



IBO

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Life Science and Analytical
Instrument Industry**

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Instrument Business Outlook

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IBO is the leading source for news, data and analysis about the \$50 billion analytical instrument and laboratory products industry. IBO informs company executives, suppliers and investors, delivering a comprehensive view of the industry, its business dynamics and market trends. IBO gives readers information essential to guiding strategy, tracking competitors and gaining industry knowledge.

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FY18 R&D: Steady Gains

Analytical instrument and lab product companies kept R&D as a percentage of sales (R&D/sales) nearly level in fiscal 2018, according to **IBO's** annual review of the R&D spending of 16 companies. Overall, total R&D spending as a percentage of revenues for the companies in the table was below 6.4% last fiscal year, or \$3.3 billion, versus 6.5% the year before, indicating the industry's financial stability and commitment to investment in innovation as well as increased efficiency.

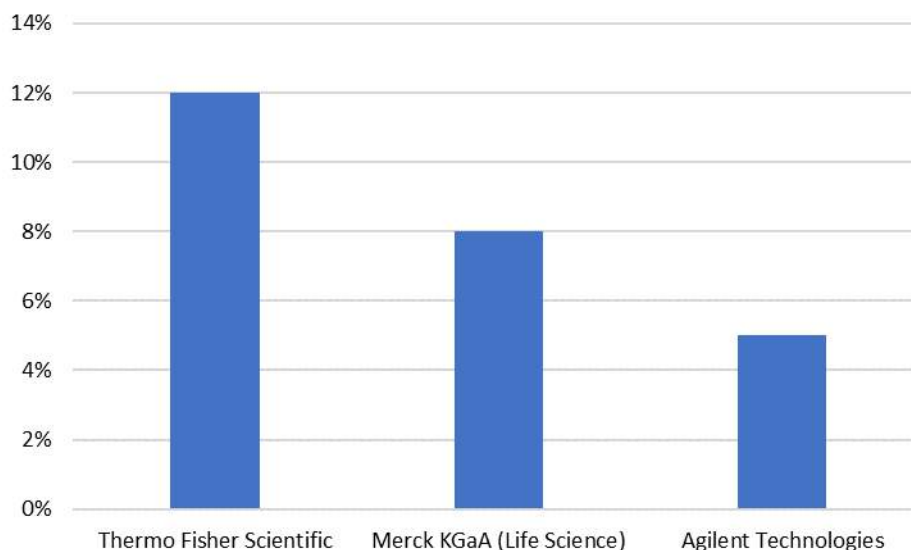
IBO's annual R&D review is based on the fiscal year 2018 (except for Oxford Biosciences' figures, which are based on FY19 sales, ending March 31) reported financial results of publicly held companies. Percentages may differ slightly due to rounding. For companies listed outside the US, financial figures are converted into US dollars. R&D expenses include currency effects and expenses, such as stock-based compensation and amortization of intangible assets.

FY18 R&D Spending as Percentage of Revenue									
	FY16			FY17			FY18		
Company	Rev. (\$M)	R&D (\$M)	% of Rev.	Rev. (\$M)	R&D (\$M)	% of Rev.	Rev. (\$M)	R&D (\$M)	% of Rev.
Thermo Scientific Fisher	\$16,965	\$754	4.4%	\$20,918	\$887	4.2%	\$24,358	\$967	4.0%
Merck KGaA (Life Science)	\$6,656	\$305	4.6%	\$6,919	\$284	4.1%	\$7,277	\$294	4.0%
Agilent Technologies	\$4,202	\$329	7.8%	\$4,472	\$339	7.6%	\$4,914	\$385	7.8%
Illumina	\$2,398	\$504	21.0%	\$2,752	\$546	19.8%	\$3,333	\$623	18.7%
PerkinElmer	\$2,105	\$124	5.9%	\$2,257	\$139	6.2%	\$2,778	\$194	7.0%
Waters	\$2,167	\$125	5.8%	\$2,309	\$133	5.7%	\$2,420	\$143	5.9%
Bruker	\$1,611	\$148	9.2%	\$1,766	\$161	9.1%	\$1,896	\$173	9.1%
QIAGEN	\$1,338	\$150	11.2%	\$1,418	\$154	10.9%	\$1,502	\$162	10.8%
Total Larger Cos.	\$37,443	\$2,440	6.5%	\$42,811	\$2,643	6.2%	\$48,477	\$2,941	6.1%
Eppendorf	\$767	\$41	5.3%	\$812	\$43	5.3%	\$858	\$53	6.2%
Bio-Techne	\$499	\$45	9.1%	\$564	\$54	9.5%	\$627	\$55	8.8%
Tecan	\$517	\$48	9.3%	\$560	\$52	9.3%	\$606	\$52	8.6%
Oxford Instruments (FY19)	\$400	\$32	8.1%	\$396	\$31	7.9%	\$445	\$34	7.6%
Fluidigm	\$104	\$30	28.8%	\$102	\$31	5.5%	\$113	\$38	34.0%
NanoString Technologies	\$86	\$35	40.1%	\$115	\$47	40.8%	\$107	\$62	57.7%
Biotage	\$77	\$6	7.4%	\$86	\$6	7.5%	\$105	\$8	7.2%
Pacific Biosciences	\$91	\$68	74.5%	\$93	\$63	67.0%	\$79	\$65	83.1%
Total Smaller Cos	\$2,541	\$305	12.0%	\$2,728	\$326	12.0%	\$2,939	\$367	12.5%
Overall Total	\$39,984	\$2,744	6.9%	\$45,539	\$2,970	6.5%	\$51,416	\$3,309	6.4%

Last fiscal year, as in FY17, total revenues for the companies in the table grew faster than R&D spending, at 12.9% and 11.4%, respectively. But total rate of R&D spending accelerated from 8.3% in FY17 to 11.4% in FY18, spurred by double-digit growth at seven companies. No companies' R&D spending declined. This was in the face of a slight decline in sales growth from 13.9% in FY17 to 12.9% in FY18.

In 2018, US corporate tax reform came into effect and with it, the potential to boost R&D spending by US-based companies. Although R&D spending grew double digits in total for the companies in table, it was nearly the same as FY16, when R&D grew 11.6%, surpassing sales growth. Although no overall trend related to the tax cuts was visible from the figures in the table, early in fiscal 2018, Thermo Fisher Scientific did announce an additional \$16 million allocated to R&D and STEM programs as a result of the cut, while Waters highlighted the tax cuts as benefiting its R&D investments.

R&D Expenditures CAGR 2015–18



Companies with Over \$1 Billion in Sales

The largest companies in the table, each with sales of more than \$1 billion, recorded R&D as a percentage of sales of 6.5% in FY18, close to FY 2017's figure of 6.4%. However,

excluding Thermo Fisher Scientific, whose overall growth in R&D spending slowed last year after double-digit growth in FY17, R&D as a percentage of sales for the larger companies stood at 8.2%. Thermo Fisher's total R&D spending represented half of the R&D spending among the eight larger companies in the table, with its R&D spanning analytical instrumentation, as well as numerous other sectors, such as contract manufacturing and bioprocessing equipment.

A more accurate measurement of the Thermo Fisher's R&D figures, excluding its service and distribution businesses, is the percentage of manufactured product sales devoted to R&D. Last fiscal year, this stood at 6.3% of sales compared to 6.5%. Among its three businesses, Analytical Instruments, which is responsible for R&D-intensive areas such as MS and electron microscopy, among others, had the largest share of R&D/manufactured-product sales at 9.8% compared to 6.3% for Life Sciences and 5.1% for Specialty Diagnostics.

Merck KGaA's Life Science division is primarily focused on life science consumables through its Research and Applied Solutions business units and bioprocessing, including services, via its Process Solutions unit. As with Thermo Fisher, this focus reduces the overall R&D/sales due to fewer manufactured products as a percentage of revenues. Thus, Merck Life Sciences, the second-largest company in the table, is the only other company in the table besides Thermo Fisher to have had R&D as a percentage of sales of less than 5% in FY18. More notably, in euros, the business' reporting currency, R&D actually declined last year by 7.0% as sales rose 4.0%. The decline comes three years after the company's merger with chemical and lab product distributor Sigma-Aldrich in November 2015 (see *IBO* 9/30/14), which resulted in synergies of €280 million (\$329 million at €0.85 = \$1).

Among the six other larger companies, Illumina and QIAGEN maintained their streak of double-digit R&D/sales. However, in the case of Illumina, R&D growth trailed revenue growth, with respective growth rates of 14.1% and 21.1%, for the second year in a row. But this is not an unusual pattern for the company due to its record of double-digit sales growth. QIAGEN's R&D as a percentage of revenue was largely consistent with the prior year as both sales and R&D spending grew around 5%.

The biggest leap in R&D spending last fiscal year among the larger companies, 39.1%, belonged to PerkinElmer. But the company also posted a 23.1% double-digit increase in revenue growth. Excluding the acquisition of EUROIMMUN in December 2017 (see *IBO* 6/30/17), the company's FY18 sales rose 9%. The company specified its acquisition of

EUROIMMUN as one factor increasing R&D expenditures as well increased staffing. PerkinElmer Chairman, CEO and President Robert Friel stated on the company's fourth quarter FY18 conference call, "This increased spending not only resulted in incremental revenue, but also enabled us to strengthen our scientific and technical capabilities in the key areas of genomics, infectious disease and digital, with most of our new R&D hires in these disciplines."

Besides PerkinElmer, R&D spending also grew faster than sales for four other larger companies. Although R&D/sales was nearly the same as in FY18, Agilent Technologies' R&D spending nonetheless rose 13.6% last fiscal year, whereas sales increased 9.9%. One reason the company highlighted was currency effects. Also, larger changes within the company' R&D organization are ongoing, according to Agilent President and CEO Mike McMullen. He told analysts on Agilent's second quarter FY18 conference call, "We're also making some major investments in our R&D system that we think will allow us to come to market more quickly. Then, from a cost standpoint, taking a lot of cost out of our platform cost because we're going to force the sharing of common components across all our divisions, where historically our divisions have operated fairly independently on the R&D side." Major product developments include a clinical sequencing system set to debut in 2020. As Mr. McMullen commented on the call, "We expect to invest about \$35 million per year to deliver our molecular clinical workflow solution to the market in 2020." In FY18, the company's Diagnostics group's R&D spending rose 9.7% to \$943 million with R&D/sales of 11.6%, the highest among its three divisions. The company's CrossLab and LSAM segments recorded R&D/sales of 3.2% and 9.6%, respectively.

Also growing R&D spending more than a percentage point faster than sales last year among larger companies was Waters. Waters lifted R&D spending 8.1% compared to a 4.8% increase in revenues. Like Agilent, the company has implemented new R&D processes. Waters' growth came in spite of a 40% reduction in the number of its R&D projects over the past three years, according to the company's investor day presentation. Major product launches this year included the BioAccord System and the soon-to-be-released Waters_Connect informatics solution.

Companies with Under \$1 Billion in Sales

For the companies in the table with revenues under \$1 billion, total R&D spending as a percentage of sales was 12.5% in FY18, up from 12.0% in FY17.

For the companies with under \$400 million in annual revenues, three illustrated the steep R&D investments required of relatively young companies to sacrifice immediate profitability in favor of product development. Fluidigm, NanoString Technologies and Pacific Biosciences each reported R&D/sales greater than 30% in FY18. Each company is focused on quickly evolving life science technologies, with investments focused on new technologies and the associated consumables market tailored to their particular platforms.

For Nanostring, in FY18, the focus was the launch of the GeoMx Digital Spatial Portfolio (DSP), officially released earlier this year. As NanoString President and CEO Brad Gray stated on the company's fiscal fourth quarter 2018 conference call, "Our total 2018 R&D expense was about \$1.6 million above our guidance, primarily driven by investments made to prepare for and support the launch of GeoMx DSP." The company's other major R&D project is the development of the Hyb & Seq technology, which has a target release date of 2021, with the company noting it was a contributor to R&D spending increases in FY18, specifically in regard to its collaboration with Lam Research. Based on NanoString's breakdown of its R&D spending, "technology development" rose 72.0% in FY18 to \$20.6 million, even though revenues declined.

In contrast, Fluidigm revenue growth bounced back last fiscal year, turning around from a decline the year before to grow 10.8% in FY18, driven by its CyTOF mass cytometry instrument line. As a result, R&D/sales grew six-fold. But rather than a new platform, the company appeared to be raising R&D spending in relation to growing its aftermarket, a stated goal of Fluidigm last year, having released a major instrument, the Hyperion Imaging System, in fall 2017.

Pacific Biosciences, which is set to be acquired by Illumina this year (see *IBO* 11/15/18), recorded its largest R&D/sales in FY18 since FY13, as company sales sank 15.9%, no doubt affected by the news of the pending acquisition, and R&D rose only 4.4% in the midst of cost restraints. Nonetheless, fiscal 2018 marked an increase in R&D spending by the company after a decline in FY17, as the company continued its roll out of new chemistries for its Sequel Systems. Nonetheless, Pacific Biosciences managed to increase R&D/sales last fiscal year.

Among the smallest companies in the table, Sweden-based Biotage maintained greater equilibrium in its R&D spending. Translated into US dollars, R&D and sales both showed double-digit percentage jumps last fiscal year in US dollars. But in reporting currency, sales and R&D spending grew roughly the same at 13.8% and 12.0%, respectively. And on a

currency neutral basis in kronas, R&D spending increased 7.4%. Biotage aims to increase its R&D/sales investment above the table's average to over 10% in the next few years, versus 7.2% last fiscal year, with a goal of 20% of sales from products released within a three-year period.

For the companies with sales over \$400 million, R&D/sales growth dipped for both UK-based Oxford Instruments and Swiss firm Tecan. For Oxford, this was despite a 3.7% decline in R&D spending and 1.1% slip in sales in reporting currency. The decline was evident for the company's Research and Discovery business, with R&D down 2.7% to R&D/sales of 8.6%, versus an 18.7% boost for R&D in the Materials & Characterization division for an R&D/sales of 11.0%.

In reported currency, Tecan R&D spending remained in step with sales growth of 8.4% in FY18. However, the company stated that excluding currency and acquisitions, R&D spending was flat. This comes in a fiscal year when the company formed a new Genomics business unit following the purchase of NuGen Technologies in September 2018 (see *IBO* 8/31/19).

In contrast to Oxford Instruments and Tecan, Eppendorf's R&D/sales among smaller companies jumped last fiscal year. In reporting currency, the growth of the company's R&D spending trailed sales growth at 4.9% versus 6.0%.

In contrast, Bio-Techne recorded one of the biggest disparities among companies in the table between FY18 sales growth and revenue growth. Sales rose 11.1% with R&D spending up only 3.4%. Even so, R&D/sales declined as a result of slower sales growth. In fact, R&D spending growth slowed from 18.4% in FY17, even though the company invested in developing the technology acquired through the FY17 purchase of Advanced Cell Diagnostics (ACD) (see *IBO* 7/1/16) and the FY18 purchases of Trevigen, (see *IBO* 9/15/17), Atlanta Biologicals (see *IBO* 1/15/18) and Eurocell Diagnostics.

But R&D spending varied within the company itself. Trevigen and Atlanta Biologicals joined the company's Biotechnology division, for which R&D spending rose 1.1% to \$35.9 million in fiscal 2018. But ACD and Eurocell Diagnostics joined the company's Diagnostics division, whose R&D spending grew 7.4% to \$3.5 million. And Protein Platforms' R&D spending grew 6.4% to \$15.3 million, even though no companies were added to the business through acquisitions.

For the companies in the table, which are indicators of the scientific instrument industry overall, a steady rate of R&D/sales year over year, together with acquisitions, represent R&D operations that may be becoming more efficient.

New Funding Announcements

Harvard Institute Receives Donation for Driving Human Health Research

Amount: \$131 million

Recipient: The Wyss Institute for Biologically Inspired Engineering at Harvard University

Funder: Hansjörg Wyss

Date Announced: June 2019

After donating \$125 million in 2009 to establish the Institute and an additional gift in 2014 to support its growth, philanthropist Hansjörg Wyss donated over \$130 million last month to the Wyss Institute for Biologically Inspired Engineering at Harvard. This latest donation brings the total of Mr. Wyss' contributions to his alma mater to more than \$400 million over the past decade.

The Wyss Institute focuses on interdisciplinary research, bringing together scientists and engineers from various field and teaming them up with specialized staff that have industrial experience, resulting in a well-rounded, collaborative research environment aiming to accelerate R&D in human health. To date, the Institute has filed over 2,600 patents and 53 license agreements, and has also established 29 startups and several industry collaborations. Innovations facilitated by Mr. Wyss' gifts include cancer vaccines, human organs-on-chips, synthetic biology-enabled molecular diagnostics and robotic exosuits for stroke rehabilitation.

NYGC Zeroes in on Neurodegenerative and Neuropsychiatric Diseases

Amount: \$125 million

Recipient: New York Genome Center (NYGC)

Funder: Simons Foundation and the Carson Family Charitable Trust

Date Announced: May 2019

To accelerate research into key disease areas, such as cancer, neurodegenerative and neuropsychiatric diseases, the Simons Foundation and the Carson Family Charitable Trust donated \$100 million and \$25 million, respectively. The NYGC's Center for Common Disease Genomics has been the recipient of over \$40 million from the NIH's National Human Genome Research Program over the past four years, and with this new funding, the Center stated that it plans to broaden its studies of whole genome DNA sequences from patients with neuropsychiatric diseases, such as autism, schizophrenia and bipolar diseases.

According to the NYGC, the Center utilizes several genomics tools for cancer research, including CRISPR and single cell sequencing. The NYGC is also the convening hub for the Genome Center Cancer Group, which is made up of cancer research specialists and clinicians from the NYGC's member institutions.

AI and Imaging Research Gets Boost at Mount Sinai

Amount: \$100 million

Recipient: Mount Sinai

Funder: Various, including Blackstone Group

Date Announced: June 2019

Mount Sinai will open a new \$100 million research center at its Icahn School of Medicine which will concentrate on AI and precision medicine research, planned to open in 2021. The funding came from various sources, including an undisclosed amount from Blackstone Group's Hamilton Evans "Tony" James and his wife Amabel, after whom the new center will be named. The Hamilton and Amabel James Center for Artificial Intelligence and Human Health will focus on research in precision imaging, integrative omics and multiscale disease modeling, and the new Center for Genomic Health.

Mount Sinai stated that this Center will be the first in New York to integrate AI, data science and genomic screening, with the purpose of enhancing clinical practice and patient outcomes. Clinicians and investigators at Mount Sinai have been touted as being some of

the earliest adopters of AI, as they use the technology in various precision medicine initiatives. The new Center will also apply AI to optimize imaging technologies and molecular imaging.

Bill Gates, European Investment Bank Fund Clean Energy Research

Amount: €100 million (\$112.3 million at €0.88 = \$1)

Recipient: Mission Innovation

Funder: European Investment Bank; Breakthrough Energy Ventures

Date Announced: May 2019

The European Commission (EC) announced in May that it, along with the European Investment Bank and Bill Gates' Breakthrough Energy Ventures (BEV), will establish a €100 million (\$112.3 million) investment fund for clean energy. Both BEV and the European Investment Bank each contributed €50 million (\$56.2 million).

The fund will invest into companies that are innovating technologies to reduce carbon emissions in several energy sectors, especially agriculture, transportation, electricity, manufacturing and building. The EC has backed the clean energy investment fund and has pledged to double its clean energy research and funding by 2021. The fund is part of the global Mission Innovation program, which was established at the 2015 Paris Summit.

New Fund Aims to Support Early Career Researchers

Amount: CAD 275 million (\$209.8 million at CAD 1.30 = \$1)

Recipient: Natural Sciences and Engineering Research Council of Canada (NSERC)

Funder: Government of Canada

Date Announced: May 2019

Scientists in Canada will be able to receive research funding from the recently launched New Frontiers in Research Fund (NFRF), aimed to facilitate international and

interdisciplinary research in high-risk and fast-breaking areas. The NFRF will receive CAD 275 million (\$209.8 million) over 5 years and CAD 65 million (\$49.6 million) on an ongoing basis.

The first 157 early career researchers to receive funding for their exploratory research have already been announced. The first phase will be \$38 million for researchers with 5 years or less of experience since their initial academic appointment, with the chosen researchers receiving up to CAD 250,000 (\$190,710) over the next 2 years. Along with facilitating cutting-edge research, the NFRF will also be used to establish state-of-the-art labs and lab equipment.

Multimillion Dollar Fund to Drive Research in Disruptive Technologies

Amount: CAD 540 million (\$411.9 million)

Recipient: National Research Council Canada (NRC)

Funder: Government of Canada

Date Announced: June 2019

Over the next five years, the Canadian government will invest CAD 540 million (\$411.9 million) in revamping the NRC, refocusing the Council on science research to drive the country's health and global competitiveness. The NRC provides support for small- and medium-sized enterprises (SMEs) and is a significant contributor to scientific and technological research activities in Canada.

The renewed support made possible by the funding will be for collaborative R&D programs, which will focus on disruptive technologies such as AI-assisted design, engineered cell and gene therapies, rapid and secure digital infrastructures, and new materials for producing clean and sustainable energy. Additionally, the fund will support exploratory collaborative research and help reduce costs to access facilities and research expertise for SMEs, universities and colleges.

Donations Facilitate Development of Global Initiative for Species Discovery

Amount: \$180 million

Recipient: iBOL/BIOSCAN

Funder: Various

Date Announced: June 2019

After proposing the DNA barcode concept in 2003, which posits that an animal species can be differentiated by sequencing under 1,000 bases of mitochondrial DNA from a specimen, Dr. Paul Herbert of Canada's University of Guelph established the International Barcode of Life, or iBOL, which aims to create a reference library of known species with their distinguished sequences. Currently, iBOL has over 7.3 million barcodes and is a valuable resource not only for identifying known animals and organisms, but also for documenting their relationships with other species.

iBOL announced last month that it has received additional support from 30 international partners, totaling \$180 million as well as in-kind services, which it will use to develop its next project, entitled BIOSCAN. BIOSCAN will focus on broadening its reference library by 15 million barcode records, with 90% of them coming from undescribed species. This data will facilitate research into pollution, land-use and global warming effects on biodiversity. Additionally, while iBOL concentrated on gathering barcodes from known species, a key objective of BIOSCAN will be species discovery.

Executive Briefing

Agilent to Pay \$1.2 Billion for BioTek Instruments

Santa Clara, CA 7/11/19—Agilent Technologies has agreed to acquire BioTek Instruments (see IBO 6/30/19) for \$1.165 billion, or \$1.05 billion after tax benefits. In 2018, BioTek recorded revenues of \$162 million, with 10% growth expected this year. BioTek supplies plate readers and cell imaging systems, as well as auxiliary products such as washers and dispensers. “The combination of these two companies will accelerate our multiyear growth strategy to expand our position in cell analysis,” stated Agilent President and CEO Mike McMullen. “This is another example of Agilent investing in high-growth segments of the life sciences market to serve new and existing customers. Agilent is committed to continuing operations in Vermont and retaining the great team of nearly 500 employees that have been at the core of BioTek’s 50-year history of excellence and success.” The acquisition is expected to close in the fiscal fourth quarter and should be accretive to Agilent’s fiscal 2020 non-GAAP EPS by \$0.02–\$0.04 and compounded going forward.

Agilent’s cell analysis product portfolio includes the Seahorse XF Analyzers Live-cell Metabolic Assay platform, and the ACEA Biosciences XCELLigence real-time cell analyzers and NovoCyte flow cytometers. Speaking with IBO, Todd Christian, general manager of Agilent’s Cell Analysis Division, commented, “I think the key thing is this rounds out our portfolio across the various platforms that are used in the cell analysis space through the addition of a leading position with plate readers and an entry point into automated microscopy solutions.” Regarding Agilent’s systems for cell analysis, he said, “Each of those platforms is providing unique and different information about the total cellular environment, and so our intent is to really bring all of that together in a way that makes it easier for customers to do that across what has traditionally been multiple different platforms.” This would create a unified workflow, according to him.

BioTek’s Cytation Hybrid Multi-Mode Readers incorporate imaging into a standard plate reader. As Mr. Christian said, it provides “a live-cell contextual element to what would have traditionally been a single-mode fluorescence absorbance measurement.” BioTek’s Lionheart systems enable fluorescence, brightfield, high-contrast brightfield, color brightfield and phase-contrast microscopy. Two years ago, the companies entered a joint development agreement that eventually became a comarketing agreement combining their

respective Seahorse analyzers and the Cytation platform to create a workflow for data normalization.

Vermont Business Magazine reported that Agilent was 1 of 5 finalists bidding for BioTek, but not the highest bidder, after BioTek put itself up for sale earlier this year.

illumina Preliminary Second Quarter Results Disappoint

*San Diego, CA 7/11/19—*illumina has announced preliminary revenue results for the second quarter, reporting \$835 million in sales, a 0.1% increase. The company cited three reasons: \$30 million in delayed revenues due to timing of a sequencing and consumables purchase, which is now expected to close later this year; a \$10 million shortfall attributed to continuing weakness in the direct-to-consumer (DTC) market, mostly affecting array sales; 10% lower-than-expected non-high-throughput sequencing and consumables sales. The company also reported that during the quarter NovaSeq consumables volume grew over 100% and shipments of NovaSeq systems surpassed expectations.

illumina also updated its 2019 revenue assumptions to 6% growth due to the reasons listed above as well as a delayed partner program. Expectations for annual sales now encompass a 10% increase in sequencing revenue, which includes 15% consumables sales growth and a slight decline in service sales, and a 14% decrease in array sales. The company maintained its expectations for NovaSeq shipments to be flat or slightly up, and pull-through per NovaSeq system to exceed \$1 million.

"We are obviously disappointed with our second quarter financial results," commented illumina President and CEO Francis deSouza. "Our preliminary analysis suggests that these challenges are transitory and do not reflect a macro change to the fundamentals of our business." illumina stated that in response to the results it is taking actions to adjust 2019 operating expenses.

Analysts' consensus estimates for second quarter sales had been \$887.9 million. illumina did not provide specific sales expectations for the second quarter, but in May, illumina forecast 2019 sales growth of 13%–14%, with sequencing sales up in the mid-teens and flat microarray sales. illumina has described population genomics and DTC as two of its emerging markets, but warned as early as last year of slowing DTC-related sales growth.

Bruker Adds to Software Business

Zurich, Switzerland 7/8/19—Scientific instrument company Bruker has purchased PMOD Technologies, which supplies RUO software for preclinical and molecular imaging in preclinical and human research, including PET studies. The software is tailored for molecular quantification and pharmacokinetic modeling. Financial details were not available. “With the PMOD acquisition, Bruker is broadening its support for translational research with outstanding imaging tools, from highest-performance preclinical MRI, PET/SPECT [single-photon emission computerized tomography] and microCT systems to state-of-the-art software,” stated Bruker Preclinical Imaging Division President Dr. Wulf I. Jung. “Preclinical PET/MR is a fast growing market, and the expertise of the PMOD team will further strengthen our quantitative molecular imaging solutions.” Current management remains in place. PMOD has an active user base of two thousand. The company’s software will continue to be vendor neutral and platform independent.

Asked about how Bruker plans to grow the business, Thorsten Thiel, PhD, vice president of Group Marketing for Bruker BioSpin, told IBO, “As a high-performance instrument provider in life science tools, we see a benefit in expanding our offerings towards end-to-end solutions for our customers including software and services.” He added, “New image evaluation software tools allow [us] to expand the customer base that now can benefit more easily from our pre-clinical imaging capabilities. This opens a variety of important application fields in preclinical and clinical research in neurology, cardiology and oncology.”

Regarding potential plans for developing PMOD’s software for LDT or CE/IVD applications, he commented, “Our focus with regard to magnetic resonance solutions for molecular phenomics and future LDT or CE/IVD applications is more concentrated on NMR spectroscopy. Here, we offer the automated and fully standardized Avance IVDr solution that has been adopted already by clinical research and translational market segments. Our PMOD offerings and solutions are focusing on research markets.”

The acquisition is another step in Bruker’s expansion of its informatics business. The software complements Bruker’s preclinical PET, SPECT, CT and MRI systems. PMOD’s software include ParaVision 360 and PMOD. The software provides image registration solutions and 3D image visualization among other capabilities.

BYK Buys Physical Testing Instrument Supplier

Wesel, Germany, Pompano Beach, FL 7/2/19—BYK, a division of chemicals firm ALTANA, has purchased the operating assets of Paul N. Gardner, a manufacturer and distributor of physical testing instruments, for an undisclosed amount. BYK's Instrument Business Line sells physical testing technology instruments and specializes in serving paint, coating and related industries. "We are extremely fortunate and happy to be able to utilize the combined strengths of BYK Instruments and Paul N. Gardner Co. Inc. to continue to provide new and innovative solutions and increased value to our combined customer base," stated BYK Instruments CEO Frank Wagner. BYK stated that the acquisition expands its position in the Americas market.

Paul N. Gardner is both a manufacturer and a distributor with 35 employees, according to an ALTANA spokesperson. Paul N. Gardner's manufactured products are abrasion testers, permeability cups, various film applicators, drying time recorders, paint adhesion testers and wet film thickness gauges. The spokesperson told IBO, "These devices effectively assess the quality of color and gloss as well as the physical properties of coated surfaces." Paul N. Gardner, also known as Gardo, currently distributes BYK Instruments products. Its distributed product offerings range from physical testing instruments to laboratory equipment.

MGI Denies Illumina's Latest Allegations

Shenzhen, China and San Jose, CA 7/2/19—In responding to new patent infringement suits filed by Illumina (see **IBO** 6/30/19), genetic sequencer maker MGI, a BGI subsidiary, has stated that it has taken legal action. The company stated, "MGI opposes the abuse of patent litigation to maintain market monopoly and suppress the development of the industry and advocates fair competition and an open environment for innovation." MGI commented that it has invested a total of CNY 5 billion (\$730 million at CNY1 = \$6.85) in R&D.

This is the latest in a series of lawsuits involving the two companies. Over the last 2 months, Illumina has filed 3 suits against MGI in Europe and 1 in the US, and BGI announced a complaint against Illumina in the US (see **IBO** 5/31/18, 6/30/19).

In January, MGI announced an installed base of over one thousand sequencers. In 2018, publicly held BGI, which primarily provides genomic sequencing services, recorded

revenues of CNY 2,528.79 million (\$382.6 million at CNY 6.61 = \$1), according to Bloomberg, a 21% increase, but also reported net profit declined. Yicai Global reported in May that BGI recently laid off some employees due to “operational difficulties.”

First Quarter Results: Bio-Rad Laboratories, Fluidigm, NanoString Technologies and Oxford Instruments

Bio-Rad Life Science Revenue Experiences Quarterly Double-Digit Growth

Bio-Rad Laboratories Life Science Q1 FYE 19

Rev. (M)	Chg.	Currency	Acq./Div.	Organic Chg.	% of Rev.
\$215.7	9.0%	—	—	12.0%	39%

Sales for Bio-Rad Laboratories' Life Science segment increased in the double-digits on an organic basis (see *IBO* 5/15/19). The Life Science segment's revenue growth was driven by strong demand for process chromatography, cell biology, food science products and digital PCR when excluding declining sales of RainDance. On a year-over-year comparison, the RainDance division suffered a \$5 million decrease in sales. Process chromatography revenue was a sales highlight due to some second quarter scheduled customer orders processed earlier in the first quarter. Excluding currency, Life Science experienced broad-based growth across geographical regions, especially in the Americas. Bio-Rad Laboratories is on track to meet its annual guidance of 4%—4.5% overall revenue growth. The company did not provide a second quarter sales forecast for its Life Science segment.

Fluidigm Achieves Double-Digit Revenue Growth for the Fourth Consecutive Quarter

Fluidigm Q1 FY19			
	Rev. (M)	Chg.	% of Rev.
Total Company	\$30.1	19.3%	
Instruments	\$12.8	70.7%	43%
Consumables	\$12.0	-7.5%	40%
Services	\$5.3	10.8%	18%
License and Grant	\$0.0	0.0%	0%

In the first quarter, Fluidigm's organic sales rose 19.3% to \$30.1 million due to an increase in both product and service revenues. The company did not report a license revenue figure (see *IBO* 5/15/19). Foreign currency negatively impacted the company's total revenues by \$400,000 or 1%. The company attributed its profitable first quarter to its growing presence in the broader marketplace beyond its early adopter customer base.

Fluidigm Q1 FY19		
	Chg.	% of Rev.
Americas	19.7%	43%
EMEA	-3.7%	27%
Asia Pacific	51.2%	30%
Other	NA	0%

Mass cytometry instruments were the primary revenue driver, delivering a 110% increase in sales to \$18.8 million due to new customers' strong demand for Helios and Hyperion Imaging Systems. Fluidigm achieved an installed base of 240 mass cytometry instrument systems, 50 of which were Hyperion Imaging Systems and the rest of which were from the Helios product line.

Also, mass cytometry consumables and services sales grew double digits despite their being a backlog of orders due to customers being trained on their new systems. The backlog of mass cytometry consumables also contributed to Fluidigm's total consumable sales decline in the high single digits. Another factor that contributed to the decline was the slow sales of microfluidics consumables. Microfluidics consumable sales struggled due to two factors: (1) the product has a small customer base and (2) there was a tough year-over-year comparison due to a \$1 million purchase of microfluidics consumables in the prior-year quarter.

Fluidigm Q1 FY19

Adj. Op. Profit (M)	Chg.	Adj. Op. Margin	Chg. (bps)
-\$14.2	-12.5%	-47.2%	286

Overall microfluidics sales decreased 30% to \$11.4 million, which the company attributed to slow sales of both instruments and consumables.

By region, Asia-Pacific was the top performing region thanks to each of the three Asia-Pacific subregions delivering double-digit sales growth. The main revenue driver for the region was mass cytometry instruments sales offset by microfluidics instrument sales. Sales in China increased 6.1% to \$3.5 million, accounting for 39% of the Asia Pacific regional sales and 12% of global sales. Japan reported \$4 million in revenue for the quarter, accounting for 45% of the Asia Pacific regional sales and 13% of global sales.

The Americas region delivered double-digit sales growth thanks to mass cytometry instruments being the primary revenue driver. The company credited the region's profitable performance to a growing research center and pharmaceutical customer base. Sales in the United States increased 23.8% to \$12.5 million, accounting for 96% of the Americas regional sales and 42% of global sales.

EMEA regional sales decreased due to a currency headwind of three percentage point and bulk consumable orders that were purchased last year. Also, the region experienced declining microfluidics instrument sales offset by robust microfluidics consumables sales.

Fluidigm projected its second quarter revenue guidance to be \$28 million—\$31 million.

NanoString's nCounter Product Line Boosts Revenue

In the first quarter, NanoString Technologies' total revenues increased double digits due to its product and service revenues rising 18.3% to \$21.4 million (see *IBO* 5/31/19).

NanoString Technologies Q1 FY19			
	Rev. (M)	Chg.	% of Rev.
Total Company	\$27.7	19.9%	
Instruments	\$4.3	-7.6%	16%
Consumables (excl. Prosigna)	\$12.1	29.8%	44%
In Vitro Diagnostics	\$2.3	6.8%	8%
Service	\$2.6	39.2%	9%
Collaborations	\$6.3	25.8%	23%

Sales highlights included a 20% expansion in the company's installed instrument base. NanoString's most profitable instrument sales were high-throughput systems, specifically, MAX systems which are both sold separately and bundled together with the GeoMx DSP. The broad-based demand for the product came from the biopharma end-market. Oncology panels remain NanoString's most profitable new product accounting for 70% of new instrument sales, while the remaining 30% stemmed from immunology and neurology panel sales. As a matter of fact, it was the sales of immunology and neurology panels that boosted overall panel revenue to 65% of total revenues. Other highlights included the nCounter product line which accounted for 18% revenue growth within the product and service revenues thanks to the strong pull-through of its consumables. Also, nCounter systems' installed base grew 19% to 760.

Total consumable sales rose 25.5% to \$14.5 million due to a 40% rise in panel revenue, which stemmed from record sales of PanCancer panels and 360 panels.

NanoString Technologies Q1 FY19

	Chg.	% of Rev.
Americas	19.6%	68%
Europe & Middle East	25.0%	26%
Asia Pacific	4.1%	6%

The company also received \$2.9 million in cash from its collaborations with Lam Research and Celgene.

Geographically, within the Americas, US revenue increased 23.0% to \$18.2 million. The Americas, Europe and Middle East, and Asia Pacific accounted for approximately 50%, 35%, 14% of instrument revenue, respectively.

End-market wise, both academic and biopharma delivered double-digit growth across all regions.

NanoString Technologies Q1 FY19

Op. Profit (M)	Chg.	Op. Margin	Chg. (bps)
-20.5	-15%	-74.0%	347

Second quarter product and service revenue are forecast to be \$21.5—\$22.5 million, maintaining the previous guidance of achieving 45% of nCounter-related product and service sales in the first half of the year and 55% in the latter half. Total company revenue is expected to be about \$28.5—\$29.5 million. Collaboration revenue is expected to be around \$7 million, which includes \$3 million from the company's Celgene collaboration. Also, the company anticipates approximately \$20 million from its Celgene collaboration.

Oxford Instruments Full-Year Revenue Delivers Double Digits

Oxford Instruments FYE 19			
	Rev. (M)	Chg.	% of Rev.
Total	£333.6	12.4%	
Materials & Characterization	£137.9	16.8%	41%
Research & Discovery	£125.2	11.8%	38%
Service & Healthcare	£70.5	5.5%	21%

In constant currency, Oxford Instruments' full-year fiscal 2019 sales ending March 31 rose 10.8% (see *IBO* 6/15/19). Orders rose 12.9% to £353.5 million (\$465.1 million at £0.76 = \$1) or 12.0% in constant currency. Also, each end-market delivered substantial revenue growth with the Advanced Materials, Life Science, Quantum Technology and Semiconductor markets representing 31%, 5%, 14% and 4% of sales, respectively. Geographically, each region experienced revenue growth with Asia, North America and Europe rising 17.7%, 9.8% and 2.5% in constant currency, respectively. Major regions global sales were the following: Asia with 43%, Europe at 24% and North America at 31%.

Oxford Instruments FYE 19				
	Adj. Op. Profit (M)	Chg.	Adj. Op. Margin	Chg. (bps)
Total	£49.7	6.9%	14.9%	96
Materials & Characterization	£22.1	10.0%	6.6%	60
Research & Discovery	£12.70	-8.0%	3.8%	-33
Service & Healthcare	£14.90	18.3%	4.5%	69

Materials & Characterization (Asylum Research, NanoAnalysis, Plasma Technology) revenue was up 15.3% in constant currency. Orders increased 11.2% to £144.0 million (\$189.4 million), or 10.3% in constant currency. Semiconductor & Communications accounted for 42% of segment revenue, with the Advanced Materials, Energy, Environment and Healthcare & Life Science segments representing 39%, 7%, 6% and 5% of sales, respectively. Geographically, there was broad-based demand across all major regions.

Industrial and commercial customers made up 58% of the Materials & Characterization segment sales, a nine-percentage point increase. Academic customers followed with substantial demand.

Sales highlights for the Semiconductor & Communications business segment included order and revenue growth of 8% and 4%, respectively, due to strong demand from the semiconductor etch, deposition solutions and compound semiconductor product lines. The strong sales of these portfolios were not impacted by the declining sales of the business' mainstream silicon chip manufacturing and electronics product line. Advanced Materials product strength entailed strong demand for the company's imaging and analysis products, etch and deposition systems, the large x-ray detector, Ultim, and Symmetry, a material-structure analyzer. The sales highlights for the Energy segment consisted of strong demand related to lithium to batteries analysis and the material x-ray analyzer, Extreme. Lastly, a strong seller for the Life Science segment was the AFM, Cypher.

Oxford Instruments FYE 19	
	% of Rev.
Healthcare & Life Science	28%
Advanced Materials	24%
Semiconductor & Communications	22%
Quantum Technology	9%
Research & Fundamental Science	8%
Environment	5%
Energy	4%

Research & Discovery (Andor Technology, Magnetic Resonance, NanoScience, X-Ray Technology, a minority share in ScientaOmicron) revenue was up 9.9% in constant currency. Orders increased 16.9% to £138.2 million (\$181.4 million) or 16.1% in constant currency. The Healthcare & Life Science, Quantum Technology, Research & Fundamental Science and Advanced Materials business segments respectively accounted for 41%, 22%, 19% and 18% of sales. Geographically, there was broad-based revenue growth across all major regions. Customer wise, academic customers made up 69% of sales, while industrial and commercial customers made up the balance. Healthcare & Life Science sales were

driven by strong demand for optical microscopy products and solutions such as the Dragonfly, a confocal microscope. Also, the business segment's image visualization and analysis software, such as Imaris and the scientific Sona camera delivered strong sales. Quantum Technology experienced substantial sales and order growth thanks to products such as the ultra-low temperature cryogenic platform, Triton, and the iXon cameras. The business segment saw its products heavily utilized by industrial and medical customers. Lastly, the product strength for the Energy, Environment and Advanced Materials segments included analytical systems, such as high-field benchtop magnetic resonance analyzers, used for research in food, water cleanliness, advanced fabrics and food supply compliance.

Oxford Instruments FYE 19		
	Chg.	% of Rev.
USA	11.5%	30%
Rest of Europe	7.8%	12%
Rest of Asia	7.8%	10%
UK	-21.5%	4%
Japan	10.9%	12%
China	30.8%	21%
Germany	14.1%	8%
Rest of World	14.5%	3%

Service & Healthcare revenue was up 7.6% in constant currency. Orders grew 8.7% to £71.3 million (\$93.8 million). The demand for service products, customer support and consumables resulted in orders and sales growth. Highlights included a sales increase of the OI Healthcare business's refurbished systems as well as demand for OiService services and support. Geographically, the company noted its service support for MRI systems in Japan.

Oxford Instruments FYE 19

	% of Rev.
Academic	49%
Commercial	51%

Oxford Instruments did not provide a sales forecast for fiscal year 2020.

Market Profile: Time-of-Flight ICP-MS

Inductively coupled plasma (ICP) optical emission spectroscopy is an atomic spectroscopy technique that uses argon plasma to energize a sample into emitting light so it can be analyzed with an optical spectrometer to determine elemental composition. However, as a related technique that uses an MS systems rather than an optical spectrometer to achieve a similar result of elemental composition but with the advantages of MS, ICP-MS is an extremely sensitive technique for these analyses. Although most ICP-MS systems on the market use quadrupole mass analyzers, other configurations exist, including TOF MS.

The heating required to produce a plasma in the gas flow (almost always argon) is provided by an induction coil, with a radio frequency generator providing the power source. Electromagnetic induction heats the gas to the plasma state, which then emerges from the plasma torch. Sample introduction is carried out in two main ways. For aqueous solutions, a nebulizer produces small droplets that are introduced into the plasma and ionized for introduction into the analyzer. For solid samples, a laser ablation apparatus can direct short pulses of high-intensity laser light onto the sample, ejecting surface material that, again, is introduced into the plasma flow.

Once ionized by the plasma, the sample is directed into the mass analyzer, in this case, a TOF analyzer. The introduced ions are all brought to the same energy, but the dependency of energy on mass and velocity means that ions of different mass take different amounts of time to traverse the distance between the sample inlet and the detector. If a pulse of ions is introduced simultaneously, the lighter ions reach the detector before the heavier ones, and a histogram of the flight times can be converted into an equivalent distribution of masses, and hence atoms, in the sample.

Data collection relies on fast electronics, and this has the additional benefit of allowing the analysis of transient events, or single particles. This latter possibility has enabled single-cell analysis, with interesting applications in biology and clinical research. Other applications involve environmental science, geochemistry and geology. The use of laser ablation can also enable the elemental mapping of surfaces, with the laser being directed to raster across a line or area on the sample, and the ICP-MS provides elemental analysis at each pixel in the resulting image.

TOF ICP-MS remains a relatively niche technology and is served by very few vendors. GBC Scientific has long championed the technique, and its Optimass systems are now in their third generation. A newer entrant to the market is TOFWERK. The company's icpTOF product is a marriage of its TOF mass analyzer, adapted to a Thermo Fisher Scientific iCAP RQ (ordinarily a single quadrupole MS instrument). Both systems are available with laser ablation options.

Leading Suppliers

- GBC Scientific
- TOFWERK
- Thermo Fisher Scientific

Largest Markets

- Academia
- Government
- Clinical

Cost

- \$250,000–\$400,000

Industry Watch

Food

Last month, the US government implemented the Modernizing the Regulatory Framework for Agricultural Biotechnology Products Executive Order. The Order will streamline regulations concerning agricultural biotechnology to help bring it to the market in an efficient, consistent and safe manner that is transparent and science-based.

Three US federal agencies—the USDA, EPA and FDA—have established a Coordinated Framework for the Regulation of Biotechnology, which oversees the regulation of agricultural biotech for human, animal, plant and environmental health. Specifically, the USDA has established regulations that concentrate on the protection of plant health, while the FDA is to focus on food and feed safety, and EPA regulations concentrate on the sale, distribution and testing of pesticides to limit their harmful effects on humans and the environment.

The Order comes after the Interagency Task Force on Agriculture and Rural Prosperity submitted a report to the White House last year, which called for improving the regulatory system for small- and mid-sized agricultural biotech innovators, removing “unjustified” trade barriers to broaden the market for US products and optimizing the commercialization of new biotech products.

Source: *Food Quality and Safety*

Biotechnology

Although private equity firms have traditionally invested in hospitals or medical device manufacturing, and other more stable parts of health care, investments in biotechnology have taken off in the past couple years.

Investing in biotech technologies has always been a gamble, as these investments are betting on results over the long term. Regulatory approvals for biotech products take a significant amount of time, and also require specialists and experts to identify and analyze the most promising products. In some cases, the biotech cycle can take up to 15 years from inception

to commercialization, and with the high failure rate of new drug candidates, this results in an unpredictable sector for investment. On average, it costs \$2.5 billion to develop a drug, with the top 20 global drug companies spending a cumulative \$60 billion a year on R&D. The vast majority of those funds are invested in the later development stages, as well as in drugs that treat more high-profile diseases, such as cancer. This serves as a disadvantage for other drugs that target less high-profile diseases, as it is harder for those projects to receive funding.

However, private equity investments in biotech seem to be on an upward trajectory. This may be due to a trend of “impact investing,” in which companies’ investments focus on good publicity, presenting the companies as social do-gooders by investing in products that will aid human health, as opposed to more self-serving investments that seem to only enrich the companies themselves.

Additionally, competition for bigger deals that take over more established, mature companies has tightened, resulting in the private equity industry looking to invest its record \$2.5 trillion in unspent cash in new arenas. Although biotech investments are riskier, private equity firms aim for returns of 25% or 2 times the amount of returns on traditional buyouts.

The decline of big pharma has also led private equity firms to move away from the sector, with the sector losing faith that pharma companies will be able to produce blockbuster drugs as in the past, due to the heightened bureaucracy and inflexibility in the industry. With high risks and an over-decade-long waiting period for biotech drugs to reach commercialization, it is unclear whether the private equity sector will continue its investments in biotech, but for the time being, funding continues to grow.

Source: *Financial Times*

Energy

Last year, global primary energy consumption grew at its fastest rate since 2010, increasing 2.9%, which is nearly two times its 10-year average of 1.5% per year. China, India and the US cumulatively accounted for over 67% of the worldwide energy demand increase, with US energy demand growing at its fastest rate in 30 years.

In regards to fuel energy, natural gas drove consumption growth, accounting for over 40% of total energy demand increase in 2018, an expansion of 5.3%. The US, China, Russia and Iran led gas consumption growth, accounting for 78 billion cubic meters (bcm), 43 bcm, 23 bcm and 16 bcm, respectively.

Oil prices rose 31.6% to \$71.31 per barrel, and consumption expanded by 1.4 million barrels per day (b/d), or 1.5%. China and the US were the largest growth drivers, accounting for 680,000 b/d and 500,000 b/d, respectively. The US also led the pack for global oil production, accounting for nearly all of the 2.2 million b/d oil produced in 2018, a record for any country in any year. Oil production growth in Canada and Saudi Arabia, which produced a respective 410,000 b/d and 390,000 b/d, was offset by decreases in Venezuela and Iran, which produced -580,000 b/d and -310,000 b/d, respectively.

One of the highest growth rates for an energy source was recorded by the renewables, hydro and nuclear sector, which grew 14.5%. Of this, solar generation accounted for over 40% of renewables growth, expanding 30 mtoe (million tonnes of oil equivalent), while wind power grew 32 mtoe. China's contribution to renewables growth was greater than growth contributed by the entire OECD, accounting for 32 mtoe.

Source: *BP*

Region Watch

South Korea

Last month, South Korean President Moon Jae-in announced a five-year federal plan providing KRW 4 trillion (\$3.46 billion) to the pharmaceutical and biotechnology sector in the region. President Moon highlighted South Korea's strong pharmaceutical and biotech industry, stating that it will soon be leading the nation's economy.

Several South Korean companies have released new drugs or are on their way to gaining approval in the global market, especially in the US. Daewoong Pharmaceutical received a US FDA license for its botulinum toxin, called Jeuveau, earlier this year, while Jazz Pharmaceuticals received FDA approval for soliamfetol, sold under the brand name Sunosi. Additionally, Celltrion's HIV treatment, Temixys, gained FDA approval in November 2018 and is forecast to be on the market this month, while SK Biopharmaceutical's epilepsy treatment, cenobamate, is expected to receive FDA approval later this year.

While the total level of R&D activity and capabilities of South Korean companies is on the rise, companies have less experience in global studies, such as designing global trials or analyzing global data. This lack of experience was cited as the reason behind declines in biotech stock in South Korea, as most pharmaceutical companies either only conduct local trials or have never attempted a global study. Through greater transparency and providing credible facts to investors, as opposed to focusing on a single pipeline, South Korean pharmaceutical companies will be better poised to reach the federal goals of a biotech-led economy and the production of blockbuster drugs.

Source: *Korea Biomed*

India

The recently released Indian Union Budget for 2019–2020 indicated a total increase of 13.4% to INR 2,786,349.45 crore (\$435.4 billion = INR 1 crore = \$160,000), with the government providing increases to scientific R&D funding across several ministries and departments.

The Department of Agriculture Research and Education's funding expanded 1.6% to INR 8,078.76 crore (\$1.3 billion), while the Department of Agriculture, Cooperation and Farmers' Welfare budget skyrocketed 92.5% to INR 130,485.21 crore (\$20.4 billion), with the greatest bump allocated to the Department's Central Sector Schemes/Projects category, which grew a staggering 116.7% to INR 113,800.00 (\$17.8 billion).

Many ministries and departments received single-digit growth in their budgets. Funding for the Department of Pharmaceuticals grew 6.9% to INR 235.51 crore (\$36.8 million), while the Ministry of Earth Sciences' budget expanded to INR 1,901.76 crore (\$297.2 million), a 5.7% increase. Similarly, the budget for the Department of Health Research grew 9.0% to INR 1,900.00 crore (\$296.9 million), and the Ministry of New and Renewable Energy's budget increased 2.1% to INR 5,254.83 crore (\$821.1 million).

The three major science departments also received single-digit increases to their budgets. The Department of Science and Technology received a 9.1% boost to INR 5,580.01 crore (\$871.9 million), while the Department of Scientific and Industrial Research's budget expanded to INR 4,895.89 crore (\$765.0 million), a 7.1% increase. The Department of Biotechnology's budget also grew in the single digits, rising 7.0% to INR 2,580.34 crore (\$403.2 million).

Ministries and departments that received double-digit increases to their budget include the Ministry of Food Processing Industries, whose budget grew 19.7% to INR 1,196.60 crore (\$187.0 million), as well as the Ministry of Environment, Forests and Climate Change, which received a 10.4% boost to INR 2,954.72 crore (\$461.7 million), and the Ministry of Petroleum and Natural Gas, whose budget jumped 32.1% to INR 42,901.49 crore (\$6.7 billion).

The Department of Chemicals and Petrochemicals was one of the few science-related departments that did not receive an increase in its budget, instead dropping 22.7% to INR 263.65 crore (\$41.2 million).

Source: *Ministry of Finance, Government of India*

Colombia

After the implementation of a peace treaty in 2016 that terminated the 50-year-long tensions between the federal government and the Revolutionary Armed Forces of

Colombia, the Colombian Congress is prioritizing science through a series of new reforms, with a focus on boosting and streamlining R&D funding.

Current investments of R&D account to only 0.24% of Colombia's GDP, and much of those funds are from petroleum-extracting or mining companies paying royalties to the Colombian government. The Colombian Science, Technology and Innovation Fund (FCTeI) is also funded through royalties and is worth COL 2.1 trillion (\$640.0 million) in the current 2019/2020 period. Between its establishment in 2012 up until last month, 378 projects have been financed in various regions in the nation, totaling \$914.5 million.

Of the total of Colombia's resource royalties, 10% is utilized for R&D support, of which 0.5% is allocated to administrative costs, with this funding under protection in the Colombian constitution. Proposed reforms to the country's R&D policies include providing the full 10% for R&D funding, and ensuring that current and future governments cannot weaken or eliminate the current constitutional protections for science.

Colombia has made many strides in increasing science R&D in the past couple of years, with the nation's first science ministry being approved last December, as well as the establishment of a new science brain trust, the Mission of Sages (Mision de Sabios), which is forecast to launch Colombia's long-term scientific roadmap by the end of 2019. Developing and optimizing the chemical industry is also a priority, with the new reforms supporting the protection of funding for chemists as well.

Source: *Chemistry World*

News

Sequencing

Company Announcements

In April, **MGI** announced that its MGISP-100 automated sample preparation system received a Class II medical device registration certificate, stating that it is the first one-stop gene sequencing preparation system in China to receive the certification.

PerkinElmer and **Illumina** announced in June the expansion of their joint metagenomics effort. The companies' automated metagenomic sequencing workflow, which is also used to perform studies on the human microbiota in stool samples, now enables researchers the ability to characterize soil metagenomic populations more accurately. The co-developed workflow isolates pure DNA from soil samples to detect a diverse spectrum of organisms, including bacteria, fungi and viruses. Soil genomic DNA is extracted with PerkinElmer's chemagic 360 instrument, followed by library preparation using Illumina's Nextera DNA Flex Library Prep Kit. It is then sequenced on Illumina's NextSeq 550 platform and data is analyzed using software apps on Illumina's BaseSpace Sequence Hub.

FDNA, a leader in artificial intelligence and precision medicine, launched in June Face2Gene LABS as part of a broader collaboration with **PerkinElmer**. Together, the firms will offer genomic services paired with next-generation phenotyping technologies for more efficient and accurate diagnoses.

In June, **Illumina** agreed to market and promote **ArcherDX**'s Archer FusionPlex line of research products. ArcherDx will continue to sell its products directly in the US. ArcherDX assays combine Anchored Multiplexed PCR chemistry and easy-to-use, lyophilized reagents.

Integrated DNA Technologies (IDT) entered into a strategic cooperation in June with **ChosenMed Technology (Beijing)**, a medical sequencing firm focused on personalized medicine and transformation health care in China. IDT will provide its NGS enrichment products for cancer sequencing. The parties will work together on the R&D of large pan-cancer panels as part of the **Cancer Genome Atlas of China** project.

In July, **Oxford Nanopore** starting automated manufacturing processes producing consumable flow cells for its sequencing devices at a new 34,500 ft² (3,205 m²) factory in Oxford, UK. Production capability will exceed one million flow cells per year in 4–5 years. The company reported that order bookings and revenues increased 2.5X between 2017 and 2018. *The Financial Times* reported that the factory is expected to produce 100,000 units this year (see Executive Briefing).

In June, **MGI Tech**, a **BGI** company, and the **Centre for Translational Microbiome Research** at Stockholm's **Karolinska Institutet** entered into a strategy collaboration for microbiome research and initiated the **10,000 Metagenomics Project** as a phase one project. MGI's DNBSEQ technology will be used to generate high-quality shotgun metagenomics data from one of the largest microbiome biobanks.

In July, the **US Federal Bureau of Investigation (FBI)** has approved **Thermo Fisher Scientific's** Applied Biosystems Precision ID System mtDNA analysis solution for use by forensic laboratories to generate mitochondrial DNA (mtDNA) profiles for submission to the National DNA Index System (NDIS) CODIS database. The Precision ID mtDNA Whole Genome Panel is part of an NGS-based system that includes the Ion GeneStudio S5 System, the Ion Chef System for automated library and template generation, as well as forensically relevant Precision ID panels for mtDNA analysis.

New Products

QIAGEN launched in June the new QIAseq Expanded Carrier Screening Panel, which provides identification of targets, genes and other regions of interest responsible for more than 200 disease indications. It is integrated with QIAGEN's comprehensive CLC Genomics Workbench and QIAGEN Clinical Insight (QCI)-Interpret for QIAseq.

In June, **BGI** introduced the 676 Quality Genome, a new standard for high-quality de novo genome assembly using MGI's DNBSEQ and stLFR (single-tube long-fragment read) technologies. The cost is expected to be \$1,000 on the MGISEQ-T7 sequencing platform. The 676 Quality Genome can detect all types of structural variants and is ideal for assembling regions of the genome not well represented by the reference genome.

Phase Genomics, which provides proximity ligation solutions for genome and metagenome assembly, released the new ProxiMeta Platform, which includes a new eight-

pack ProxiMeta Kit bundled with cloud-based ProxiMeta Analysis, to accelerate microbiome research at a significantly reduced cost per sample.

Thermo Fisher Scientific debuted the Invitrogen Colibri DNA Library Prep Kits for high-throughput Illumina systems, containing a tracking dye to quickly and easily visualize library preparation progress. All kits contain adapters with unique dual indexes or combinatorial dual indexes that allow pooling of up to 24 or 96 different samples before the sequencing run.

In July, **Thermo Fisher Scientific** introduced three new Applied Biosystems AgriSeq targeted genotyping by sequencing solutions for genotyping canines and felines more efficiently and cost effectively: AgriSeq Canine Traits & Disorders Panel, AgriSeq Canine SNP Parentage & ID Panel, and AgriSeq Feline Parentage & ID + Traits & Disorders Panel.

In June, **Twist Bioscience** debuted the Twist Mouse Core Exome Panel, calling it its first NGS product for the research market and its first non-human exome NGS product.

Sales and Orders of Note

In June, **QIAGEN** announced that its cloud-based QIAGEN Clinical Insight (QCI) clinical decision support platform for interpretation and reporting of variants derived from analysis of NGS data, achieved a milestone of more than one million patient test cases analyzed and interpreted. More than one thousand customers have uploaded and processed patient tests.

QIAGEN disclosed in June that its QCI offering was selected by the **National Cancer Center of Japan**, as part of the **Japan's Ministry of Health, Labor and Welfare's** precision medicine program, for the analysis, interpretation and reporting of molecular oncology and oncogenetic screening of cancer patients to contribute to the identification of targeted therapy treatment and clinical trial options.

Life Science Consumables

Company Announcements

In February, the **US Department of Treasury's Office of Foreign Assets Control** announced that it fined **AppliChem**, an **Illinois Tool Works** company, \$5.5 million for the May 2012 to February 2016 sale of chemical reagents to Cuba in violation of US trade sanctions via an intermediary company.

In April, **Zymo Research** announced its support of seven new pilot projects at the **University of California, Irvine** as part of its sponsorship of **the 2019 UCI Microbiome Initiative**.

In May, **Bioz** entered into a partnership with primary enzyme producer **Worthington Biochemical**. This technology now enables Worthington's researchers in academia and biopharma to access real-world Worthington product applications that come directly from scientific articles.

In June, **Bioz** partnered with **New England Biolabs (NEB)**, a life science reagent producer. Bioz's technology enables NEB's customers to access real-world NEB product applications that come directly from scientific articles.

Antibody supplier **Cell Signaling Technology (CST)** formalized partnerships in May with eight local non-profit organizations in **Massachusetts' North Shore (Change is Simple, Seeding Labs, Greenbelt, Ipswich River Watershed Association, Raw Art Works, Montserrat College of Art, Beverly Bootstraps and LEAP for Education)**.

Genovis, the producer of SmartEnzymes, announced in May a distribution agreement with **FUJIFILM Wako Pure Chemical** for Japan, Taiwan and Singapore.

Product Introductions

ArcticZymes introduced in June the Cod UNG Glycerol and Triton FREE, and HLdsDNase Triton FREE, a glycerol-free formulation that is suitable for lyophilization and automated processes. The company aims to maintain an EU REACH-compliant product portfolio after Triton X-100 becomes subject to authorization in January 2021.

Gene-based Analysis

Company Announcements

In May, **Twist Bioscience**, a high-quality synthetic DNA provider, appointed to its Board Nelson C. Chan, former CEO of **Magellan**, which serves the consumer, survey, GIS and OEM GPS navigation and positioning markets. Mr. Chan was an advisor to Twist for the last 18 months. He replaces Paul Conley, PhD, managing director of **Paladin Capital**.

Arzeda showcased in May a DNA assembly platform, which integrates Arzeda's genetic design software Scribe, **Twist Bioscience's** high-quality DNA gene fragments, Labcyte's Echo acoustic liquid handler, and TeselaGen's automated DNA assembly design software and LIMS. The integrated platform supports the high-throughput testing of Arzeda's computationally designed proteins and enzymes.

In May, **DNA Script**, a developer of enzymatic technology for de novo synthesis of nucleic acids, reported an oversubscribed Series B fundraising of \$38.5 million led by health care investment firm **LSP**. DNA Script stated that it was the first company to enzymatically synthesize a 200 mer oligo de novo with an average coupling efficiency that rivals the best organic chemical processes.

In June, **ERS Genomics** licensed to **Bioneer** access to its CRISPR/Cas9 genome editing technology IP. Bioneer, which offers research-based services, will utilize CRISPR/Cas9 technology to generate and commercialize CRISPR-edited cell-based models.

In June, **Oxford Gene Technology**, a **Sysmex** company, celebrated the opening of its new facility in Cambridge, UK. The new facility boasts refitted laboratories and has approximately three times the floorspace of the previous site.

In July, **Integrated DNA Technologies (IDT)** partnered with **3CR Bioscience (3CR)**, combining IDT's rhAmpSNP and rhAmpSeq PCR technologies with 3CR's PACE Genotyping Master Mix and expertise in designing assays. Researchers will be able to design and order custom PACE SNP assays. The service will speed up and reduce the cost of high-volume genotyping, particularly useful for those working in the agricultural biotech sector.

PathogenDx, which provides a DNA-based pathogen testing platform for the cannabis, hemp, agriculture and food safety industries, announced in July a strategic sales and service distribution partnership with **Zef Scientific** for Canada.

In July, **Horizon Discovery**, a gene editing and gene modulation product supplier, announced that **Celyad**, a clinical-stage biopharmaceutical company focused on the development of CAR-T cell-based therapies, received FDA Acceptance of the Investigational New Drug (IND) application for the autologous NKG2D based CAR-T cell therapy CYAD-02 that deploys Horizon's optimized SMARTvector shRNA technology. The Phase 1 trial will be the first CAR-T cell therapy to employ the SMARTvector platform. Horizon will receive an undisclosed milestone payment for the successful IND filing.

In July, **New England Biolabs** opened its eighth subsidiary, located in Australia. NEB also maintains subsidiary offices in Canada, China, France, Germany, Japan, Singapore and the UK.

Product Introductions

In May, **Integrated DNA Technologies (IDT)** introduced the CRISPR enzyme, Alt-R Cas12a (Cpf1) Ultra, which makes it easier to achieve precision genome editing at new sites across genomes. The new Cas12a Ultra also retains activity across a wider temperature range than the wild-type enzyme, making it useful for genome editing in additional organisms, including plants.

In June, **Synthego**, a genome engineering solutions company, released the Gene Knockout Kit v2. It is based on a novel multi-guide strategy that employs up to three modified sgRNAs targeting the same gene.

Sales and Orders of Note

Transomic Technologies' CRISPR whole-genome arrayed library was purchased by the **Victorian Center for Functional Genomics (VCFG) at the Peter MacCallum Cancer Center** in Melbourne, Australia, in May. The VCFG has established arrayed, synthetic- and pooled lentiviral-screens.

GenScript, a gene synthesis provider, announced in June a significant upgrade to its GenBrick Gene Synthesis platform, bringing researchers access to DNA sequences up to 200kb long with 100% accuracy.

In June, genomic products and services provider **Collecta** introduced what it called the first commercially available dual-sgRNA libraries designed for CRISPR activation (CRISPRa) and CRISPR interference/repression (CRISPRi) genetic screens, including gain-of-function screens.

In July, **Promega** unveiled the adenosine triphosphate (ATP)–based Water-Glo test for measuring water quality at water treatment plants and in other industries by detecting living microbes. Formatted for lab use in a 96-well plate format, Water-Glo kits and companion instrumentation can analyze ATP levels in up to 90 samples in less than 90 minutes.

Cell-based Analysis

Company Announcements

In May, **Xylyx Bio**, formerly **East River BioSolutions**, announced partnerships with nine international distributors for its cell-specific extracellular matrix biomaterials.

BioIVT, a provider of research models and services for drug and diagnostic development, in May began offering **Promega** Immune Checkpoint and antibody-dependent cell-mediated cytotoxicity (ADCC) Reporter Bioassays to support immunology and immunology research.

In May, **AxoSim**, a provider of neuroscience discovery platforms, gained an exclusive license with **Johns Hopkins University** for IP underlying the "Mini-Brain" technology, which uses iPSCs to create functional models of the human brain.

FUJIFILM Holdings America, which provides in vitro imaging systems, opened in May a **FUJIFILM Life Science** Strategic Business Office in Cambridge, Massachusetts.

In July, **FUJIFILM Irvine Scientific**, which supplies cell culture media, announced plans to open a third manufacturing facility, which will be located in Tilburg, the Netherlands. The 250,000 ft² (23,226 m²) building is expected to be commissioned in the second half of 2021.

In July, **FUJIFILM** and **Axcelead Drug Discovery Partners** announced a collaboration to provide an iPSC-based integrated platform for drug discovery solutions. By combining Fujifilm's iPSC-derived products that its subsidiary FUJIFILM Cellular Dynamics offers and Axcelead's compound evaluation and analytical services, the companies will work towards developing new drug efficacy evaluation methods and toxicity testing to meet specific needs of clients.

In June, **Emulate**, developer of Organs-on-Chips technology, entered into a strategic collaboration with tattoo company **INTENZE Products** to investigate the biological response associated with tattoo pigments, formulations or inks.

AXT announced in June an agreement to distribute **StemBioSys'** human-derived stem cell products in Australia and New Zealand.

Product Introductions

In June, **INDIGO Biosciences**, a supplier of nuclear receptor and in vitro toxicology testing solutions, added the Human MDR-1/P-Glycoprotein Drug Interaction Assay to their portfolio. Each aliquot of cells is provided as a single-use reagent, though both may be combined to run one full assay plate. MDR1 Drug Interaction Assay utilizes the company's CryoMite preservation process.

Sales and Orders of Note

Xona Microfluidics announced the sale of 100,000 microfluidic devices and chips to neuroscientists and laboratories worldwide since 2008. Xona introduced the cyclic olefin copolymer XonaChip in March to address increasing demand among neuroscientists for a preassembled, easier-to-use and more reliable compartmentalized platform. Over 4,000 XonaChips have been sold. Since launching the XonaChips, sales have nearly doubled.

Protein-based Analysis

Company Announcements

In June, **BIOKÉ**, a business unit of **Cell Signaling Technology Europe**, announced a distribution agreement for the Netherlands, Belgium and Luxembourg for **Parallex BioAssays'** SnapChip Cellular Signaling Series antibody microarrays for the biomedical and food industries. The SnapChip is a simple microarray-to-microarray approach to eliminate false signals in multiplexed immunoassays, as it reproduces the conditions of a common ELISA by colocalizing the capture and detection antibodies in nanodroplets.

BenchSci, the developer of an AI-assisted antibody selection platform, announced in June an additional investment from **Gradient Ventures**, **Google's** AI-focused venture fund, that brings the company's total funding to \$20.5 million.

In July, **Antibodies.com**, a digital marketplace for critical research reagents at cost effective prices from primary manufacturers, raised £400,000 (\$506,348) in pre-seed financing. **Nidobirds Ventures** joined local angel investors and industry veterans in the funding round.

Product Introductions

In June, **Gyros Protein Technologies**, a provider of automated nanoliter-scale immunoassays, synthesizers and reagents, released a new host cell protein kit for automated impurity analysis of biotherapeutics expressed in *E. coli* systems, optimized for use in Gyrolab systems. It was developed as part of a licensing and supply agreement with **Cygnus Technologies** (part of **Maravai LifeSciences**), incorporating their industry standard *E. coli* HCP antibodies and other reagents.

Expedeon introduced in June Lightning-Link Metal Labeling Kits for use in multiple immunoassay-based applications to support single-cell analysis.

In May, **Expedeon** added the CaptSure DIY ELISA from **TGR BioSciences**, which was acquired by Expedeon in May 2018, to its product portfolio. CaptSure DIY ELISA is designed to reduce time and improve flexibility and sensitivity for ELISA assay development, Expedeon's metal labeling kits require 30 seconds of hands-on time.

In June, **Proteona**, a developer of DNA-barcoded antibodies, debuted its latest ESCAPE proteogenomics assay designed specifically for CAR-T cell characterization. The company calls it the first commercial product designed to characterize both RNA and protein expression levels across thousands of single CAR-T cells. The assay is able to identify CAR positive cells, measure changes in cytokine expression, deeply phenotype cells through measuring the expression of 25 key cell surface proteins and discover new gene expression patterns.

In July, **SnapGene** announced it now supports conversion of Vector NTI Express files and databases, as well as the previously supported Vector NTI Advance files and databases. The converted files preserve sequence data together with annotations and construction histories, and the converted databases preserve the parental folder structure. SnapGene supplies software solution for planning, visualizing and documenting everyday molecular biology procedures.

Informatics

Company Announcements

In June, **Genedata**, a provider of advanced software solutions for biopharmaceutical R&D, announced a collaboration with **AstraZeneca** to automate HCS image analysis using Genedata Imagenex, expanding their partnership.

In July, **Genedata** expanded a partnership with enzyme manufacturer **AB Enzymes**. As part of the expanded partnership, AB Enzymes has licensed Genedata Selector as its central bioinformatics platform for managing the genomic and phenotypic information of all production-relevant organisms.

Multi-omics data management firm **Genestack** and **Nebion**, a transcriptomic data curation firm, entered into a collaboration in June to facilitate the integration of Nebion-curated data into Genestack's Omics Data Manager.

In June, **Cambridge Semantics**, a supplier of data discovery and integration software for enterprise data fabrics, announced the integration of **Graphileon** framework with its stand-alone version of AnzoGraph graph analytics database. Graphileon navigates, manages and visualizes the content of multiple graphs.

In July, **Hitachi High Technologies America** teamed with **SparkCognition** to deploy SparkCognition's automated machine learning modeling platform, Darwin, at Hitachi High-Tech's customers in Japan and other areas in Asia. In Japan, Hitachi High-Tech Solutions will distribute Darwin. Other Hitachi High-Tech Group companies will distribute Darwin in additional Asian countries and regions. Darwin is a machine learning product that accelerates data science at scale by automating the building and deployment of predictive models.

Certara, a provider leader in model-informed drug development, regulatory science, real world evidence and market access services, formed in June a new practice area called Certara Global Health to focus its technological expertise on helping to achieve equity in health for all people worldwide.

In July, **Riffyn** announced a collaboration with **BASF** to advance its development of bio-based solutions and fermentation processes. BASF will integrate its white biotechnology research tools and data systems with Riffyn SDE, a cloud-based platform for experiment design and deep data analysis.

Product Introductions

In June, **Genestack** released Omics Data Manager, an enterprise data management solution for cataloging, curating, indexing, searching and sharing biological data. It provides organizations with a centralized multi-omics repository and helps them implement a FAIR (Findable, Accessible, Interoperable and Reusable) data catalog.

In July, SAAS firm **Cellara** released CultureTrax software V2.0, calling it the first productivity software designed to meet the unique needs of stem cell scientists. CultureTrax software enables researchers to quickly and easily plan and fully document cell culture and analytical work.

In July, **Abbot** debuted STARLIMS Quality Manufacturing Solution QM 12.0 to support integration with various types of platforms and manage data from product concept to consumer. It features a new Integrated Request Management Portal.

Sales and Orders of Note

In June, **IDBS**, a **Danaher** company, announced that its E-WorkBook has been implemented by Solvay, an advanced materials and specialty chemicals company. The E-WorkBook platform was rolled out to over 1,500 users across 30 global sites and 80 labs.

In July, the UK's **SES Water** chose the Matrix Gemini LIMS from **Autoscribe Informatics** to manage water testing results in its UKAS-accredited laboratory. The lab annually performs approximately 120,000 tests on around 13,000 samples taken from every point in the supply chain, including water sources, treatment works, storage reservoirs and randomly selected customer premises.

Genedata announced in July that **Genmab**, a biotech firm specializing in the creation and development of differentiated antibody therapeutics for the treatment of cancer, has adopted the Genedata Biopharma Platform to support its global oncology programs.

In July, **Schrödinger** received a preclinical milestone payment from **Sanofi** for a drug discovery program advancing as part of a multi-year, multi-target collaboration between the two companies. Under the terms of the collaboration, Schrödinger provides advanced molecular simulation and computational design expertise to Sanofi across multiple stages of drug discovery, from target analysis and lead optimization to identification of a development candidate. Earlier this spring, Schrödinger announced the advancement of a separate program in autoimmune disease into clinical trials.

Molecular Spectroscopy

Company Announcements

In June, **Advanced Instruments** named **LA Biosystems** the exclusive distributor of its portfolio of osmometers, cryoscopes, fluorometers and Anoxomat jar system in Belgium. LA Biosystems is a sister company of **I&L Biosystems**, which is a key distributor for Advanced Instruments products in Germany and Austria.

Ocean Optics announced in June a new name, **Ocean Insight**. The company stated that the change reflects its evolution from one of many suppliers of spectroscopy products to a singular provider of Applied Spectral Knowledge. The company also explained that the

change represents deep investment in optical sensing solutions and expanded peer partner services to help bring greater value to customers.

TOPTICA Photonics announced in June that it opened TOPTICA Photonics (China) in March, with a head office in Shanghai and a branch in Beijing.

Product Introductions

In June, **Applied Photophysics** released the Circularly Polarized Luminescence (CPL) accessory for the Chirascan V100 CD spectrometer. The Chirascan CPL accessory monitors the chirality of fluorescence emission.

Stratio launched in June LinkSquare, a portable, accessible and affordable spectrometer that offers tailor-made solutions for the enterprise LinkSquare. LinkSquare 1 currently covers wavelengths from 400 nm to 1000 nm. Stratio will soon launch a version with wavelength measurement of 700–1050 nm.

Unity Scientific, a **KPM Analytics** company, released in June the CommUnity Networking Suite, enabling the remote configuration, monitoring and data reporting of Unity SpectraStar NIR analyzers. One to one hundred instruments can be monitored.

In June, **PerkinElmer** introduced the AuroFlow AQ Afla strip test and QuickSTAR Horizon strip reader solution, which features a single-step, water-based extraction method and lateral flow testing at room temperature. It delivers results for mycotoxins, including aflatoxins like B1, M2, G1 and Aflatoxicol at detection levels of 2–300 ppb in 6 minutes.

Bruker launched in June standardized and automated Bruker IVDr (B.I.) Methods 2.0 on the AVANCE III HD and newest AVANCE NEO NMR console platform. The B.I. 2.0 methods have expanded with a new plasma and serum quantification package B.I.Quant-PS 2.0., which detects and quantifies up to 40 different metabolites using 1D NOESY NMR.

Bottom Line

Reported Financial Results

\$ in Millions USD	Period	Ended	Sales	Chg.	Op. Prof.	Chg.	Net Prof.	Chg.
Xylem	Q1	31-Mar	\$1,237.0	1.6%	\$109.	-3.5%	\$79.00	0.0%
Xylem (Water Infrastructure)	Q1	31-Mar	\$482.0	0.4%	\$51.0	4.1%	NA	NA
Other Currencies (in Millions)								
Jiangsu Skyray Instruments	FYE	31-Dec	¥1,024.0	29.3%	¥158.0	21.5%	¥36.0	-65.4%
Jiangsu Skyray Instruments	Q1	31-Mar	¥183.0	-13.7%	¥19.0	-26.9%	¥19.0	-20.8%

NA = Not Available

NM = Not Material

Now available: SDi's Global Assessment Report 2019



NOW AVAILABLE

Strategic Directions International Global Assessment Report 2019

Analytical & Life Science Instrumentation

10

Categories

80+

Techniques

5

Year Forecast

- This report provides detailed data on every major life science and analytical instrument technology in the industry, enabling you and your staff to make accurate evaluations and informed decisions.
- Includes market sizing for **2018 and forecasts through 2023**.
- Each instrument technique includes data and discussion of market segmentation by **product, industry, function, and region**.
- Vendor share data** for 2018, a chart of vendor participation versus product area for all significant suppliers.
- A brief description of **related business developments** and/or significant product introductions for each instrument technique section.

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