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Instrument Business Outlook

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2017 M&A Activity: Private Equity Makes its Mark

Analytical instrument and laboratory product companies continued to branch out over the last year via M&A activity. As usual, Danaher and Thermo Fisher Scientific remained active in their acquistions, both within and outside the analytical instrument and lab product market. For instance, in Thermo Fisher's case, its largest purchase, the $7.2 billion acquisition of contract development and manufacturing firm Patheon (see ***IBO*** 5/15/17), was outside the analytical instrument and lab product market. Likewise, a number of other instrument makers sought to broaden their end-markets, such as Bruker and PerkinElmer, which invested in companies dedicated to diagnostics products.

Nonetheless, M&A activity for analytical instrumentation, and especially the consumables and software products

used with them, was in line with previous years. The largest deal this year was Avantor's $6.5 billion purchase of VWR (see ***IBO*** 11/30/17). In fact, three deals topped the billion dollar mark this year (see table below). Three of the year's largest deals involved private equity, indicative of those buyers' interest in the laboratory sector and willingness to spend.

Five Largest Pure-Play Instrument and Laboratory Product–Related Acquisitions in 2017			
Purchaser	**Acquired**	**Purchase Price ($M)**	**Acquired Co.'s Annual Sales ($M)**
Avantor	VWR	$6,500	$4,510
Fujifilm	Wako Pure Chemicals	$1,400	$710
KKR	Hitachi Koki	$1,280	$1,310
EQT	Certara	$850	$64
Sartorius	Essen BioScience	$320	$60

Surprisingly, two of these transactions were ranked among 2017's five "best values" (see table below). Also on that list is Horizon Discovery's purchase of Dharmacon (see ***IBO*** 7/31/17), a divestment by GE Healthcare that also yielded a stake in Horizon. Also leaving a market via a divestment was Oxford Instruments, which sold its atomic spectroscopy business to Hitachi High-Technologies (see ***IBO*** 4/20/17).

Five Best Values, Based on Revenue Multiples, in 2017 for Pure-Play Companies with Sales Over $5 Million				
Purchaser	**Acquired**	**Purchase Price ($M)**	**Acquired Co.'s Annual Sales ($M)**	**Price to Sales Ratio**
Diploma	Abacus	$19	$20	0.97
KKR	Hitachi Hoki	$1,280	$1,310	0.98
SYGNIS	Innova Biosciences	$14	$11	1.2
Avantor	VWR	$6,500	$4,510	1.4
Horizon Discovery	Dharmacon	$85	$37	2.3

In this review of the year's M&A activity, ***IBO*** focused on pure-play acquisitions by analytical instrument and lab product companies. Thus, the review excludes acquisitions in markets such as diagnostics and process analytics. The review of M&A activity is based on acquisitions news published in ***IBO*** between November 30, 2016 and December 15. Unless otherwise noted, the information is based on publicly available company financial reports and press releases.

Among the most active companies this year were Bruker, which made a series of small bolt-on purchases, adding new technologies and investing in its MALDI Biotyper franchise. Other companies choosing to add to successful product lines included Agilent Technologies and Population Genetics (see ***IBO*** 7/31/17), Bio-Rad Laboratories and RainDance Technologies (see ***IBO*** 1/31/17), and Mettler-Toledo and Biotix (see ***IBO*** 11/15/17). In many cases, companies also acquired former suppliers, as with Bio-Techne and Trevigen (see ***IBO*** 9/15/17), Teledyne Technologies and Scientific Systems (see ***IBO*** 7/15/17), and Spectris (PANalytical) and Pixirad (see ***IBO*** 2/28/17).

Five Highest Premiums, Based on Revenue Multiples, in 2017 for Pure-Play Companies with Sales Over $5 Million				
Purchaser	**Acquired**	**Purchase Price ($M)**	**Acquired Co.'s Annual Sales ($M)**	**Price-to-Sales Ratio**
EQT	Certara	$850	$64	12.2
Thermo Fisher Scientific	Core Informatics	$94	$10	9.4
Sartorius	MKS Data Analytics	$73	$13	5.6
Thermo Fisher Scientific	MTI-GlobalStem	$33	$6	5.5
Thermo Fisher Scientific	Finesse Solutions	$221	$50	4.4

Companies entering new technology markets via M&A included Danaher's deal for IDBS (see ***IBO*** 10/31/17), Shimadzu with its purchase of AlsaChim (see ***IBO*** 6/30/17) and Teledyne Technologies through its acquisition of Hanson Research (see ***IBO*** 12/15/16).

Distributors Attract Buyers

The year's largest acquisition by far was Avantor/New Mountain Capital's purchase of laboratory product and services firm VWR (see ***IBO*** 11/30/17). Avantor highlighted the critical mass, synergies and end-to-end solutions created by combining its chemicals business with VWR's lab products business. The size of the new company and its diverse offerings can be expected to enhance VWR's ability to compete for large accounts and internationally with its major competitor, Thermo Fisher Scientific.

In another leveraged buyout targeting lab product distribution, private equity firm Golden Gate Capital acquired Cole-Parmer, a manufacturer and distributor of laboratory equipment, for a reported $910 million (excluding fees and expenses), according to Moody's. Moody's reported that Cole-Parmer has 2016 revenues of approximately $343 million. This purchase, along with the acquisition of US lab product distributor Thomas Scientific for an undisclosed amount by Carlyle Group, one of the world's largest private equity firms (see ***IBO*** 9/30/17), suggests increased interest in lab product distribution, as well as continued growth in this market by these private equity participants through additional acquisitions.

Hot Markets: Cell Research, Software, Raman

Products for cell biology research, both instruments and aftermarket, were also the focus of acquisitions as the current market and the future promise of cell biology provides an important sales growth and strategic driver. In fact, an effort to grow a cell research business was behind one of the year's largest purchases. This spring, Fujifilm acquired Wako Pure Chemicals for $1.4 billion (see ***IBO*** 12/31/17). Wako Pure Chemical produces cell research products, particularly customized cell culture media. Fujifilm highlighted the synergies with its other life science research businesses, which includes Cellular Dynamics. But the purchase also impacts the laboratory chemicals market in general, as Wako Pure Chemicals is among the largest suppliers in this market.

Sartorius continued its investments in cellular analysis instrumentation with the purchase of Essen BioScience (see ***IBO*** 3/15/17). Similarly, Bio-Techne added to its consumables line for cell analysis by purchasing Trevigen (see ***IBO*** 9/15/17), which not only adds the cell culture and cell assay products Bio-Techne previously distributed, but also expertise in the field and thus the ability to grow the business. Thermo Fisher purchased MTI-GlobalStem (see ***IBO*** 11/30/17), a provider of cell culture and transfection products, similarly adding to its existing offerings for cell research.

In another market addressing current research trends as well as the future products for laboratory data management, Thermo Fisher purchased Core Informatics, building its cloud and lab data management capabilities (see ***IBO*** 3/15/17). Thermo Fisher paid $221 million for the company, whose annual sales totaled $10 million (see table below).

The software sector also attracted another major lab instrument player. Danaher announced the purchase of ELN company IDBS for a reported $100 million, adding further capabilities for serving the pharmaceutical market, as well as dedicated software company (see ***IBO*** 10/31/17). The purchase marked Danaher's entrance into the ELN and data informatics market, positioning it to offer more comprehensive lab solutions. This was also indicative of Danaher's continued investments in its analytical instrument business.

Initially Undisclosed Purchase Prices (Excluding Future Consideration)			
Purchaser	Acquired	Purchase Price (M)	IBO Issue
Teledyne Technologies	Hanson Research	$25.0 (net of cash acquired)	12/15/16
Bruker	Active Spectrum	€ 2.8	12/31/16
Merck KGaA Life Science	BioControl Systems	$167.0	1/15/17
Bio-Rad Laboratories	RainDance Technologies	$87.0	1/31/17
Bruker	Hysitron	$27.2 (net of cash acquired)	1/31/17
Thermo Fisher Scientific	Finesse Solutions	$221 (net of cash acquired)	2/15/17
PANalytical	Pixirad	£2.8	2/28/17
Thermo Fisher Scientific	Core Informatics	$94 (net of cash acquired)	3/15/17
Porvair	J. G. Finneran	$6.0	4/15/17
Bruker	Luxendo	$18.8	5/15/17
Teledyne Technologies	Scientific Systems	$31.0	7/15/17
Merck KGaA Life Science	Natrix Separationns	$15.0	8/31/17
Brooks Automation	RURO	$5.5	8/31/17

As for entering new technology markets, several companies focused on molecular spectroscopy, focusing, not surprisingly, on the fastest growing segment. Agilent Technologies and Anton Paar each entered Raman spectroscopy market by acquiring Cobalt Light System (see ***IBO*** 7/15/17) and BaySpec's Raman product line (see ***IBO*** 12/15/16), respectively. Metrohm expanded its Raman offerings with the purchase of Diagnostics anSERS (see ***IBO*** 11/30/17).

Companies Build NGS Capabilities

Agilent continued to enlarge its footprint in the NGS market. The company acquired the intellectual property of Population Genetics for NGS sample preparation, building upon a successful franchise by purchasing a previously licensed technology (see ***IBO*** 7/31/17). The company also acquired Multiplicom, a supplier of NGS assays for both research and diagnostics applications (see ***IBO*** 12/31/16).

Although the pace of M&A for NGS has slowed somewhat from previous years, NGS-related companies continue to be targets. The acquisitions targeted the growing sample preparation tools and analysis software markets. Takara Bio purchased Rubicon Genomics, which provides the ThruPLEX products for NGS sample prep (see ***IBO*** 12/31/16). Bio-Rad's $87 million purchase of RainDance Technologies (see ***IBO*** 1/31/17) also addresses NGS sample prep, utilizing RainDance Technologies' digital PCR and microfluidic technology for such applications. Spiral Genetics (see ***IBO*** 1/31/17) and OmicSoft (see ***IBO*** 1/15/17), providers of NGS analysis software, also changed hands. They were acquired by QIAGEN and Fabric Genomics, respectively, as consolidation continued in the fragments of the NGS software market.

Consumables: Always a Draw

As expected, companies invested in life science consumables companies, ever aware of the benefits of these high-margin, recurring revenue product lines. Mettler-Toledo expanded its Rainin pipettor franchise with a deal to acquire Biotix (see ***IBO*** 11/15/17). In the case of Brooks Automation, the firm expanded its biostorage business, adding a new PCR consumables product line by purchasing 4titude (see ***IBO*** 10/15/17).

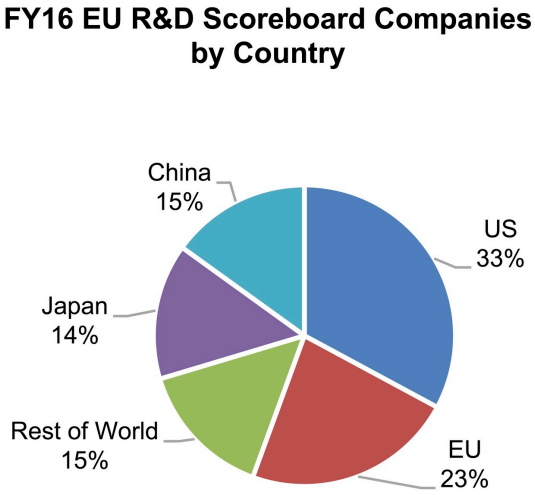
Moving away from services by enlarging its consumables business was Horizon Discovery, which acquired Dharmacon for $85 million as well as sold a stake in the combined company to GE Healthcare (see ***IBO*** 7/31/17). In doing so, Horizon shored up its genetic engineering product lines, becoming less reliant on its genetic engineering services as a major percentage of revenues.

M&A in the last year was a story of a few megadeals and many smaller bolt-ons purchases, with an emphasis on life science but also healthy interest in spectroscopy and bioprocess chromatography (see ***IBO*** 8/31/17, ***IBO*** 11/30/17). It was driven not only by the industry's biggest companies, but also by private equity buyers.

EU Scoreboard Companies' R&D Expenditures Continue to Rise

In the 2017 edition of the *EU Industrial R&D Investment Scoreboard*, which annually tracks R&D spending at the world's largest companies, data indicated that the world's 2,500 largest companies from 43 countries increased their fiscal 2016/17 R&D spending 5.8% to total €741.6 billion ($872.5 billion = €0.85 = $1), which reflects approximately 90% of global business-funded R&D. Of this, 567 EU companies made up 23%, 822 US companies accounted for 33%, 365 Japanese companies represented 14%, 376 Chinese companies comprised 15% and the Rest of World firms made up 15%. Last year's rise in R&D investments marks the sixth consecutive year of increases.

Data in the *Scoreboard* are indicated in euros, and all foreign currencies were converted based on the exchange rate of the closing date of the report, December 31, 2016. The deviations in exchange rates affected the company rankings, as countries with appreciated currency were ranked higher in respect to other currencies. During the reporting period of the report, the exchange rate of the Euro depreciated 3.3% against the US dollar and 6.2% against the Japanese Yen, but appreciated 17.4% against the British pound.



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Companies from the US and EU had a 7.2% and 7.0% increase in R&D, respectively, which was more than the global average. Although Chinese companies' R&D grew 18.8%, in comparison to the size of the nation's economy, its total R&D was smaller than that of the top performing regions.

Although investments in R&D grew modestly, *Scoreboard* companies in fiscal 2016/17 increased sales only 0.1%. However, operating profits and workforce numbers of *Scoreboard* companies grew 8.7% and 1.7%, respectively. Capital expenditures dropped 6.2%. Global R&D intensity, which is calculated as total R&D as a percentage of sales, was 4.1%, while capital expenditure intensity and profitability, also computed as a percentage of sales, was 6.7% and 9.5%, respectively.

Top 100 Spenders

The top 100 companies accounted for 53% of total global R&D spending, growing 5.9% in total, with 61 companies having positive R&D growth in 2016/17. Of this figure, 30 companies' R&D grew in the double digits, with 17 of them also showing double-digit growth in net sales. Thirty of the top 100 companies are based in the EU. In regards to sectors, 25 of the top 100 R&D spenders are in health industries, 19 are in automobiles and other transportation, and 34 are in information and communication technologies industries. The remaining companies are dispersed in other sectors.

Not all companies in the top 100 increased in R&D investments, as 39 companies experienced decreases in R&D spending. Five companies also had operating losses, while 23 companies recorded profitability of 5% or less. Twenty-five companies experienced profitability of over 20%, and 23 of these firms operate in R&D-intensive sectors.

Sector Growth

Automobiles and other transport represented 17% of total R&D, growing 2.7%. Chemicals represented 3% of total R&D, dropping 1.9%, while health industries, which includes biotechnology, health care providers, medical equipment and pharmaceuticals, comprised 22%, a growth of 6.9%.

The ICT (Information and Communications Technology) services sector was the greatest driver of R&D growth, at 11.7%. ICT services, health industries, ICT producers, and automobiles and other transport comprised 75% of total R&D of the 2,500 *Scoreboard* companies.

Compared to data from last year's *Scoreboard*, for a group of selected industries (see table below), the greatest increase in sales and capital expenditures was in the alternative energy sector, which grew 17.5% and 17.0%, respectively. In line with recent trends, the oil and gas sector's sales and capital expenditure dropped the most, with decreases of 11.3% and 26.0%, respectively.

Industrial sector	R&D 2016/17 (€M)	R&D 1-year Growth	Sales 2016/17 (€M)	Sales 1-year Growth	R&D Intensity	Capex 2016/17 (€M)	Capex 1-year Growth	Capex Intensity
Alternative Energy (6 Cos.)	602.3	5.8%	20,137.6	17.5%	3.0%	706.2	17.0%	3.5%
Automobiles & Parts (161 Cos.)	119,248.8	3.3%	2,412,870.0	2.7%	4.9%	143,614.0	-8.7%	6.0%
Chemicals (122 Cos.)	23,484.7	-1.9%	807,576.5	-2.3%	2.9%	55,008.0	-9.7%	6.8%
Food Producers (56 Cos.)	7,473.8	1.6%	541,566.6	1.0%	1.4%	23,004.8	3.4%	4.2%
Industrial Metals & Mining (38 Cos.)	4,927.2	3.8%	446,153.8	-3.1%	1.1%	24,226.0	-13.6%	5.4%
Oil & Gas Producers (24 Cos.)	8,553.0	-4.9%	1,809,326.7	-11.3%	0.5%	190,326.1	-26.0%	10.5%
Pharmaceuticals & Biotech (398 Cos.)	154,783.0	7.4%	1,237,804.4	2.5%	12.5%	79,523.3	4.4%	6.4%

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Pharmaceuticals and Biotechnology

As a whole, the pharma and biotech sector, which includes 398 companies, increased R&D in fiscal 2016/17 by 7.4% to €154 billion. Fifty-three pharma companies are from the EU and had a combined R&D intensity of 13.7%; 145 of non-EU pharma companies had a total R&D intensity of 13.2%.

Although R&D investments and sales in the biotech sector were significantly less than pharma sales, R&D intensity in biotech soared, with 30 EU companies having R&D intensity of 24.0% and 127 non-EU companies with 26.2%.

Top pharma and biotech companies include AstraZeneca and Roche, and QIAGEN and Gilead Sciences, respectively.

Chemicals

The 122 companies in the chemicals sector, which includes commodity and specialty chemicals, represented 3% of total R&D, with 18% of companies based in the EU and 82% in non-EU countries. R&D in chemicals declined 1.9%. Global net sales for the chemicals sector also declined, falling 2.3%, while capital expenditure fell 9.7%.

Among EU companies, the largest net sales decline was attributed to the chemicals sector, dropping 6.0%. China Petroleum and Chemical had the largest increase in chemicals net sales at 8.0%.

Top companies in the chemicals sector include BASF, DuPont and Dow Chemical.

Quanterix Completes IPO

Lexington, MA 12/11/17—Quanterix, maker of the Simoa technology for digitalizing biomarker analysis, announced the completion of its IPO (see ***IBO*** 11/30/17), raising $73.7 million in gross proceeds. The company sold 4.9 million shares at $15 per share. Shares now trade on the NASDAQ under the ticker symbol QTRX. The underwriter's option to purchase additional shares was fully exercised.

The stock began trading on December 7. The company's stock price closed up 7.2% on its first day, opening at $16.30 per share and closing at $17.47 per share. Quanterix's estimated market cap at the time of its IPO was $339 million, according to nasdaq.com.

Biotage Expands SPE Business to Additional Markets

Stockholm, Sweden 12/6/17—Separations technology firm Biotage has entered into an agreement acquire Horizon Technology for $18.4 million. Horizon Technology supplies separation systems and consumables for water purification, food safety, the petrochemical industry, biofuels, agriculture and the pharmaceutical industry, among others. Horizon Technology generated 2016 revenues of $8.2 million and EBITDA of $0.7 million. "The acquisition of Horizon is in line with our strategy to grow our separation business through expansion into new application areas. This transaction enables Horizon's existing products to reach a larger global market through Biotage's direct sales channels, at the same time as Biotage's existing products get access to customers in industries where Biotage historically has not been as active," stated Biotage CEO Torben Jörgensen. "The acquisition is complementary to our existing offering and allows us to meet the global trend of increasing awareness and concern of environmental issues, pollution and toxics." The deal is expected to close in the first quarter of 2018.

The purchase will be funded with a bank loan and cash on hand. Horizon Discovery, which has 41 employees, provides SPE products. Serving the for the environmental, food, petrochemical and energy markets, Horizon Discovery takes Biotage into new markets for SPE products. Currently, Biotage primarily offers such products for life science and pharmaceutical applications

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Thermo Fisher Scientific Acquires CEM Provider

Waltham, MA 12/4/17—Thermo Fisher Scientific has acquired certain assets of EPTEK Technology and related entities for an undisclosed amount. The assets acquired consist of Volatile Organic Compound (VOC) CEMS for measuring air quality. EPTEK has offices in China and Taiwan. The company joins Thermo Fisher's Analytical Instruments segment.

The acquisition complements Thermo Fisher's other VOC CEMS products. The company has reported strong sales in recent years for air quality monitoring systems in China due to increasing regulations.

Porvair Adds Lab Robotics Firm

London, UK 12/8/17—Porvair, a provider of products for niche filtration and separation markets, has acquired Dutch firm Rohasys for an undisclosed amount. Rohasys supplies robotic sample handling systems. The company joins Porvair's newly formed Laboratory division, which is focused on filtration and sample preparation solutions. Porvair stated that the purchase will add to its capabilities for bioscience sample preparation.

The acquisition adds automated solutions for sample preparation, including systems automating water and soil testing and for microbiology. Porvair's Seal Analytical instrument business serves environmental labs. Porvair's Life Science Research business sells microplates, including SPE and assay plates.

Third Quarter Results: Fluidigm, HORIBA, Merck KGaA, Pacific Biosciences and QIAGEN

CY Q3 2017 Results								
	Revenues			Rev. Growth Summary			Adj. Operating Profit	
Company	Rev. ($M)	% of Co. Rev.	Growth	Curr.	Acq./Div.	Org. Growth	($M)	% Growth
Fluidigm	$24.7	100%	11.5%	0%	0%	12%	-$8.8	-15.9%
HORIBA (P&E, SI)	¥10,215.0	23%	4.5%	1%	0%	3%	¥49.0	-36.4%
Merck KGaA (Life Science)	€1,408.0	38%	1.2%	-4%	0%	5%	€220.0	1.9%
Pacific Biosciences	$23.5	100%	-6.3%	0%	0%	-6%	-$21.6	NM
QIAGEN	$365.0	100%	7.8%	1%	1%	6%	$63.9	32.4%

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Strong Third Quarter for Fluidigm

Third quarter sales for Fluidigm grew 11.5% to $24.7 million, driven by higher product revenue from mass cytometry products. Sequentially, sales also increased, up 3.3%.

Instrument sales for the quarter increased 14.7%, amounting to $10.5 million. However, sales growth was partially offset by weak demand for genomics products. Overall instrument sales accounted for 43% of total company revenue. License and Grant sales remained flat for the quarter.

Fluidigm Q3 FY17			
	Rev. ($M)	% Rev. Growth	% of Rev.
Instruments	$10.5	14.7%	43%
Consumables	$10.1	14.0%	41%
Service	$4.1	-0.5%	17%
License and Grant	$0.1	-19.1%	0%

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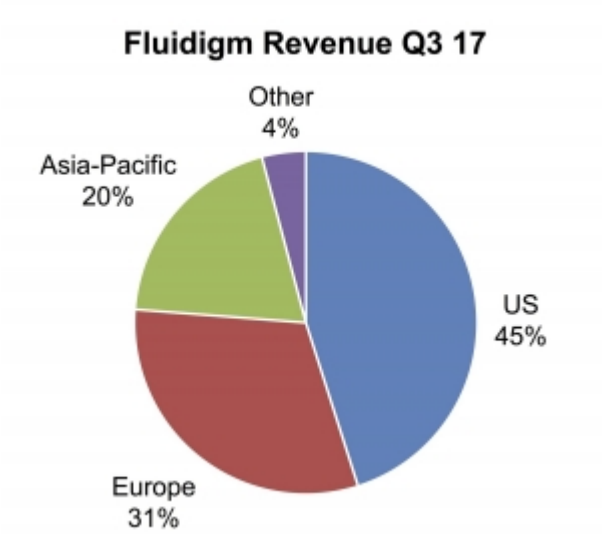
Consumables revenue rose 14.0% to $10.1 million, accounting for 41% of total company revenues. Consumables sales were primarily driven by increased sales growth for both mass cytometry reagents and high-throughput genomics IFCs. However, consumables sales growth was partially offset by decreased single-cell genomics sales and lower than average selling prices. Service revenue was mainly flat for the quarter, dipping just 0.5% to $4.1 million.

Overall, product revenue increased 14.4% to $20.6 million, driven by strong mass cytometry revenue. Weak genomics revenue offset overall product sales. Mass cytometry product revenue increased 101.9% to $10.3 million, largely driven by instrument and consumables revenue. Mass cytometry sales delivered strong double-digit growth in the pharma market, up 54.0%, and in the research market, up 87.0%. As for genomic products, sales decreased 20.1%, mostly due to lower single-cell genomics revenue. Single-cell genomics sales fell both sequentially and on a year-over-year basis.



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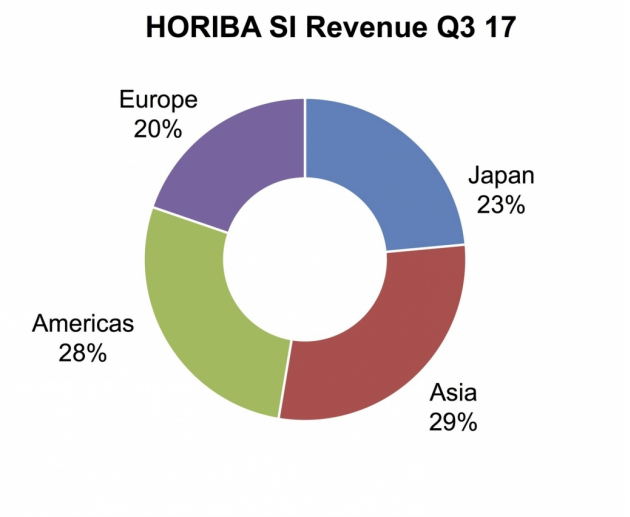
Geographically, sales in all regions except for the US increased for the quarter; however, US sales still represented the majority of total region sales at 45%. US sales for the quarter fell 10.9% to $11.2 million, largely due to weak genomics product sales, particularly for single-cell genomics. Sales in Europe vaulted 48.5% to $7.7 million due to higher genomics product sales.

Sales in the Asia Pacific region also grew significantly, up 34.0% to $4.9 million. Sales in Asia were driven by China's strong performance both in mass cytometry and genomics products. Sales in China alone amounted to $2.8 million, an increase of 21.7%. Additionally, Chinese sales represented 11% of total company sales. As for the rest of the world, sales increased 20.0% to $1.0 million.

For the fourth quarter, Fluidigm expects sales to be $25.5–$28.5 million, an increase from last year's fourth quarter revenue of $25.1 million.

SI Revenue Lifts HORIBA for Third Quarter

For the third quarter, HORIBA's Scientific Instruments & Systems (SI) sales increased 8.5% to ¥6,260.0 million ($55.7 million at ¥112.4 = $1). Segment sales amounted to 14% of total company revenues. SI operating loss for the quarter totaled ¥51.0 million ($0.45 million), an improvement of ¥126.0 million ($1.1 million) from last year's third quarter. Year to date, segment sales fell 2.0% to ¥17,773.0 million ($158.2 million) due to lower-than-expected sales of analytical instruments in Japan and Europe. Operating loss year-to-date amounted to ¥492.0 million ($4.4 million) in part due to higher R&D expenses.



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Geographically, for HORIBA's SI segment, third quarter sales in Asia grew 25.8% to ¥1,821.0 million ($16.2 million), accounting for 29% of segment sales. Representing 28% of segment sales was the Americas, for which sales increased 17.8% to ¥1,729.0 million ($15.4 million). Sales in Europe also experienced healthy growth, up 19.1% to ¥1,236.0 million ($11.0 million). However, sales in Japan fell 18.8% to ¥1,473.0 million ($13.1 million) due to lower analytical instrument sales.

HORIBA Q3 FY17			
	Rev. (M)	% Rev. Growth	% of Rev.
Process & Environmental Instruments & Systems	¥3,955.0	-1.4%	9%
Scientific Instruments & Systems	¥6,260.0	8.5%	14%

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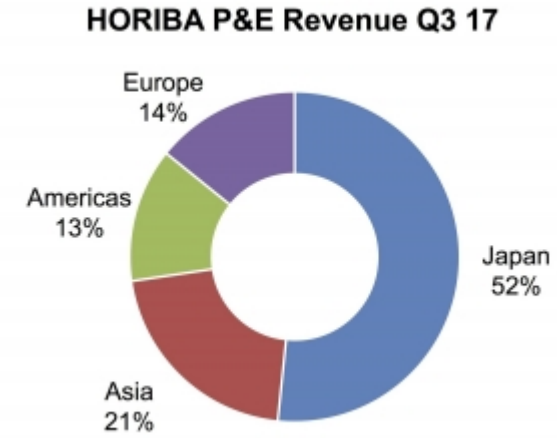
Third quarter sales for HORIBA's Process & Environmental Instruments & Systems (P&E) segment slid 1.4% to ¥3,955.0 million ($35.2 million). For the quarter, P&E sales accounted for 9% of total company revenue. Operating income fell 60.6% to ¥100.0 million ($0.89 million). Year to date, however, segment sales rose 1.9% to ¥12,034.0 million ($107.1 million), driven by robust sales of stack gas analyzers to Japan and China. Operating income fell 62.4% to ¥422.0 million ($3.8 million) year to date due to weak profitability in Asia and the Americas.



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Geographically, the P&E segment's largest contributor to third quarter sales was Japan, accounting for 52% of segment sales. Segment sales in Japan amounted to ¥2,043.0 million ($18.2 million), a decrease of 0.5%. However, for the rest of Asia, sales increased 45.8% to ¥831.0 million ($7.4 million), driven by strong sales in China. Europe also experienced double-digit growth, up 20.1% to ¥562.0 million ($5.0 million). European sales for the quarter accounted for 14% of segment sales. Conversely, sales in the Americas were down double digits, decreasing 43.4% to ¥520.0 million ($4.6 million), largely due to slow process-measurement equipment sales.

For the fourth quarter, HORIBA expects P&E segment sales to reach ¥4,965.0 million ($44.2 million) and its SI segment to hit ¥8,226.0 million ($73.2 million) in sales. As for the full year, the company projects P&E sales to be approximately ¥17,000.0 million ($151.3 million), a downgrade of ¥1,000.0 million ($8.9 million) from the previous guidance. The sales forecast for the SI segment was revised upwards by ¥1,000.0 million ($8.9 million) to ¥26,000 million ($231.4 million) due to the strong performance of Asia.

Life Science Sales Steady for Merck KGaA

Merck KGaA's Life Science division (LS) delivered €1,408.0 million ($1,659.4 million at €0.85 = 1$) in revenue, an increase of 1.3%. Organically, LS sales grew 4.8%, with currency effects negatively impacting sales by 3.9 percentage points. Acquisitions, on the other hand, favorably affected sales by 0.4 percentage points.

Merck KGaA Life Science Q3 FY17

	Rev. (€M)	% of Rev.	% Rev. Growth	Currency	Acq./ Div.	Org. Growth
Process Solutions	€ 539.0	38%	1.1%	-4.0%	-0.1%	5.2%
Research Solutions	€ 492.0	35%	-0.1%	-3.9%	-0.3%	4.1%
Applied Solutions	€ 378.0	27%	3.4%	-3.7%	1.9%	5.2%

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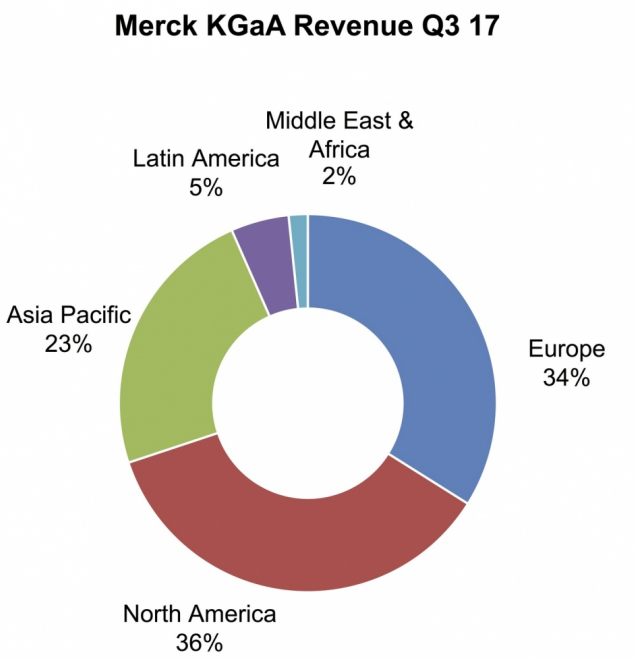
Process Solutions segment sales increased 1.1% to €539.0 million ($635.2 million) on a reported basis. Currency effects negatively impacted sales growth by 4.0 percentage points, while acquisitions deducted 0.1 percentage points. Organically, segment sales rose 5.2% driven by strong demand for single-use products and services. Additionally, the segment's small molecules business also experienced significant growth, accounting for 30% of total Process Solutions sales. However, the segment's filtration and chromatography business performed below expectations due to weaker demand globally. Process Solutions sales represented 38% of total LS revenue.

Sales for the Research Solutions segment were mostly flat for the quarter, falling just 0.1% to €492.0 million ($579.8 million). Currency effects and acquisitions both slowed sales growth, decreasing growth 3.9% and 0.3%, respectively. Organic sales growth remained healthy, increasing 4.1% due to solid demand for specialty lab chemicals, particularly the lab essentials portfolio. Additionally, continued strength in the segment's e-commerce platform in Western Europe and China also contributed to sales growth. The segment's sales accounted for 35% of total LS revenue.

Applied Solutions sales grew the fastest amongst the three LS segments, advancing 3.4% to €378.0 million ($455.5 million). Currency effects negatively impacted sales growth by 3.7 percentage points, while acquisitions added 1.9 percentage points due to strong BioControl (see ***IBO*** 1/15/17) systems sales. Organically, sales rose 5.2%, primarily driven by the segment's strong performance in its Biomonitoring and Lab Water businesses. Overall, segment sales experienced growth across all regions and businesses. Applied Solutions segment revenue amounted to 27% of total LS revenue.



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Geographically, North America accounted for the largest percentage of LS sales in the third quarter. North American sales rose 0.7%, on a reported basis, to €507.0 million ($597.5 million) to represent 36% of total LS revenue. Organically, sales increased 5.0%, driven by strong demand in the Upstream & Systems business. Continued sales growth for cell culture media and single-use products also added to North American sales. Sales in Europe advanced 1.9% to €478.0 million ($563.4 million) on a reported basis, accounting for 34% of total LS revenue. European sales grew 2.6% organically and were primarily driven by Research Solutions and Applied Solutions sales.

In the Asia Pacific region, sales were flat, up just 0.2% on a reported basis to €331.0 million ($390.1 million). Organically, however, sales increased 7.1% as currency effects adversely affected sales by 6.4 percentage points. APAC sales were mostly driven by Process Solutions, as cell culture media and single-use products experienced strong demand. Sales in the APAC region represented 23% of total LS revenue.

Sales in Latin America amounted to €70.0 million ($82.5 million), an increase of 3.9% on a reported basis. Organically, sales grew 6.8%, also driven by the Process Solutions segment.

For the full year, Merck KGaA confirmed its group revenue guidance of €15.3 billion ($18.0 billion), the lower end of the previously projected €15.3–€15.7 billion ($18.0–$18.5 million). As for the company's LS segment, organic sales growth is expected to be around 4%, with EBITDA amounting to €1,780–€1,850 million ($2,097.8–$2,180.3 million).

Product Sales Grow Double Digits for Pacific Biosciences

Third quarter revenues for Pacific Biosciences increased 9.4% to $23.5 million, excluding $3.6 million of terminated contractual revenue (see ***IBO*** 12/15/2016). However, including the terminated contractual revenue, third quarter sales fell 6.3%.

Pacific Biosciences Q3 FY17			
	Rev. (M)	% Rev. Growth	% of Rev.
Product	$20.3	12.7%	86%
Service and Other	$3.2	-7.8%	14%

Click to enlarge

Product revenue grew 12.7% to $20.3 million for the quarter, driven by strong consumables sales. Instrument sales amounted to $9.7 million, a decrease of 15.6% due to lower-than-expected demand of Sequel and RSII instruments in the US and Europe. However, instrument sales were up 36.6% from $7.1 million sequentially. Consumables revenue leaped 63.1% to $10.6 million, largely driven by a higher installed base of instruments and growth in instrument utilization. Service and Other revenue fell 7.8% to $3.2 million.

Geographically, sales in China continued to experienced significant growth, exceeding 30% of total company sales for the quarter driven by strong Sequel sales to Novogene (see ***IBO*** 9/1/17). In the US, instrument sales experienced a slight recovery, but overall government spending still remained below expectations. European sales were significantly lower than expected due to the slow adaptation of Sequel instruments.

Due to slow sales in Europe and the US, Pacific Biosciences revised its full-year revenue guidance to approximately $90 million, a decrease from the previously projected $105–$115 million.

Healthy Gains for QIAGEN Third Quarter

Third quarter sales for QIAGEN advanced 7.6% to $364.4 million, in line with company expectations. Currency effects had minimal impact on total company sales. Organically, sales grew around 6.5%, for which acquisitions added approximately 1.0%.

Consumables and related revenues grew 8% on a constant currency basis, representing around 88% of total company revenues. Instrument sales experienced a recovery from the first half of the year, increasing 2% in constant currencies to represent 12% of total company revenues.

QIAGEN Q3 FY17				
	Rev. ($M)	% Rev. Growth	% of Rev.	Rev. Growth (Excl. Currency)
Molecular Diagnostics	$180	10%	49%	9%
Academia	$80	3%	22%	2%
Pharma	$69	6%	19%	5%
Applied Testing	$36	16%	10%	15%

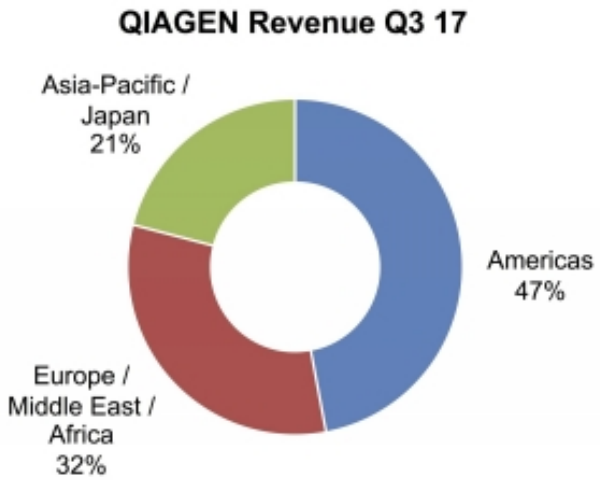
Click to enlarge

Third quarter sales in QIAGEN's Molecular Diagnostics segment advanced 9.0% on a constant currency basis, driven by strong QuantiFERON-TB and QIAsymphony automation system and consumables sales. QuantiFERON latent TB test sales grew at company expectations of 25% on a constant currency basis. QIAsymphony consumable sales increased double digits as well, along with revenue from companion diagnostic partnerships. HPV sales were mixed across all regions, with US HPV sales up 4%. HPV sales in Latin America and China both decreased due to the discontinuation of a tender and unexpected regulatory changes.

Academia segment sales increased 2.0% on a constant currency basis primarily due to strong consumables growth. However, a double-digit decline in instrument sales partially offset these gains. Pharmaceutical segment revenue

grew 5.0% on a constant currency basis driven by growth in both consumables and instrument sales. Overall geographical sales growth, particularly in Europe, also contributed to segment sales.

For the quarter, sales in the Applied Testing segment leaped 15.0% in constant due to increased demand for Human ID and Forensics solutions in all geographies, especially the Americas and EMEA region.



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Geographically, sales in the Americas represented the majority of company revenues at 47%. Sales in the Americas rose 3.0% to $172.0 million due to modest growth in Brazil and the US, partially offset by a double-digit decline in Mexico. The EMEA region experienced double-digit growth, increasing 17.0%, 15.0% in constant currencies, to $117.0 million driven by strong sales in France, Turkey and the Netherlands. Sales in the northern area of Europe, along with sales in the Middle East, were weaker than expected, partially offsetting overall EMEA sales growth. However, EMEA sales still accounted for nearly a third of total company sales, at 32%. In Asia Pacific, sales grew 6.0% to $74.0 million, representing 21% of total company revenues. Healthy growth for the region came primarily from strong sales in China, South Korea and India.

For the fourth quarter, QIAGEN expects its adjusted net sales to grow between 5% and 6% on a constant currency basis. Organically, the company projects adjusted net sales growth to be about 4%–5%. As for the full year, QIAGEN expects adjusted net sales growth of about 7% in constant currencies, reaching the higher end of the previously projected 6%–7%. Organically, adjusted net sales are projected to grow 5%–6%, with 1%–2% growth from acquisitions.

Industrial X-ray Computed Tomography

Strictly considered, Computed Tomography (CT) covers a variety of imaging methods that assemble multiple 2D images to reconstruct a full 3D image of a sample. The most common specific modality involves the use of x-rays to produce the individual images, and software algorithms produce the final image from the underlying sectional images. While CT or CAT scans are a common medical imaging technology, this market profile focuses on the industrial applications of x-ray CT. In this context, CT imagery provides an ideal means for producing images of complex samples in a nondestructive manner.

In CT, as in a standard x-ray, an x-ray source is directed toward the sample, and detectors are placed on the opposite side, so that the method is based on x-ray transmission. The x-rays interact with the sample in many ways, but the primary effect is that the sample absorbs the x-rays, and this absorbance is proportional to the radiodensity of the sample. Radiodensity is a combination of two primary factors: the mass density of the sample and the atomic number of the elements present in the sample. Atoms with a high atomic number more readily absorb x-rays, thus

allowing fewer x-rays to pass through the sample.

A single x-ray radiograph involves interactions with the entire 3D sample “flattened” into a single 2D image in the plane of the detector. By rotating the sample or the x-ray source and detector, multiple images are captured by the CT scanner. Following the acquisition of the sequence of flat images, software reconstruction takes place, generating the 3D image of the sample. This image can be manipulated in various ways to focus on particular areas or present certain sections of the image. Industrial x-ray CT products are differentiated primarily by the x-ray source (which can be mini- or micro-focus x-ray sources for better resolution), the detectors, the software capabilities and the physical size of the sample chamber. Some systems also have integrated automation to image multiple samples, or have been integrated into in-line inspection tools for real-time process analysis in a manufacturing setting.

Applications for industrial x-ray CT can be found in virtually any material manufacturing setting, but a number of industries make particular use of the technique. The primary application is found in semiconductors and electronics, where the technique is commonly used as a QC tool for inspecting defects, such as improperly bonded components, breaks in solder, and other features of printed circuit boards, integrated circuits and other electronic components. The aerospace and automotive industries are also a significant source of demand. The high-performance materials and complex subassemblies in both industries are very suitable for nondestructive testing of this type. Cracks in alloys or imperfectly joined components can be investigated in situ with complete components. Similarly, the medical device industry also makes use of industrial x-ray CT to examine critical components in products.

More generally, industrial x-ray CT can be applied in many manufacturing situations to verify that finished parts match the specification of the CAD design, or to reverse engineer an existing component to determine its dimensions. The nascent industry of 3D printing technology is also making use of industrial x-ray CT to explore new materials and assemblies. Other customer types include plastics manufacturers, metal foundries and materials-research laboratories. Outside of specific industries, there is also a significant source of demand stemming from independent test laboratories, which provide CT imaging as a service to clients who cannot justify the expense of their own systems.

There are a number of suppliers of industrial x-ray CT systems, and for the most part they are distinct from the major medical imaging suppliers of CT systems for use with patients. The market leader is YXLON, which offers a broad range of solutions for x-ray and x-ray CT inspection for various specific types of customer. In November, the company introduced the Cheetah EVO and Cougar EVO product lines; both lines have models with CT, in addition to traditional x-ray imaging. Nikon also has a strong position in this market, particularly for industrial metal products. ZEISS is another major supplier and offers several high-end research systems. In October, ZEISS introduced a new version of its LabDCT diffraction CT solution, which adds diffraction analysis to 3D reconstructions, providing more information on grain structure within alloys and other advanced materials.

Other significant market participants include Bruker, GE Measurement, North Star Imaging (Illinois Tool Works), Shimadzu and Wenzel. In June, two spinoff companies from the Ghent University Centre for X-ray Tomography merged, as XRE and Inside Matters joined forces as XRE. The total market demand for industrial x-ray CT is estimated to be about $300 million in 2017.

Industrial X-ray CT at a Glance:

Leading Vendors:

- YXLON
- Nikon
- ZEISS

Largest Markets:

- Semiconductors and Electronics
- Aerospace and Automotive
- Medical Device

Instrument Cost:

- $100,000–$750,000

Clinical

The US FDA is establishing a new regulatory process for developers of NGS-based Lab-Developed Tests (LDTs) for cancer. On November 15, the FDA greenlighted IMPACT, an in vitro diagnostic test developed at the Memorial Sloan Kettering Cancer Center that uses NGS to screen hundreds of genes to detect the presence of cancer tumors. Along with the approval, the FDA also formed a new pathway for approving these types of tests.

The revamped process will be less burdensome and will make it simpler for developers to obtain 510(k) clearance, which is how the Agency assesses whether a product is equivalent to those already on the market. The announcement is less about revising the FDA's stance on the need for standards for NGS-based testing and more about aiding developers that want their tests to be cleared, with the Agency creating a less complicated process for developers to indicate that the test has met those standards.

The approval of IMPACT is unlikely to affect the two draft guidances released by the FDA last July regarding the regulation of NGS tests, with an Agency spokesperson stating that the IMPACT authorization is separate from the FDA's efforts on NGS draft guidances. The "one-test, one-disease model" of FDA regulations is unable to adequately assess NGS tests, because they have the capability to analyze millions of DNA variants in a single run. However, with the establishment of this precedent, it is possible that tests that include class II devices such as IMPACT may be able to obtain 501(k) clearance in the future.

Source: *Bloomberg BNA*

Pharmaceuticals

As of September 17, 940 Immuno-Oncology (IO) products were in clinical development, while 1,064 were in preclinical development. There are 3,042 active interventional clinical trials evaluating clinical-stage immunotherapies, covering all types of common cancers and the majority of less-common cancers.

The IO drugs in development can be grouped into six categories: immunomodulators that act on inhibiting or activating molecules expressed by T cells; immunomodulators that release antitumor immunity by acting on other immune cells or the tumor immune environment; cancer vaccines that incite antitumor immunity that is antigen specific; cell therapies focused on programming immune cells to attack cancer cells; oncolytic viruses dependent on the direct killing of a tumor and the activation of antitumor immunity; and CD3-targeted bispecific antibodies that lead T cells to the targeted tumor cells for direct killing.

The 940 IO drugs moderate 271 different targets and are owned by 462 companies or higher education institutes. However, of the 940 products, almost 50% modulate 40 targets, indicating the high level of duplications in the field. Among countries, China leads in CAR-T-cell therapies, with 46 Chinese companies owning 98 clinical-stage products, as opposed to 22 US companies owning 51 clinical-stage products. There has also been a rise in non-industry sponsored trials, such as those involving individual higher education centers, government agencies or nonprofit organizations.

Source: *Cancer Research Institute*

Government

The EPA is moving forward on plans to perform risk assessment of chemicals in the US market without the use of vertebrate animals. Animal testing requires a great deal of time and money, and causes suffering to animals for obtaining results that are not always relevant to humans.

Based on changes in the Toxic Substances Control Act (TSCA) (see ***IBO 6/15/16***), the EPA now has authority to evaluate health risks in everyday products by obtaining pertinent toxicity information from manufacturers. The revisions to the TSCA also require the EPA to explore alternative methods to test chemicals that do not involve experimentation on vertebrate animals. Such methods include high-throughput cell assays that examine how biological pathways can harm human health and data analysis software that predicts the outcome of a chemical on human health by comparing its properties to other chemicals in the database.

The TSCA regulates approximately 80,000 chemicals. By establishing alternative testing methods and technologies, the EPA can narrow its focus for chemical risk evaluation, creating a further opportunity for using newly created techniques to analyze existing information for regulating bodies. Promising applications of these novel technologies include exposure prediction and bioactivity.

Currently, the EPA is working with the Interagency Coordinating Committee on the Validation of Alternative Methods (ICCVAM) to replace six toxicity tests that rely on vertebrate animals with alternative tests that comply with Organization for Economic Cooperation and Development standards, and is using high-throughput models for assays for screening endocrine disrupters. However, a major challenge for the EPA is that the Agency is unaware of many of the new technologies and advancements being made in-house by industry, as these technologies are not standardized or commonly shared.

The EPA has until the statutory deadline of January 22, 2018 for promoting alternative testing methods.

Source: *Chemical & Engineering News*

Spain

In 2016, R&D expenditures in Spain grew 0.7% to reach €13.3 million ($16.0 million), or 1.19% of the country's GDP, down from 2015 when it comprised 1.22% of GDP.

The business sector led R&D expenditures with €7.1 billion ($8.4 billion), comprising 54% of expenditures. Of this total, 82% was funded by the private sector, 9% by the public administration sector and 9% by foreign sources. Higher education had R&D expenditures of €3.6 billion ($4.2 billion), with the private and public administration sectors investing 5% and 72%, respectively. Sixteen percent of higher education R&D expenditures was self-funded, and 6% came from foreign sources.

By region, the Community of Madrid, Cataluña and Andalucía had the highest R&D expenditures at €3.5 billion ($4.1 billion), €3.1 billion ($3.6 billion) and €1.4 billion ($1.6 billion), respectively.

R&D services represented 22% of R&D expenditures in 2016, while pharmaceuticals comprised 9%. Professional, scientific and technical activities (excluding R&D services) made up 7% of R&D expenditures, while motor vehicles represented 6.2%.

Source: *Spanish National Institute of Statistics*

EU

Next year, the European Commission (EC) and the European Investment Bank will launch a new fund for the

purpose of accelerating private investment in bio-based markets, or "all economic activity that uses land and aquatic biomass to generate new bio-based materials, chemicals or processes." The investments into the bioeconomy is projected to also positively impact the food and agriculture sectors in Europe. The EC will provide €100 million ($118.1 million) from Horizon 2020, while further funds will be requested by public and private funding sources.

The EC is focused on exploring technological innovations within bioeconomy. Biofuel is the most popular bioeconomical product, but communities all over Europe have been using natural resources for other needs, such as Sicilian families recycling frying pan fat into fuel and English farmers using lavender for cosmetics. Analysts at the European Investment Bank estimate that all the bioeconomy-related sectors amount to approximately €2 trillion ($2.4 trillion) in Europe and already create employment opportunities for over 17 million people, 8% of the EU workforce.

Source: *Science|Business*

Germany

Recently, German companies have increased investment in international R&D. Expenditures on R&D in Germany have been on the rise, and simultaneously, the proportion of foreign R&D investment has risen to 35% of total R&D expenditures. The increase in foreign R&D investments did not negatively impact domestic R&D investments, as companies consider foreign R&D to be complementary to domestic R&D as opposed to its replacement.

In 2015, R&D expenditures of German countries abroad reached €24 billion ($28.3 billion). Between 2003 and 2015, expenditures of foreign German companies grew 91.7% to approximately €69 billion ($81.3 billion). Sixty percent of this increase is attributed to companies located in Germany, while the remaining 40% was contributed by foreign German companies. The pharmaceutical sector was a major driver of this growth, as it represented an additional 32% growth in foreign German companies' R&D expenditures post-2003. In 2015, the chemical industry represented 28% of R&D expenditures of Germany companies abroad, while the pharmaceutical industry made up 58%.

Source: *German Institute for Economic Research*

Broad-based Companies

Company Announcements

Wako Pure Chemical Industries, a manufacturer and seller of lab chemicals, specialty chemicals and clinical diagnostics reagents, announced a name change in October to **FUJIFILM Wako Pure Chemical**, effective April 1, 2018.

Avantor opened the Avantor Korea Laboratory, a life sciences research and applications lab, in Suwon, South Korea, in October.

In October, **HORIBA** announced executive changes. Atsushi Horiba, chairman, president and CEO, was named chairman and Group CEO. Juichi Saito, executive vice president, was named vice chairman and Group COO. Masayuki Adachi, senior managing director, was named president and COO.

HORIBA, **HORIBA STEC** and **HORIBA Advanced Techno** announced in November an agreement with **Shiga University** in the field of data science research and human resource development. HORIBA plans to utilize artificial intelligence to analyze the data gathered by its measurement instruments. Focus areas include reducing operational burden at wastewater treatment facilities.

In November, **Shimadzu** opened an R&D innovation center in Singapore. The Shimadzu Innovation Centre has seven staff members, who will promote joint R&D with local researchers. Prototypes developed at the Center will be transferred to the head office in Japan for final product creation.

As part of its second quarter fiscal 2018 results presentation, **Shimadzu** stated that it plans to establish a sixth analysis center for its Analytical & Measuring Instruments business in Xian, China, by August 2018.

Shimadzu Scientific Instruments, Shimadzu's US business, announced in December a partnership with **Restek** to sell Restek's consumables throughout the US, Latin America and the Carribean. The consumables line includes HPLC and GC columns, and column hardware, valves, syringes, septa and vials, as well as reference standards.

Diploma's fiscal 2017 sales ending September 30 for its **a1-group** of Environmental business grew 9%, 3% in constant currency to £20.1 million ($22.1 million). Revenue for the Germany-based **A1-environsciences** grew 3%.

According to **Becton, Dickinson**'s fiscal 2017 **SEC** filing, Biosciences sales for the year ending September 30 grew 1.8%, 2.4% excluding currency, to $1,139 million to make up 29% of Life Sciences revenue.

In November, **Illumina** opened of its Solutions Center on the Genopole Campus near Paris. The customer training center will host up to one thousand scientists a year. It will also accommodate Illumina's first commercial office on the European continent, which will provide support in the development of skills for the expanding genomics industry in France.

In November, **GE Healthcare Life Sciences** entered into a strategic partnership with China-based **RiboBio** aimed at establishing a deep alliance to jointly build Asia's largest oligonucleotide drug development and manufacturing facility in China. GE Healthcare Life Sciences will provide the advanced instrumentation, including its new IN Cell Analyzer 6500HS and Äkta OligoProcess (1800 mmole) systems.

For the six months ending September 30, **Halma Environmental & Analysis** sales rose 17.9% to £116.5 million ($128.0 million) (see ***IBO*** 11/30/17), including 11% organic constant currency growth, 2% growth from acquisitions and 5% growth from currency effects. The segment reported a strong performance in Spectroscopy & Photonics revenue. Adjusted operating profit rose 69.7% to £19.9 million ($21.9 million).

Spectris announced in November that like-for-like sales for its Materials Analysis segment grew 6% for the July–October period.

In November, **Fluidigm** voluntarily dismissed with prejudice its suit against **Thermo Fisher Scientific** alleging breach of a patent cross-license agreement (see ***IBO*** 5/31/17).

In November, **Metrohm** announced that its **MEP Instrument** business will be renamed Metrohm Australia and Metrohm New Zealand, effective January 1, 2018. MEP Instrument was jointly established by Metrohm and Anton Paar. **Anton Paar** now plans to establish Anton Paar Australia and New Zealand as a separate entity.

In November, **QIAGEN** announced plans with **Health Innovation Manchester** to participate in the establishment of a life science campus in Manchester, UK. QIAGEN currently employs 270 people in the city, according to the *Manchester Evening News*. The **University of Manchester**, the **NHS Trust** and the UK government would also be partners in the project.

In November, **Danaher** named Joakim Weidemanis as executive vice president, with responsibility for the Product Identification and Water Quality platforms. He previously served as a vice president and Group executive of the Product Identification platform.

Bruker announced in December a 10-year partnership with the **Metropolitan Museum of Art** to further advance novel analytical technologies and methods in the field of cultural heritage science. The partnership is focused on MS, as well as XRD and Raman imaging. Bruker will provide instruments and technical expertise for the **Network Initiative for Conservation Science**.

Informatics

Company Announcements

In October, **Schrödinger**, which provides molecule simulations and drug discovery software solutions, announced a

collaboration with Professor Jang-Joo Kim of South Korea's **Seoul National University** to advance the development and design of organic electronic materials. He will use Schrödinger's Materials Science Suite.

Schrödinger announced in November a strategic partnership with **ShanghaiTech University** in China. The companies will establish the Shanghai Center for Excellence in Computational Chemistry at the University.

The **Jackson Laboratory** and **Seven Bridges** announced in October a collaboration to build a **National Cancer Institute**–funded data platform to accelerate translational research using patient-derived tumor xenograft (PDX) datasets. PDXNet, a collaborative network, will coordinate large-scale testing for preclinical therapeutic cancer drugs in PDX trials.

In October, **Scottish Equity Partners** completed a significant investment in **Dotmatics**, a scientific informatics software provider. Dotmatics currently employs more than 100 people.

BioDiscovery appointed **Be Creative Lab (Beijing)** in November to be its exclusive reseller and distributor in China.

In November, cheminformatics firm **ChemAxon** entered into a strategic partnership with **DEXSTR**, a provider of the Inquiro scientific knowledge management solutions.

RowAnalytics, which provides a platform for disease population studies by analyzing all forms of biological, genomic and clinical data, opened a North American office in Cambridge, Massachusetts, in November.

In December, **Genedata** and **Titian Software** announced a technology partnership to create an automated, off-the-shelf solution for small molecule and biological inventory management, and advanced screening data analysis. The solution integrates their respective Genedata Screener and Titian Mosaic SampleBank software. The solution provides a single workflow from sample to screening results.

Product Introductions

In October, **Autoscribe Informatics** released the Matrix iPlanner, an optional module for its Matrix Gemini LIMS that optimizes lab instrument usage by taking into consideration the booking of prerequisite tests, the test order, sample availability dates, available instruments and their capacities.

In November, **Dotmatics** expanded its biologics capabilities, including the integration of application capabilities to minimize the number of user interfaces.

H&A Scientific debuted in November the SLIM (Stability Lab Information Manager) 5.0, which is designed for complete management of drug stability programs. New features include an updated user interface. The company also released SLIMState 6.0.

In November, **sciNote** incorporated artificial intelligence into its ELN platform, adding the sciNote Manuscript Writer. sciNote is used by over 20,000 scientists.

IDBS introduced in November its latest Bioprocess Execution (BPES) informatics solution, which leverages the IDBS E-Workbook Cloud platform. BPES enables cell-line development, fermentation scale-up and purification, and clinical supply workflows to be executed in a single, unified and compliant informatics and data management environment.

In November, **Genedata** launched Genedata Selector 5, an enterprise software solution for genome management and analysis. It features a new web-based user interface, automated workflow and an interactive collaboration portal.

PerkinElmer introduced PerkinElmer Signals Medical Review, a cloud-based analytics and visualization solution that provides medical monitors in clinical development. It aggregates clinical and lab data and provides medical monitors with visual analytics most applicable to their roles via tailor-built workflows.

In November, **Zegami** launched its beta cloud platform for searching and exploring databases with an innovative

use of images.

Certara released in November Simcyp Population Simulator 17, featuring new in silico cancer patient and premature baby populations models, enhanced skin and gut transporter models and additional compound qualification summaries.

Sales/Orders of Note

In October, **Autoscribe Informatics** announced the **Australian Institute of Marine Science** chose its Matrix Gemini LIMS to monitor workflow across three operation sites.

In November, **EXCELRA**, data and analytics firm, entered into a database license agreement with the **California Institute of Biomedical Research** for access to the GOSTAR manually curated small molecule SAR database.

Certara announced in November that the **US FDA** has greatly expanded the use of its PBPK Simcyp Population-based Simulator, and its Pediatric and Cardiac Safety Simulators, almost tripling the number of licenses.

Sample Preparation

Company Announcements

In November, **Pressure BioSciences** named Professor Tiannan Guo's lab at **Westlake Institute for Advanced Study** as its first Center of Excellence in China.

In December, **Pressure BioSciences** acquired the assets of **BaroFold**, maker of the PreEMT high-pressure protein refolding technology for scientific research and biopharmaceutical manufacturing applications. The majority of the purchase price was paid in Pressure BioSciences' restricted common stock.

Purigen Biosystems, which is developing a nucleic acid sample preparation technique based on isotachophoresis technology, named Barney Saunders, PhD, as CEO and a Board member in December. Most recently, he served as **Nanostring Technologies**' commercial leader.

In December, **Zymo Research** entered into a collaboration with **Bertin** to ensure the sample lysis step in the microbiome workflow is complete and unbiased. The solution combines Bertin's Precellys Evolution Homogenizer, and Zymo Research's ZymoBIOMICS Microbial Community Standards and ZymoBIOMICS DNA Miniprep Kit.

Product Introductions

In September, **Tecan** launched the automated RESOLVEX A200 positive pressure workstation for LC/MS sample preparation, which is lighter and smaller than the previous system. The walkaway system features eight-channel dispensing, and is compatible with Tecan's range of 96-well plate and column format smart consumables.

Promega introduced in November the Maxprep™ Liquid Handler and the Maxwell RSC (Rapid Sample Concentrator) 48 Instrument for use with its Maxwell nucleic acid preparation solution. The Maxprep™ automates sample preparation of Maxwell RSC cartridges and trays, as well as post-extraction sample preparation for fluorescence quantitation, sample normalization and a variety of PCR reaction setups. The Maxwell RSC 48 works with individual prefilled cartridges to process 1–48 samples without the risk of wasting reagents. New Promega Portal Software allows the instruments to work together to transfer sample tracking information.

In November, **Chromatrap**, a **Porvair** company, released an affordable, easy-to-use range of DNA kits for routine molecular biology applications: the Chromatrap DNA Extraction kit, which is available in both spin column and 96-well plate designs; the Chromatrap DNA and Gel Purification kits; the Chromatrap DNA Purify & Concentrate kit; and the Chromatrap Size Selection kit.

Laboratory Products

Laboratory Equipment

Company Announcements

In September, **BINDER** opened an 89,340 ft^2 (8,300 m^2) Competence Factory in Tuttlingen, Germany.

In October, **Panasonic Healthcare** announced it will change its name to **PHC** in April 2018. Biomedical products will be sold under the brand name PHCbi.

In November, **Hitachi Koki** announced that it will change its name to **Koki Holdings** on June 1, 2018. Last month, the company's new European subsidiary, Koki Holdings Europe, commenced operations.

Product Introductions

In September, **Avidien Technologies** released the microPro 300 96-channel pipettor and controller app for the Apple iPad Mini. The system combines a wirelessly connected touchscreen tablet with a compact semi-automated pipetting station. It is capable of transfers of 5–300 µL.

VistaLab Technologies launched in October the Ovation ali-Q, calling it the world's only aliquoting pipette controller.

In October, **Esco** introduced the Containment Barrier Isolator–III, the latest addition to its series of Class III biological safety cabinets.

Panasonic Biomedical Sales Europe debuted in October a new VIP ECO Ultra Low Temperature Upright Freezer. It features an internal capacity of 729 L.

In October, **Advantage-Lab** released the three touch-screen carbon dioxide incubators. They feature a 200°C sterilization cycle.

Beckman Coulter Life Sciences introduced in October the Avanti J-15 Series of refrigerated, high-speed, benchtop centrifuges. The systems are designed to save time and increase versatility. They feature a maximum speed of 10,000 RPM and maximum sample capacity of 3 L.

In November, **Labnet** launched the Labnet mini centrifuge with the capacity for 8 place MCT and 4 place PCR stripe rotors.

Sales/Orders of Note

In October, **Elemental Machines** doubled the installation of its smart lab technology, the Elemental Machines Sensory Network, to support **LabCentral**'s recent expansion.

Laboratory Automation

Company Announcements

In October, **Sarstedt**, a supplier of consumables and lab automation equipment for medicine and science, announced the acquisition of **ASSAYMATIC**, which develops and sells devices, systems and software for lab automation for life science applications.

In November, the **Pohlad family** acquired **PaR Systems**, a provider of integrated robotic automation and specialized material handling solutions, from **MML Capital Partners**. The Pohlad family of operating companies includes United Properties and NorthMarq. PaR Systems has 380 employees.

Labcyte, maker of the Echo Liquid Handler and Access Automation platform, announced in November the extension of its personalized medicine collaboration with the **Institute for Molecular Medicine Finland** (FIMM). New applications include cell-based assay development and screening, advanced cell model development and integration of the Echo into the FIMM's genomics program.

Brooks Automation Brooks Life Science Systems' revenue for the fiscal year ending September 30 grew 37.6% to $148.7 million (see ***IBO*** 11/30/17), or 22% of total company's revenues. Organically, segment sales increased 27%. Organic growth was driven by sample storage services, automated storage systems, including the BioStore III Cryo, and consumables and instruments. Consumables, infrastructure services and storage services account for 53% of segment revenue. In 2018, segment sales are estimated to increase more than 30%, including 20% organic growth, according to the company's quarterly conference call.

Product Introductions

Peak Analysis & Automation (PAA) introduced the compact, affordable S-LAB automated plate handler for single-instrument loading, claiming the same reliability as a robotic arm. It features an on-board camera system, and handling of up to 100 unlidded or 80 lidded microplates.

Electrochemistry

Product Introduction

In October, **Metrohm** released enhancements to its Ti-Touch Titrator family of potentiometric and Karl Fischer titrators, and a new low-cost autosampler. New features include the ability to connect a second titration stand, do pH-stat titrations and fully automated analysis of up to 24 samples.

Reported Financial Results

$ in Millions USD	Period	Ended	Sales	Chg.	Op. Prof.	Chg.	Net Prof.	Chg.
HTG Molecular Diagnostics	Q3	30-Sep	$3.7	307.4%	($5.1)	-15.8%	($5.4)	-17.1%
IDEX (Health & Sci Tech.)	Q3	30-Sep	$207.1	12.8%	$46.1	23.9%	NA	NA
MKS Instruments	Q3	30-Sep	$486.3	27.7%	$110.2	107.8%	NA	NA
Pressure Biosciences	Q3	30-Sep	$0.6	20.7%	($1.1)	149.1%	NA	NA
Simulation Plus	Q4	31-Aug	$6.3	58.3%	$1.5	45.0%	$1.2	45.8%
Simulation Plus	FYE	31-Aug	$24.1	20.5%	$8.3	14.3%	$5.8	16.0%
Other Currencies (in Millions)								
Diploma (Life Sciences)	FYE	30-Sep	£125.9	14.6%	£23.3	18.9%	NA	NA
Pfeiffer Vacuum Technology	Q3	30-Sep	€154.2	34.7%	€24.9	63.9%	€17.3	63.9%

NA = not available, NM = not available
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