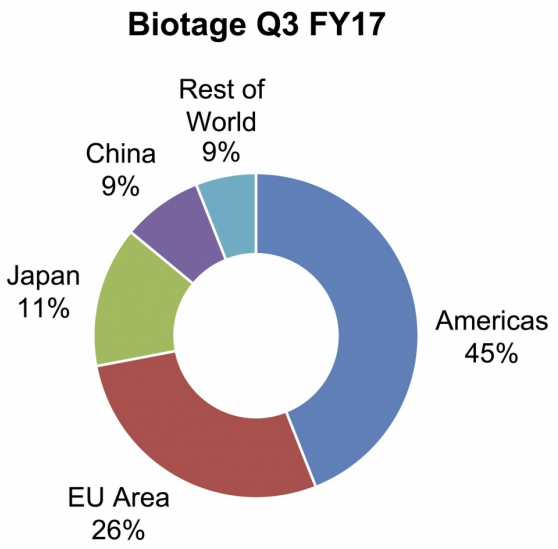
Segment sales, however, were partially offset by a decline in process chromatography demand. Specifically, unfavorable ordering patterns. Furthermore, lower sales of process media, for which sales were estimated to be $6 million less than last year, also adversely affected LS sales. However, process media sales are expected to turn around in the fourth quarter.

For the fourth quarter, total company sales are expected to be between $615 million and $625 million, signifying a 4% currency-neutral growth rate.

Biotage Continues to Prosper with Solid Third Quarter

Biotage delivered SEK 177.7 million ($22.5 million at SEK 7.9 = $1) in sales for the third quarter, an increase of 6.4%. Currency effects negatively impacted sales growth by 3.4%. On a constant currency basis, sales for the quarter grew 9.8%. Strong sales growth was driven by larger sales volumes, along with increased demand in Asia.

Operating profit for the quarter rose 7.5% to SEK 29.3 million ($3.7 million), partially offset by the adverse currency effects. Operating margin grew slightly, up 20 basis points to 16.5%. Biotage's strong operating results for the quarter was primarily driven by efficiency improvements in production. On a trailing three-year basis, operating margin lies at 14.4%, nearing the company's long-term goal of 15.0%.



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Geographically, sales in Asia continued to be strong, as South Korea and Japan both delivered significant sales growth. Strong sales in China also contributed to overall Asian sales. However, in India, sales development weakened due to a lack of demand. Revenue in the Americas still remains the largest portion of total Biotage sales, at 45%. Sales in the European region, however, fell 2 percentage points to account for 26% of total company revenues. Similarly, Japanese sales also fell 2 percentage points, now representing 11% of total company revenues. China's share of sales remained steady, accounting for 9%.

Shimadzu AMI on Top for First Half of Fiscal Year

First-half sales for Shimadzu's Analytical & Measuring Instruments segment (AMI) grew double digits, up 11.0% to ¥104.0 billion ($956 million at ¥109 = $1). On a constant currency basis, AMI sales increased 7.7%. Operating income for the segment amounted to ¥14.4 billion ($132 million), a slight increase of 1.3%. The small increase in operating income was due to Shimadzu's accelerated strategic investments. Operating margin for the first half decreased 1.3 percentage points to 13.8%.

Shimadzu AMI First-Half FY17			
	Rev. (¥B)	% Rev. Growth	% Rev. Growth Excl. Currency
LC	¥30.2	12.0%	7.6%
MS	¥18.1	15.3%	11.3%
GC	¥10.3	10.6%	6.8%
Other	¥45.5	8.9%	6.5%

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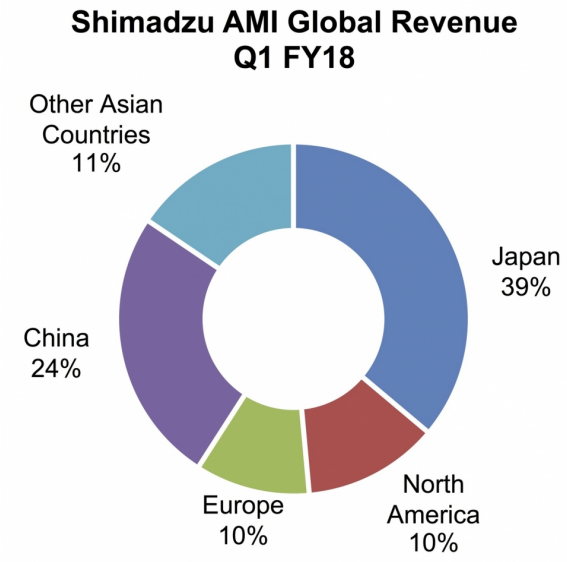
By product, LC, MS and GC sales all delivered double-digit growth for the first half. LC sales increased 12.0%, 7.6% in constant currencies, to ¥30.2 billion ($280 million), driven by sales in Europe and China. MS sales leaped 15.3% to ¥18.1 billion ($170 million), primarily due to overall growth in all regions. Organically, MS sales rose double digits as well, up 11.3%. GC sales advanced 10.6% to ¥10.3 billion ($90 million), and were up 6.8% in constant currencies. Within the segment, instrument sales grew double digits, rising 10.5% to ¥74.4 billion ($680 million). Aftermarket sales also rose double digits, gaining 12.2% to ¥29.7 billion ($270 million). Instrument sales accounted for 72% of AMI sales, while aftermarket sales represented the remaining 28%.

Geographically, sales in Japan accounted for 39% of AMI sales, the most of all regions. AMI sales in Japan grew 4.7% to ¥40.7 billion ($370 million), driven primarily by LC sales. LC sales in Japan rose significantly due to strong sales to the pharmaceutical and chemical end-markets. Similarly, sales for testing machine products in the automotive end-market further added to AMI sales growth in Japan. Increased GC sales, especially to the public sector, also contributed.



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In North America, AMI sales were up 3.8% to ¥10.8 billion ($100 million). On a constant currency basis, North American AMI sales fell 0.7%. Sales for the region were particularly strong for MS products. MS sales were driven by increased demand in the clinical, chemical and government end-markets. Overall, North American sales accounted for 10% of AMI sales.

Sales in Europe advanced double digits, up 15.3% to ¥10.4 billion ($96 million). The strong performance in the region was driven by increased sales for both LC and MS products. Furthermore, demand for both products accelerated in the pharmaceutical and food end-markets. In China, sales amounted to ¥25.2 billion ($23 million), vaulting 23.2%, primarily driven by double-digit gains for all three product lines, LC, MS and GC.

For the fiscal year ending in March, Shimadzu expects total company revenues to be ¥365.0 billion ($3,355 million),

an increase of ¥10.0 billion ($92 million) over the previously projected revenue guidance. Operating income was similarly revised upwards to ¥40.0 billion ($37 million) from ¥38.0 billion ($35 million). Shimadzu upgraded both its financial figures due to its expectations of continued economic improvement in the US, along with overall economic strength in Southeast Asia.

Time-Domain NMR

NMR is well known for its ability to determine the chemical structure of molecules. The basic principle of NMR revolves around atomic nuclei, which have a quantum property called spin., which has an associated magnetic moment. While ^{13}C or ^{1}H are the most common isotopes analyzed by NMR, other magnetic isotopes can be analyzed as well. When an external magnetic field is applied, the magnetic moment of the nuclei aligns with the external magnetic field, either with the field, a low-energy state, or against the field, a high-energy state.

Radio frequency electromagnetic radiation can cause nuclei to “flip” or transition to the high-energy state. When the radiation is removed, the relaxation to the low-energy state fluctuates the magnetic field, which produces a measurable signal. This signal is interpreted by Time-Domain–NMR (TD-NMR) by determining chemical composition based on the time domain data, without the high-resolution magnets required to Fourier transform to frequency-domain spectra in other NMR systems.

While not as powerful as and serving different functions than high-field NMR systems, TD-NMR systems have several advantages. Small, fixed magnets, which do not require the use of cryogens, power the analysis in TD-NMR systems. These small magnets allow for benchtop models, unlike the large magnets found in other NMR systems. Also, these systems are able to analyze complex mixtures, like whole seeds or polymers, with little to no sample preparation. They also offer analysis times ranging from a few seconds to a few minutes, making TD-NMR an attractive option for quick analysis of samples.

These instruments are used across several industries, particularly in QC and research applications. In the food and agricultural industry, TD-NMR is used to determine solid-fat content, and oil and moisture content in a variety of products. In the pharmaceutical industry, TD-NMR allows for fast quantification of components in a drug sample or precision noncontact weighing. Polymers and petroleum products can also be analyzed for parameters like crystallinity or hydrogen content, respectively.

Bruker leads the market with its minispec series of TD-NMR systems. Oxford Instruments is the second largest supplier and offers the MQC+ and MQR product lines. CEM, Magritek and Niumag are also prominent suppliers. Many companies in this market produce whole systems, while some make spectrometers that can be used as a component in an TD-NMR system. Given the quick results produced by these instruments, automation seems to be the next step forward, an enhancement that Bruker and CEM now offer.

The total TD-NMR market in 2017 was over $100 million. Despite not being able to resolve molecular structure like larger NMR systems, the applications for these instruments keeps demand strong. The market is expected to experience solid growth in the future, driven by increasing government regulations in the food and agriculture industry, as well increasing usage by the pharmaceutical industry.

Leading Vendors

- Bruker
- Oxford Instruments
- CEM

Largest Markets

- Agriculture and Food
- Pharmaceutical
- Polymers

Instrument Cost

- $10,000–$100,000

Pharmaceuticals

In 2017, the total deal volume and value of the life science industry decreased almost 20%, according to EY's "2018 M&A Firepower Report." The EY Firepower Index examines leading life science companies and their "firepower," the ability to enter M&A agreements based on the companies' state of finances, such as market capitalization, cash equivalents and debt capacity. The decline in life science M&A activity in 2017 was due to a changing policy structure for health care and corporate tax rates, as the effects of favorable tax reform did not materialize until the end of the year. In contrast to this decline, the value of medtech M&A value jumped 50% in 2017, largely due to therapeutic device companies, which drove the value of aggregate M&A to over $200 billion. Sector wise, the number of biopharmaceutical acquisitions fell greatly, from representing 80% of all M&A value in 2016 to approximately 25% in 2017.

Sixty percent of life science executives surveyed for the Report indicated that they plan to pursue M&A opportunities in 2018, compared to 46% in April 2017. Of this figure, 28% of executives plan to purchase or collaborate with digital companies; for large life science companies, defined as companies with over $5 billion in revenues, 47% of executives are planning for digital partnerships this coming year. Approximately 44% of executives indicated that they are developing corporate venture capital branches to accelerate innovation and R&D, while 37% stated they are developing digital capabilities in house.

Factors driving M&A growth in 2018 include patent expirations, payer pricing pressures and increased competition in therapeutic sectors. The top five countries for investment are the US, China, the UK, Germany and Japan. EY forecasts that customer-centric care platforms, brought to the forefront with the CVS/Aetna merger, may increase consolidation, with 2018 expected to surpass 2017's $200 billion in M&A value.

Source: *EY*

Oil

By 2022, global bioplastics production is forecast to increase 50%, according to Berlin's European Bioplastics Association (EUBP). Companies such as BASF and Stora Enso Oyj have entered the bioplastics business due to the growing demand from companies such as Coca-Cola and Lego. The biochemical and bioplastic industries intend to impact oil demand, giving bio-based products a greater share of the supply.

The desire to shift to more environmentally friendly plastic products is shared by both activists and companies that use plastics the most. According to the Ellen MacArthur Foundation, by 2050, there will be more plastic in the world's oceans than fish. Moreover, the plastics pollution in the oceans threatens the food chain.

The EUBP stated that currently, bioplastics make up 1% of the plastics industry. Made by processing the sugars from plants, they produce a much smaller carbon footprint compared to traditional plastics. According to the International Energy Agency, accelerated growth in the bioplastics industry will likely increase petroleum demand, which is why oil company giants, such as Saudi Arabian Oil, Exxon Mobil, Royal Dutch Shell and Total, are focusing on incorporating petrochemicals into their businesses, with the industry expected to grow 4% annually.

Leading companies in the bioplastics industry include Brazil's Braskem, the US' NatureWorks and Italy's Novamont.

Source: *Bloomberg*

Government

The US FDA has prioritized streamlining the regulatory process for generic drugs and positioning generic drugs in markets in which they have no existing competition. In 2012, the backlog for generic drug applications was over 2,800; as of January, FDA commissioner Scott Gottleib stated that the backlog is now in the low 100s. Mr. Gottleib expressed that his goal is to remove the backlog all together so that companies would be able to receive a review for their generic drugs immediately after applying with the FDA.

Part of the FDA's streamlined approach is highlighting applications for generic drugs that have only 1 competitor in the market, pledging to create more choices of generic drugs for consumers who currently can only access a single brand. The FDA is also working on simplifying the process for generic drugs companies for proving that their generic version is identical to the branded drug their generic drug is based on.

In October 2017, the FDA approved 763 generic drug applications, compared to 651 approvals in 2016 and 492 approvals in 2015. Near the end of 2017, Mr. Gottleib stated that the FDA approved over 1,000 drugs, the highest number of generic drugs approvals in one year in the Administration's history. He stated the FDA also approved the highest number of novel drugs in 2017 in its history at 46, as well as the largest number of novel devices and first gene therapies.

Source: *The Washington Post*

UK

Due to the ramifications of Brexit, the UK is facing uncertainty regarding business operations in every industry, including pharmaceuticals. Traditionally, the UK has been one of the leading recipients of research funds from the EU for drug discovery, receiving nearly €8.9 billion ($10.7 billion) from Horizon 2020 between 2007 and 2013. But with the future of the UK up in the air after Brexit, scientific innovation has slowed down, with many potential international collaborators hesitating to enter deals with the country.

According to the Association of Clinical Research Organizations, the UK clinical testing industry is valued at around £2.5 billion ($3.4 billion) annually, with approximately 40% of experimental drugs used in EU-based clinical trials manufactured in the UK. However, EU regulations state that experimental drugs for clinical trials in member countries must be made and approved by Union officials, and with the UK soon to be out of the EU, this has increased the challenges for the UK to collaborate with EU member countries.

Exacerbating this are the relocation plans of the European Medicines Agency (EMA) from the UK to Amsterdam, which will transfer its 900 job positions, $322 million budget and business with the 40,000 people who work with the Agency annually. The EMA expects that up to 30% of its staff may quit, which will delay drug approvals, decrease income from fees charged for product reviews and even, in the worst case scenario, leave the Agency inoperable.

The UK also must work on a deal with the EU to obtain EU approval for its drugs. After the UK drug is approved, it will then need to be registered in a member country in order for it to be sold across Europe. Approximately 2,400 medical products will need new marketing approvals through an EU country, and there may be a large influx of applications received by the EMA at the same time, which may also delay approvals even further. In the meantime, to keep operations running as smoothly as possible, many pharmaceutical companies, such as GlaxsoSmithKline, have been creating new infrastructures for manufacturing and testing in EU member countries.

Source: *Bloomberg*

Japan

According to the Japanese Health, Labor and Welfare Ministry, approximately 100 hospitals and medical institutions will consider providing cancer genomics-based treatments to patients in fiscal 2018, which will involve determining the most appropriate and effective treatment for a patient based on their personal genetic information. Hospitals will submit applications and, after a review by the Ministry, 12 will be appointed "core hospitals" by March. The core hospitals will play a vital role in the new proposal, conducting bulk tests and analysis of over 100 gene types and sending the information to collaborating hospitals, which will directly treat the patients by selecting specific drugs and treatments in accordance with the analyses of the genetic tests. For the purposes of patient accessibility, collaborating hospitals will be located throughout Japan. Core hospitals will provide treatment options as well. The approximately 100 hospitals that are considering participation in the initiative are vying for both core and collaborating designations.

Source: *The Japan News*

China

While in previous years China's drug industry mostly replicated Western medicines, recently there has been a shift in the country's pharmaceutical sector, with Chinese companies now wanting to play a larger role in the global drug market. Chinese drug companies were traditionally reluctant to pour money into pharmaceutical R&D, considering it a risky endeavor, and consequently focused on more guaranteed revenue streams, such as duplicating Western-made drugs. However, due to the rise of cancer and diabetes in the country, China has prioritized drug innovation, with the government pledging to streamline drug approvals and work on stopping the current brain drain by incentivizing Chinese scientists working abroad to return to China. The Chinese government has also announced plans to provide land, as well as tax breaks for and higher investments in R&D.

Recently, three original drugs were created in China—one stopping the spreading of cancer into other organs, one treating blood cancer and one using immuno-therapy to kill tumors—and are awaiting regulatory approval in the US.

Although drug companies in the country are in the early stages of drug development, experts predict that China will soon be on par with pharmaceutical powerhouses like Pfizer and AstraZeneca. Until then, accessibility to quality drugs remains limited in the country. Chinese drug companies such as Chi-Med and BeiGene are trying to change this by making drug discovery and innovation a top priority through increased R&D, as well as through international collaborations with established pharmaceutical companies such as Celgene and Merck.

Source: *The New York Times*

Informatics

Company Announcements

In November 2017, drug discovery company **Cronin Group** acquired **OpenIOLabs**, which develops hardware and software for scientific and industrial uses. OpenIOLabs provides open source hardware platform for organizations working with multiple pieces of equipment. In 2016, OpenIOLabs generated revenues of £77,694 ($102,229).

CSols announced in December 2017 the establishment of its **Dendrite Labs** business, which provides software solutions to improve lab efficiency. Dendrite Labs offers Instrument LabTiles, which provides a dashboard display of instrument data.

LIMS provider **Ovation.io** announced in December 2017 a partnership with **Coriell Life Sciences**, a provider of clinical genetic reporting solutions, to create a seamless ecosystem for sample and workflow management, genetic data interpretation and external client communication.

Ovation.io closed an expanded $18.5 million round of financing in January.

ELN firm **Collaborative Drug Discovery** announced the receipt of a $1.5 million US Small Business Innovation Research grant entitled, "Comprehensive But Simple Encoding of Bioassays to Accelerate Translational Drug Discovery."

In January, bioinformatics and genomics profiling company **Strand Life Sciences** announced a merger with **Healthcare Global Enterprises' Triesta Sciences business**, which provides molecular diagnostics services for oncology.

In January, **KineMatik** named **Delaware** as an authorized partner.

KineMatik named in January **Mannai Trading** as an authorized partner for Qatar.

Clarivate Analytics named **Mukhtar Ahmed** as president of its Life Sciences division. He previously held executive posts at **Oracle**, **Parexel** and **Kendle**.

In January, **OWKIN**, a predictive analytics company, closed an $11 million Series A financing round, bringing the company's total financing to $13.1 million in one year.

In January, **Riffyn**, provider of a cloud-based Scientific Development Environment, opened an office in Boston, Massachusetts. The company more than doubled its staff in 2017.

Bio-IT firm **BioBright** announced in January a collaboration with the **Wellcome Sanger Institute** with the aim of faster development of drugs for diseases of the immune system.

Qlucore partnered with **Nebion** in January to make it easier to combine their respective Omics Explorer and Geneinvestigator tools for investigating RNA-seq gene expression data.

In January, **Cogenica** appointed David Atkins, PhD, as CEO and a Board member. He was previously CEO of **Synevo**, a clinical diagnostics lab service business.

Product Introductions

IDBS introduced in December 2017 an extension of its E-WorkBook Connect cloud-based platform to include a synthetic chemistry offering.

In December 2017, **BioSymetrics** launched the Augusta pre-processing and analytics platform for standardized processing and integration of multiple, diverse raw data type to facilitate and deploy AI projects. The platform features over 150 modules for processing raw genomic, metabolomics, MRI/fMRI, chemical ECG/EEG and EMR data.

Genedata announced in December that it has launched a cloud-based deployment of its Genedata Profiler software on platforms such as **Microsoft** Azure and **Amazon** Web Services.

In January, **Genedata** launched the Genedata Selector for Precise Genome Editing for data management and analysis of CRISPR-related genomic data.

Genedata announced in January the release of Genedata Screener 15, which features extended support of large-scale mechanistic analyses and new automation features. It includes new instrument integrations with the **Creoptix** WAVE, **Pall ForteBio** Octet and **Sierra Sensors** MASS. In addition, a new web-accessible version is available.

Sales and Orders of Note

In December 2017, **Cresset** announced that software and contract research services provider **Proximagen** has licensed its Flare platform for structure-based design.

Autoscribe Informatics announced in January that **Clatterbridge Cancer Center** is using its Matrix Gemini

LIMS.

Certara announced in January that the **Brazilian National Health Surveillance Agency** has adopted its Phoenix WinNonlin software for reviewing drug regulatory submissions.

The **RWTH Aachen University's Center for Biohybrid Medical Systems** has adopted **labfolder**'s ELN.

Sequencing

Company Announcements

The **Neuromuscular Disease Foundation** announced in December 2017 a collaboration with **PerkinElmer** for whole-genome sequencing paired with metabolomics analysis of 100 samples. The partners will create a database to facilitate patient recruitment for clinical trials.

In December 2017, **MediSapiens** announced it has joined the €59 million ($65 million) **FinnGen** project, which will genetically profile 500,000 Finns. The company will provide data curation, data management, data exploration and discovery software solutions.

In January, **DNAnexus**, a bioinformatics and data management company, closed a $58 million financing round. Investors included **Microsoft**, **GV** (formerly **Google Ventures**) and **WuXi NextCODE**.

ReadCoor received a grant from the **Chan Zuckerberg Initiative** and **DAF**, an advised fund of the **Silicon Valley Community Foundation**, to spatially map cortical cells for the **Human Cell Atlas** using its Fluorescence in Situ Sequencing (FISSEQ) technology. FISSEQ is a pan-omic spatial sequencing platform. The project is part of an **Allen Institute**-led consortium.

BGI and **Miracle Light Incubator** launched in January the BGI Accelerator program, which will provide seed funding, mentoring service, lab hours, equipment and other resources to five life science startups.

BGI announced in January that it has sequenced over 10,000 human samples using its BGISEQ-500 system since the launch of its $600 whole-genome sequencing pricing in 2016. The company also launched the **BGI Genomics**' 2020 Program, in collaboration with **Intel** and **Alibaba Cloud**, to perform human whole-genome sequencing within 24 hours at a price of less than $300. In addition, BGI announced the BGI Genomics' Life Periodic Plan to digitalize all animals and plants on earth.

HTG Molecular Diagnostics announced in January preliminary 2017 revenues, which showed an increase of 169%–175% to $13.8–$14.1 million. Collaborations drove revenue growth. The initial revenue guidance for 2018 is $20.0–$25.0 million.

In January, **Illumina** and China's **KingMed Diagnostics** agreed to jointly develop novel oncology and hereditary disease testing applications. The companies will codevelop an integrated NGS system for IVD assays for molecular oncology and hereditary cancer testing based on Illumina's MiniSeq System and related sequencing consumables integrated with KingMed Diagnostics' proprietary testing components, which include library preparation kits.

Stratos Genomics, a fourth generation, low-cost sequencing technology developer, announced in January that it has raised $20 million in venture capital from **Fisk Ventures**.

10x Genomics announced in January that the BGISEQ-500RS sequencer from **MGI**, a **BGI** company, has met the standards of its 10x Genomics Compatible Program.

In January, **Curetis**, a molecular diagnostics solutions provider, signed a supply and authorization agreement, as well as a further R&D collaboration and service agreement, with **MGI** for NGS-based infectious disease testing. The parties will integrate Curetis' Unyvero Lysator-based sample preparation technology.

In January, **Luna DNA** named Dawn Berry as president. Previously, she served as vice president of Applied Genomics at **Illumina**.

Vela Diagnostics announced in January that it has licensed two technologies for enriching rate sequences in nucleic acid libraries from the **University of California, San Francisco**: FLASH (Finding Low Abundance Sequences by Hybridization) and DASH (Depletion of Abundant Sequences of Hybridization). The agreement covers the US and other countries. Vela Diagnostics plans to use the methods to develop products for oncology and infectious disease testing, including cell free DNA/RNA and microbiology/microbiome testing approaches.

Data solutions firm **MediSapiens** announced in January that it has joined the nonprofit **Pistoia Alliance**.

Oxford Nanopore announced the certification of two labs of China-based **NextOmics (GrandOmics)** to provide its sequencing technology as a service.

In January, **Diagenode** and **Genialis** announced a streamlined RNA-seq data analysis workflow to assess gene expression in low input or degraded RNA samples. It combines Diagenode's "Capture and Amplification by Tailing and Switching" RNA-seq library preparation products with a validated, automated bioinformatics developed by Genialis.

Product Introductions

In January, **Thermo Fisher Scientific** introduced two new Oncomine NGS assays. The Ion Torrent Oncomine Pan-Cancer Cell-Free Assay enables reproducible detection and analysis of tumor DNA and RNA across all major classes of somatic mutations from a single vial of blood with as little as 1 ng of nucleic acid input within 2 days. It targets over 50 genes. The Ion Torrent Oncomine Tumor Mutation Load Assay is designed to improve potential selection strategies for immune therapy clinical trials, and features 409 genes that can be sequenced using as little as 20 ng of FFPE. The company also released the next generation Ion AmpliSeq HD technology, which now adds highly customization design capabilities to solid tumor and cell-free DNA panels.

QIAGEN announced in January the coming launch of several NGS products. These include an upgraded GeneReader NGS chemistry enabling increased output, the new GeneRead QIAact Myeloid panel, additional GeneReader QIAact Custom Panels, and upgraded versions of the GeneRead QIAact BRCA 1/2 panel and the GeneReader QIAact Actionable Insights Tumor Panel FPPE panel.

In January, service firm **Dovetail Genomics** launched the Dovetail Hi-C Kit, its first commercial kit, with cloud-based HiRise software for genome assembly.

10x Genomics introduced in January Supernova 2.0, its de novo assembly solution software, for plant and animal research. It features optimized sample preparation protocols and software algorithms for cost effective assembly.

SOPHiA GENETICS announced in January that its AIR platform now includes radiomics capabilities.

Sales and Orders of Note

In January, **SolveBio** received a $1.5 million grant from the **NIH's National Institute of General Medical Sciences** for "The Variant Explorer: a Cloud-based Data Integration and Visualization System for Improving Clinical Interpretation of Sequenced Genetic Variants."

Edico Genome partnered with **Genomics England** in January to use its DRAGEN platform for Genomics England's Rare Disease Pilot. Genomics England is currently using the product to reprocess five thousand whole human genomes from individuals with rare diseases.

In January, **BC Platforms** announced that **Amgen Finland** will use its platform to study data in cardiovascular and bone diseases, hematological malignancies and other regions of oncology.

In January, **NRGene** announced a long-term license agreement for its GenoMAGIC big data analytics platform with **Syngenta** following a collaboration agreement.

Arima Genomics' Arima-HiC sample preparation platform was selected in January by the **Genome 10K** consortium to generate chromosomal-level phase genomes for all vertebrate order species as part of phase 1 of the project. The

collaboration will be a service offering.

In January, the **City of Hope** procured **Takara Bio USA**'s SMARTer ICELL8 Single-Cell System for high-throughput single-cell RNA-seq applications.

Pacific Biosciences announced in January that **BGI Genomics** has purchased 10 additional Sequel Systems. **BGI Genomics** currently operates 2 Sequel Systems and 1 PacBio RS II Sequencing System.

MS & LC/MS

Company Announcements

In November 2017, **NPL**, the UK's **National Measurement Institute**, announced the launch of the 3D OrbiSIMS, which is capable of the highest-reported simultaneous spatial and mass resolutions using label-free molecular imaging on the single-cell scale. The system is the result of a collaboration between **GSK**, the **University of Nottingham**, **ION-TOF** and **Thermo Fisher Scientific.**

Halvec Laboratories, a subsidiary of **Global Haltech**, signed a memorandum of understanding in November 2017 with **Thermo Fisher Scientific** aimed at delivering an international reference method for gelatin analysis. Global Haltech will use the Thermo Scientific TSQ Altis Triple Stage Quadrupole MS and Thermo Scientific Vanquish Flex Binary UHPLC System.

Shimadzu announced in December 2017 a collaboration that begun last year with **Fujitsu** and **Fujitsu Laboratories** to develop technology that utilizes AI to process the data used in analyzing the measurement results acquired by its MS systems. The collaboration is focused on the application of deep learning to address issues with peak picking and the variability of operator practices. The first application to use this technology is metabolomics, with an aim to integrate the capabilities into MS software in 2018.

BIOCRATES Life Sciences, a provider of metabolomics kits and other solutions, acquired **Metanomics Health** in January. Metanomics is a metabolomics biomarker development and health care services specialist. **BIOCRATES Life Sciences** also announced the close of a new financing round.

In January, **PREMIER Biosoft** entered into a research collaboration with Dr. Francisco Fernadez-Lima at the **Biomolecular Sciences Institute at Florida International University** to provide advanced MS-based data analysis for lipidomics analysis.

Product Introductions

In December 2017, **Shimadzu** launched the C2MAP-2000 automated pretreatment module for cell culture–media analysis. Its consists of the C2MAP-20000 module with LC/MS (the Nexera X2 UHPLC and LCMS-8060/8050. The system adds reagents, filters precipitated proteins and dilutes samples.

Shimadzu debuted in February the Nexera Mikros, a micro flowrate-compatible LC/MS, for improved sensitivity. The system accommodates semi-micro flowrates (100–500 mL/min) to micro flowrates (1–10 mL/min). It features a solvent delivery pump with a new control system.

908 Devices introduced in January a software update for its MX908 MS system, featuring the new Drug Hunter, Chemical Warfare Hunter and Explosive Hunter mission modes. The Drug Hunter mode enables the detection of fentanyl at trace levels.

In January, **PerkinElmer** debuted the NeoBase 2 non-derivatized MSMS Kit for semi-quantitative measurement and evaluation of amino acid, succinylacetone, free carnitine, acylcarnitine, nucleoside and lysophospholipid concentrations. It employs a three-step assay workflow. An IVD kit, it has been CE marked in Europe.

SCIEX Diagnostics launched in January the Citrine Triple Quad MS/MS and Citrine QTRAP MS/MS Systems for

clinical diagnostics. They enable the measurement of metabolites and biomarkers at picomole concentrations. ESI or APCI options are available.

Sales and Orders of Note

Advion announced in January the cumulative shipment of more than 700 Compact Mass Spectrometer systems, as of December 31, 2017. In Japan, 30 units were sold during the year. In China, 9 units were sold in the fourth quarter 2017.

Process Analysis and Bioprocess Analysis

Process Analysis

Company Announcements

In November, **Atonarp** announced that it will supply its miniaturized advanced MS technology to **IMA North America**, a division of **IMA**, for aseptic processing and freeze drying solutions. IMA gains exclusive rights to the technology for product freeze drying solutions as a process analytical tool to monitor potential silicon oil contamination, and primary and secondary drying endpoints as well as perform in-line vacuum leak detection.

In November 2017, **Emerson** withdrew its unsolicited proposal to acquire **Rockwell Automation**. Rockwell Automation rejected the proposal citing the proposal's undervaluation of the company and its prospects, as well as long-term risks and weakened competitive position if completed. The proposal represented a 16.8% premium to Rockwell Automation's closing price prior to the announcement of the offer. The offer was valued at more than $27 billion, according to Reuters.

APIX Analytics, a supplier of GC-based next generation miniaturized gas analyzers, raised nearly €8 million ($10 million) in December 2017 as part of a Series B round.

Product Introductions

Hach launched last fall the Claros Water Intelligence System, which combines connected lab and process instruments to provide valuable insights for water management across data, instruments and process.

In October 2017, **Hamilton** released a new version of its ArcAir software for its Arc sensors. The software features a single interface for PC and mobile devices, barcode scanning of the pH buffer and conductivity standards, and ability for the sensors to be grouped together.

In January, **Micromem Applied Sensor Technologies** released the AROMA Tracer Detection fluid tracer analyzer for tracer detection studies in producing oil fields. The technology, exclusively licensed from **Entanglement Technologies**, combines cavity ring down spectroscopy with unique surface-interaction dependent separation techniques. It features sub-ppb quantitation.

Bioprocess Analysis

Company Announcements

In November 2017, **MilliporeSigma** signed a memo of understanding with **Samsung Biologics** for a strategic alliance on biopharmaceutical manufacturing and biologics process development. The alliance will accelerate process development and clinical materials production at small biotech start-ups focusing on novel drug development for which Samsung Biologics acts as a contract manufacturer. This extends a 2014 long-term supply agreement for raw materials for biopharmaceutical manufacturing.

MilliporeSigma announced in December an agreement with **IPS-Integrated Project Services** and **G-CON Manufacturing** to provide a 2,000 L mAb facility and single-use process technology platform. The project extends MilliporeSigma's BioReliance End-to-End offering.

Contract discovery, development and manufacturing organization **WuXi Biologics** and **Pall** announced in November 2017 the establishment of a joint lab to develop full continuous processing for the manufacturing of mAbs. The three-year project starts with the continuous operation of individual processes, and will gradually expand to downstream processing development and production. The lab will house Pall's Cadence Integrated Continuous Bioprocess System integrated with its single-use technology platform.

Pall announced in November a partnership with the **BioFactory Competence Center** in Fribourg, Switzerland, to launch new training courses in early 2018 focused on continuous bioprocessing advances. Pall Life Sciences' Cadence platform technologies will be used for hands-on training.

In December, biopharmaceutical firm **Orgenesis** and **Pall** completed their joint program to develop a commercially viable project process, using viral transduction, for a novel cell therapy for diabetes to support submission of an IND application in the US. The project was supported by funding from the **Israel-US Binational Industrial Research and Development Foundation**.

Quad Technologies announced in January an exclusive strategic partnership with **Sartorius Stedim Biotech** to enable availability of a magnetic bead–free T cell activation product.

Product Introductions

In December 2017, **Sartorius Stedim Biotech** introduced a new version of its SIMCA and SIMCA-online data analytical solutions. New SIMCA features include an intuitive graphical interface and flexibility to handle complex data, such as reworking, splitting and merging. New SIMCA-online features include self-service analytics capability and a new web client.

Sales and Orders of Note

In January, **Abzena**, which provides services and technologies for developing and manufacturing biopharmaceutical products, selected **Sartorius Stedim Biotech** as its preferred equipment supplier in the US.

Reported Financial Results

$ in Millions USD	Period	Ended	Sales	Chg.	Op. Prof.	Chg.	Net Prof.	Chg.
Corning (Life Sciences)	Q4	31-Dec	$225.0	9.2%	$16.0	23.1%	NA	NA
Corning (Life Sciences)	FYE	31-Dec	$879.0	4.8%	$64.0	10.3%	NA	NA
Danaher (Life Sciences)	Q4	31-Dec	$1,625.1	11.8%	$324.3	32.5%	NA	NA
Danaher (Life Sciences)	FYE	31-Dec	$5,710.1	6.4%	$1,004.3	22.6%	NA	NA
Honeywell (Performance Material & Tech.)	Q4	31-Dec	$2,854.0	12.4%	$607.0	3.4%	NA	NA
Honeywell (Performance Material & Tech.)	FYE	31-Dec	$10,339.0	-0.9%	$2,206.0	4.5%	NA	NA
Illinois Tool Works (Test & Meas., and Elec.)	Q4	31-Dec	$545.0	11.7%	$127.0	29.6%	NA	NA
Illinois Tool Works (Test & Meas., and Elec.)	FYE	31-Dec	$2,069.0	4.8%	$464.0	24.4%	NA	NA
Illumina	Q4	31-Dec	$659.0	25.5%	$230.0	60.8%	$208.0	67.7%
Illumina	FYE	31-Dec	$2,289.0	12.6%	$606.0	3.2%	$726.0	56.8%
Meridian Bioscience (Life Sciences)	Q1	31-Dec	$14.8	13.8%	$2.8	-14.8%	NA	NA
PerkinElmer	Q4	31-Dec	$641.6	13.2%	$97.4	21.1%	($41.1)	NM
PerkinElmer (Discovery & Analytical Solutions)	Q4	31-Dec	$448.2	9.3%	$93.7	13.0%	NA	NA
PerkinElmer (Diagnostics)	Q4	31-Dec	$193.4	23.3%	$59.5	23.9%	NA	NA
PerkinElmer	FYE	31-Dec	$2,257.0	6.7%	$304.8	7.7%	$292.6	24.9%
PerkinElmer (Discovery & Analytical Solutions)	FYE	31-Dec	$1,578.5	4.3%	$270.9	5.9%	NA	NA
PerkinElmer (Diagnostics)	FYE	31-Dec	$678.5	12.6%	$210.4	13.3%	NA	NA
Thermo Fisher Sci. (Life Sciences Solutions)	Q4	31-Dec	$1,578.0	11.2%	$561.0	20.1%	NA	NA
Thermo Fisher Sci. (Analytical Instruments)	Q4	31-Dec	$1,414.0	16.2%	$346.0	16.1%	NA	NA
Thermo Fisher Sci. (Specialty Diagnostics)	Q4	31-Dec	$914.0	9.6%	$242.0	6.1%	NA	NA
Thermo Fisher Sci. (Laboratory Prod. & Serv.)	Q4	31-Dec	$2,401.0	42.8%	$301.0	28.6%	NA	NA
Thermo Fisher Sci. (Life Sciences Solutions)	FYE	31-Dec	$5,728.0	7.7%	$1,896.0	18.8%	NA	NA
Thermo Fisher Sci. (Analytical Instruments)	FYE	31-Dec	$4,821.0	31.4%	$1,027.0	37.9%	NA	NA
Thermo Fisher Sci. (Specialty Diagnostics)	FYE	31-Dec	$3,486.0	4.4%	$930.0	2.2%	NA	NA
Thermo Fisher Sci. (Laboratory Prod. & Serv.)	FYE	31-Dec	$7,825.0	16.4%	$1,007.0	3.7%	NA	NA
Waters	Q4	31-Dec	$687.3	9.3%	$230.2	10.5%	$196.8	12.9%
Waters	FYE	31-Dec	$2,309.1	6.5%	$661.9	6.0%	$570.3	9.4%
Other Currencies (in Millions)								
Hitachi High-Technologies	9 mo.	31-Dec	¥495,800.0	7.1%	¥38,700.0	-11.8%	¥29,374.0	-11.6%
Hitachi High-Tech. (Science & Medical Systems)	9 mo.	31-Dec	¥129,900.0	-3.6%	¥14,900.0	-31.7%	NA	NA

NA = not available, NM = not meaningful