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IBO Fall 2017 Patent Litigation Review: PacBio v. Oxford Nanopore Cases Multiply

IBO's biannual review of US patent litigation involving analytical instrument and lab product companies finds further activity on the NGS front, including more settlements (see ***IBO*** 5/15/17). In addition, Eppendorf wins damages, and Thermo Fisher takes on Agilent Technologies.

Selected New US Patent Infringement Cases among Instrument and Lab Product Companies				
Plaintiff	**Defendant**	**US Patent No.**	**Patent Title**	**Case Filed**
Bio-Rad Laboratories, Lawrence Livermore National Security	10x Genomics	9,089,844 9,126,160 9,216,392 9,347,059 9,500,664 9,636,682 9,649,635	System for Forming Emulsions System for Forming an Array of Emulsions " Methods and Compositions for Nucleic Acid Analysis Droplet Generation for Droplet-based Assays System for Generating Droplets—Instruments and Cassette System for Generating Droplets with Push-Back to Remove Oil	July 31, 2017
Trustees of Columbia University in the City of New York, QIAGEN Waltham	Illumina	9,708,358 9,718,852 9,719,139 9,725,480	Massive Parallel Method for Decoding DNA and RNA " " "	Nov. 18, 2017
Pacific Biosciences	Oxford Nanopore Technologies	9,678,056 9,738,929	Control of Enzyme Translocation in Nanopore Sequencing Nucleic Acid Sequence Analysis	Sept. 25, 2017
Thermo Fisher Scientific	Agilent Technologies	RE45,386 (reissue of 7,202,470) 7,230,232 RE45,553 (reissue of 7,211,788)	Means for Removing Unwanted Ions from a Ion Transport System and Mass Spectrometer " Mass Spectrometer and Mass Filters Therefor	May 24, 2017

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New Cases

Pacific Biosciences (PacBio) filed a second US patent suit (see ***IBO*** 5/15/17) in the US District Court of Delaware in September against UK-based **Oxford Nanopore** alleging infringement of two patents by all of Oxford Nanopore's nanopore sequencing products (see table). Oxford Nanopore has not yet filed a response.

In addition to this latest case, PacBio has cases pending against the company before the US **International Trade Commission** (ITC) claiming infringement of two patents, including US Patent No. 9,542,527 (Compositions and Methods for Nucleic Acid Sequencing), which was added to the complaint file earlier this year in March.

This summer, an administrative law judge ruled that the terms "single-molecule sequencing process" and "single-molecule sequencing" as used in the patents were limited, and subsequently granted Oxford Nanopore's motion for summary determination. The ITC has since granted PacBio's request for a review of both rulings.

Overseas, PacBio has two patent cases pending against Oxford Nanopore. Filed in February in the High Court of England and Wales, one suit is focused on the same patents as the ITC case. A similar claim was filed in Germany in April. But Oxford Nanopore has fired back. In April, the company and patent holder **Harvard University** brought suit against PacBio in the High Court of England and Wales charging infringement of European Patent (UK) No. 1,192,453 (Molecular and Atomic Scale Evaluation of Biopolymers).

NGS technology is at the center of another suit, this one involving former legal foes. Following dismissal of a suit involving the same parties but different patents (see below), **Columbia University** and **QIAGEN** have filed another suit against **Illumina** (see table). This suit regards a patent related to sequencing by synthesis, specifically nucleotide analogues, issued in July. QIAGEN is the exclusive licensee. The complaint alleges infringement by Illumina's NGS systems and kits. Three additional patents, issued the same month, were added to the suit in August. The plaintiffs are requesting royalties and a permanent injunction. In an answer to the complaint filed last month by Illumina, the company denied the allegations.

In July, **Bio-Rad Laboratories and Lawrence Livermore National Security (LLNS)** filed suit against **10x Genomics** in the US District Court for the Northern District of California (see table). The suit charges infringement of seven patents, five of which are owned by Bio-Rad, and two of which are co-owned by Bio-Rad and LLNS with Bio-Rad as the exclusive licensee.

The complaint alleges infringement of patents, which are employed in Bio-Rad's ddPCR (Droplet Digital) systems, by 10x's GemCode and Chromium systems. 10x was established by former Bio-Rad employees. According to the complaint, "On information and belief, the GemCode and Chromium products both utilized the same scientific principles to create emulsions in a microfluidics chip, and use the same type of microfluidic chips, both of which

infringe the claims of the asserted patents." Among the plaintiffs' requests are injunction relief, compensation and damages. In September, 10x filed an answer denying the allegations and counterclaiming for declaratory judgment. Bio-Rad and LLNS commenced an ITC complaint against 10x in August (see ***IBO*** 8/31/17) regarding five of the patents.

Earlier this year, Bio-Rad acquired **RainDance Technologies** (see ***IBO*** 1/31/17), which along with the **University of Chicago**, has a 2015 suit pending against 10x Genomics (see ***IBO*** 4/30/15).

In a case involving competitors in the ICP-MS market, **Thermo Fisher Scientific** filed suit against **Agilent Technologies** in May, alleging infringement of three patents by Agilent's 8800 and 8900 ICP-QQQ (see table). According to the complaint, Thermo Fisher first notified Agilent of the alleged infringement in 2012, which Agilent denied. Two of the patents were reissued (a patent is reissued to correct an error in the original patent) in 2015. Last month, Agilent filed a motion to dismiss for failure to state a claim.

Judgment

Eppendorf announced that in July the US District Court issued a final default judgment in Eppendorf's 2015 suit against **Topscien Instrument** (**Ningbo China**). The judgment permanently enjoins Topscien from using Eppendorf's MiniSpin centrifuge trademark or product design trade dress (visual product appearance) in the US. Eppendorf was also awarded liquidated damages.

In September, Eppendorf was also awarded two separate judgments of the **Landgericht Duesseldorf** in its suit against **Ritter** for infringement of European Patent Nos. 2575402B1 and 2279791B1 by Ritter's Ritips pro and Ritips professional dispenser tips. Ritter recently dropped its appeals. Ritter is permanently enjoined from using Eppendorf's patents in Germany, and Eppendorf was awarded damages. Eppendorf stated, "While Eppendorf has an active licensing program for much of its intellectual property, Eppendorf is not willing to tolerate infringement of its patents or unauthorized use of its registered trademarks or its product trade dress (designs)."

Settlements

As noted above, plaintiffs **QIAGEN and Columbia University**, and **Illumina** have settled two NGS cases. The US District Court dismissed the 2013 case which was originally brought against **Intelligent Biosystems**' (IBS) (now QIAGEN). The court's order cited a settlement between the parties. Columbia and IBS' claims were dismissed with prejudice (the case cannot be brought again on the same claims) and its counterclaims were dismissed without prejudice, while Illumina's counterclaims were dismissed without prejudice. The settlement comes after a 2014 decision, upheld in 2015, by the USPTO that found the plaintiffs' patents invalid.

In a related case that resulted in an injunction barring sale of QIAGEN's original NGS system in the US (see ***IBO*** 9/15/16), in July, the District Court dismissed Illumina's 2016 patent infringement suit against QIAGEN following the parties' request. However, the court wrote, "Except as otherwise permitted by the parties' settlement agreement, Defendants and their officers, affiliates, and employees, agree not to use, offer to sell, or sell within the United States, or import into the United States, any products or systems that comprise a nucleotide or nucleoside molecule, wherein the nucleotide or nucleoside molecule has a ribose or deoxyribose sugar moiety with an azido-containing protecting group attached via the 2′ or 3′ oxygen atom of the ribose or deoxyribose sugar moiety. This includes the azido-protecting group chemistry sold by QIAGEN in 2016 in connection with its GeneReader product. Nor shall they infringe, contribute to the infringement, or induce infringement of any Patent Claims."

454 Life Sciences' (now Roche) 2015 suit against Ion Torrent, Life Technologies and Thermo Fisher Scientific has also been dismissed. The case centered on emulsion PCR. The suit involved three patents: US Patent Nos. 7,323,305 (Methods of Amplifying and Sequencing Nucleic Acids), 8,748,102 and 8,765,380 (both for Bead Emulsion Nucleic Acid Amplification). Earlier this year, the USPTO terminated an inter partes review of the three patents due to notice of a settlement agreement. The case was closed in April following the parties' stipulation to dismissal with prejudice of 454's claims, and dismissal without prejudice of Thermo Fisher's counterclaims.

Another suit involving **Thermo Fisher** was also settled earlier this year. The 2016 suit, brought by **Bio-Rad**

Laboratories and involving US Patent No. 8,236,504 (Systems and Methods for Fluorescence Detection with a Movable Detection Module), was dismissed by a US District Court.

In the conclusion of a six-year case, in August, the US District Court granted the parties' motion to dismiss without prejudice **Scientific Plastic Products**' (SPP) 2011 patent infringement suit against **Biotage and Merck & Co.** (see ***IBO*** 4/30/12). Both patents were subjects of US Patent and Trademark Office (PTO) inter partes re-examinations. Earlier this year, the PTO upheld its ruling invalidating SPP's patents. In a press release, Biotage stated, "Defendants have not agreed to any liability and no claim remains pending against Defendants." Settlement terms were confidential.

Also in August, **Omni Medsci**'s case against **Leica Microsystems** (see ***IBO*** 5/15/17) was closed after the court agreed to the parties' stipulation for dismissal. All claims were dismissed with prejudice.

R&D Expenditures Drop in Three EU Countries

The countries of Finland, Hungary and Slovenia recently released preliminary figures on 2016 total R&D expenditures, and data indicated that spending for research declined in all three nations.

Although the European countries represent three different levels of R&D output and scientific innovation, the decline in total 2016 R&D spending shared by Finland, Hungary and Slovenia suggest that the trend of higher business R&D expenditures in all countries is unable to offset the slowing R&D spending of the countries' governments.

Finland, a research-intensive powerhouse, has traditionally been amongst the Nordic countries that spend the largest share of GDP on R&D, according to the UNESCO Institute for Statistics. Hungary has been steadily increasing its R&D spending since the mid-1990s, but according to the European Commission, growth plateaued in 2002, and has since staggered upwards. Slovenia, one of the fastest growing European countries for innovation and research spending, has the highest GDP per capita in regards to innovation indicators in Central and Eastern Europe, as defined by the Organization for Economic Cooperation and Development .

2016 Total R&D Expenditures		
	($M)	% Change
Finland	$6,907	-2.5
Hungary	$1,596	-8.8
Slovenia	$943.2	-5.1

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Finland

In Finland, 2016 R&D expenditures were €5.9 billion ($6.9 billion = €0.85 = $1) in 2016, a 2.5% decrease. The business sector in Finland was largely responsible for the decline, as R&D spending fell nearly 4% in the sector. In the higher education and government sectors, 2016 R&D expenditures were nearly equal to the year prior. Preliminary data suggests that R&D expenditure will increase by €100 million ($116.6 million) in 2017, with business enterprises' spending recovering.

In total, 72,400 researchers were working in Finland in 2016, with around 50% in the business sector, a 5.0% decrease. Approximately 74% of R&D staff were researchers and R&D engineers, with the remaining staff serving as support or other research personnel. In the business sector, although 58% of R&D staff worked full time, overall R&D staffing decreased by 600 people.

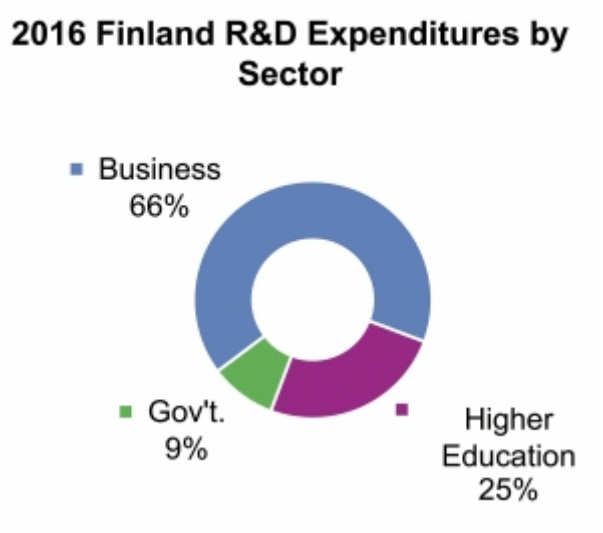
As a percentage of the nation's GDP, R&D expenditures made up 2.8% in 2016, continuing the downwards trend that began in 2009 when R&D spending made up 3.8%. In 2017, R&D expenditure is forecast to account for 2.7% of GDP.

Business Sector

Finnish R&D expenditures in the business sector were €3.9 billion ($4.5 billion), a 3.6% decrease, and accounted for 66% of total R&D expenditures and 55% of funding expenditures. Out of this, €3.2 billion ($3.7 billion) was spent by domestic enterprises, while foreign funding totaled €483.8 million ($563.9 million), a decline of 1.1% and 28.3%, respectively.

Extramural research is defined by Statistics Finland as "entire R&D projects or undertakings contracted out by the enterprise or organization, which are not service purchases of own R&D activities or support functions." This R&D expenditure is estimated to total €370 million ($431.2 million) in 2016. Fifty-four percent of extramural research was accounted for by the Finnish business sector, totaling €200 million ($233.1 million).

Business enterprise funding in 2017 is estimated to increase to approximately €4 billion ($4.7 billion), representing 66% of total R&D expenditures, with €100 million ($116.6 million) coming from foreign sources.



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Higher Education

Expenditures on R&D in higher education increased 0.6% in 2016, amounting to €1.5 billion ($1.7 billion). But public funding slightly declined to €1,202.0 ($1.4 billion), a 1.4% decrease, while the number of grants decreased 5.0% to €112.8 million ($131.5 million). Regionally, 40% of R&D was carried out in Uusimaa, 12% in Varsinais-Suomi and Pirkanmaa, and 9% in North Ostrobothnia.

As a share of total R&D expenditures, higher education represented 25% of spending. In the higher education sector, research is infrequently outsourced, but research services conducted by the higher education sector amounted to €35 million ($40.8 million).

Government

Government spending on R&D totaled €554.2 million ($646.0 million) in 2016, down 1.6%. R&D expenditures of state administrative branches also decreased, amounting to €333.6 million ($388.8 million), a 4.3% decline. Foreign funding, however, increased 8.2% to €85.8 million ($100.0 million).

Although the government made up 9% of total R&D expenditures, its share in funding was 33%, which includes basic funding of higher education as per the Ministry of Education and Culture. Regionally, 64% of government R&D was performed in Uusimaa.

Hungary

More than HUF 427 billion ($1.6 billion = HUF 265.7 = $1), or 1.22% of GDP, went towards R&D expenditures in 2016 in Hungary, an 8.8% decrease at current prices. Spending fell 7.9% both in the business sector and at R&D institutes and other budgetary units, and fell 16.1% in the higher education sector.

Foreign R&D sources contributed approximately HUF 71 billion ($265.3 million), a 1.2% increase, while the amount of R&D funding from the government and nonprofit sectors declined. Federal R&D capital expenditures dropped 21.2% to HUF 49,163 million ($183.7 thousand), while the government's share of R&D spending declined 9.3% to represent 12% of total R&D expenditures in 2016.

Business Sector

HUF 316.7 billion ($1.2 billion) was spent on R&D activities by business enterprises in 2016, a 7.9% decrease. However, R&D expenditures funded by the business sector increased 3.5%, with its share in spending rising 13.5% to represent 56% of total R&D expenditures. However, this rise in business sector funding was unable to offset the decrease in business R&D spending. Generally, the number of research units within the business sector are steadily on the rise, while in contrast, the higher education and government sectors are slowly declining. Last year, 1,291 business enterprises had functioning R&D units in Hungary, an 8.6% drop.

The number of employees conducting R&D activities in companies fell 1.5% to 23,349, with the number of researcher staff growing 1.5%, but the number of technical staff falling 5.3%. Over 58.2% of all full-time R&D staff were employed at R&D units at business enterprises in 2016 out of a total of 20,825 full-time staff, a 1.0% decline.

The proportion of R&D capital expenditure, within the total R&D expenditure, was HUF 41 billion ($153.2 million), or 13%. Almost 50% of total business R&D expenditures were spent on manufacturing, including the manufacture of pharmaceutical products, which accounted for 36%, with the amount of R&D spent on basic pharmaceutical products increasing almost 1.5 times.

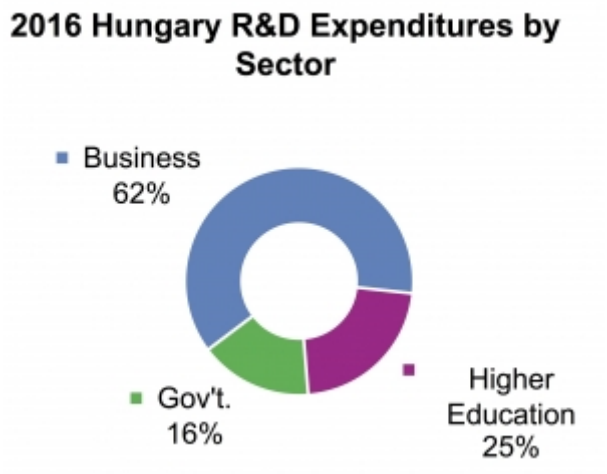
Higher Education

In 2016, total R&D expenditure in Hungary's higher education sector dropped 16.1% to HUF 47.6 billion ($177.8 million). Almost 93%, or HUF 44 billion ($164.4 million), of total R&D expenditures was used for current R&D costs, with 75% of these costs for personnel purposes. R&D capital expenditures totaled HUF 3.6 billion ($13.5 million), with nearly 75% spent on equipment, 22% on land and buildings, and 3% on software.

There were 1,311 R&D units within the higher education sector, with the proportion of all research units within this sector rising to 48%. Out of these units, 21,969 personnel worked on R&D activities, with virtually no changes in staff numbers in 2016. Within R&D personnel, the number of researchers increased 2.5%, while the number of technicians and support staff fell 5.2% and 8.0%, respectively. As with previous years, the number of full-time staff performing scientific research at universities decreased to 5,592.

Almost 69% of higher education R&D funding came from the government, and around 10% from the business sector. Fifteen percent of R&D funding for higher education came from foreign sources, and nonprofit organizations funded the remaining 6%.

The fields of natural science, medical and health sciences, and agricultural sciences spent HUF 44.7 million ($167.0 thousand), HUF 45.8 million ($171.1 thousand) and HUF 32.5 million ($121.4 thousand) on R&D, respectively, in 2016.



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Government Sector

Over HUF 57 billion ($213.0 million) was spent on government R&D in 2016, an 8.0% decrease. Current costs comprised 14% of total federal R&D expenditure, while capital expenditure accounted for 9.5%. Approximately 82% of R&D spending came from federal sources, with 12% coming internationally.

Federal R&D units comprised almost 5% of the total number of research units in Hungary, dropping by 10 units in 2016. Total R&D personnel in government were 9,318, including 7,456 full-time staff, a decrease of 11.0% and 8.0%, respectively, with the main factor for the decline being the drop in the number of technicians at research institutes.

The vast majority, or 55%, of R&D expenditures were in the natural sciences with an additional budget of HUF 1 billion ($3.7 million); however, only 33% of natural sciences R&D expenditures were spent by the government, as 57% was expended by the business sector. Agricultural research spending also increased 1% in 2016, accounting for 11% of total government R&D expenditures.

Slovenia

R&D expenditures in Slovenia were 2.0% of GDP in 2016, totaling €809.2 million ($943.2 million), a 5.1% drop.

September data indicated that government budget allocations for R&D increased 1.8% to €162.8 million ($189.8 million), or 0.40% as a share of Slovenia's GDP. Approximately 91% of government allocations were spent in the government and higher education sectors, while 8% was expended in the business sector, and foreign and nonprofit sectors received the remaining 1%.

Socioeconomic objectives for the country that received the most budget allocations were General Progress of Knowledge, Industrial Production and Technology, and Health, receiving €91.8 million ($107.0 million), €16.2 million ($18.9 million) and €15.1 million ($17.6 million), respectively, with the same priorities predicted for 2017. The planned government budget allocations for R&D for 2017 total €172.3 million ($200.8 million), signaling a 5.5% increase.

After 2013, R&D expenditure began a downward trend in Slovenia, which has continued into 2016. R&D staff numbers have declined 3.2% to 19,975, with 56% of staff working as researchers in 2016.

Expenditures by Sector

In the business sector, Slovenian R&D expenditures decreased 5.2% to €559.3 million ($651.9 million) and accounted for 69% of total funding. As a share of GDP, business R&D expenditures comprised 1.69%. R&D expenditures by higher education, however, jumped 9.7% in 2016. Higher education comprised 0.3% of total funding and made up 0.23% of the country's GDP.

In 2016, government R&D expenditures nominally declined 3.3% to €164.0 million ($191.2 million) and comprised 13% of total funding. R&D expenditure in this sector had a 0.30% share of GDP. Foreign R&D expenditure also declined 8.3% to €82.6 million ($96.3 million), while private nonprofit R&D expenditures contracted 30.3% to €46 million ($53.6 million).

Sales and Marketing Pros Share Expertise at ACP-LS Annual Meeting

IBO attended the fifth annual meeting of the Association of Commercial Professionals–Life Sciences (ACP-LS) in Boston, Massachusetts, from October 25 to 27, where collaboration was the dominant theme of the event. ACP-LS is the premier society of all life science commercial professionals dedicated to selling and marketing to organizations that discover, develop and manufacture pharmaceutical, biopharmaceutical, medical device, and

diagnostic products and therapies.

Mary Kachinsky, vice president of Strategic Sourcing at **Forma Therapeutics**, started the event on the right foot with her opening keynote, “Demystifying Procurement.” Her lively presentation showed participants how to partner with procurement teams by understanding what their goals are and the types of questions they should ask. For example, is the company in growth mode or saving mode?

Panels

The meeting featured several panel discussions and a lot of attendee interaction. A panel of two senior scientists, two early-career scientists and two procurement specialists, convened by Bill Kelly, president of **BioInformatics LLC**, answered questions about purchasing decisions and what they look for when buying from life science suppliers. The discussion centered on the recognition that as older scientists retire, they make room for newly trained scientists who bring updated skills to the lab and new approaches to problem solving and information searching. The implications of those generational differences were discussed as they relate to social media, influencer marketing–sponsored content and other forms of marketing communication.

Three commercial experts from smaller companies like **Lucigen** as well as behemoths like **Thermo Fisher Scientific** shared their experience, answering questions from their peers. Public relations pros from Thermo Fisher Scientific, **Waters** and **Spectrum Science Communications** joined an editor from *Chemical & Engineering News* magazine to discuss what is important in earned media and how it is changing with the advent of social media.

Life science companies continue to use funding and other data to guide their marketing and sales programs. Andy Bertera, executive director of Marketing at **New England Biolabs**, and Craig Dobbs, vice president of Marketing and Sales at **TriLink Biotechnologies**, joined Aaron Sorenson, Bibliometrics Engagement leader for **UberResearch,** to lay out the types of data available and how to use them to identify opportunities in the context of a case study around the first CAR-T therapy approved for childhood leukemia.

Breakouts

In the breakout sessions, sales and business development professionals learned about prospecting, account planning, the use of dashboards for better forecasting and the importance of adding value in the sales process. The presentation of David Hanna, Director, Genotyping Sales, Americas Region for **Affymetrix**, “Negotiating Deals is Neither Art nor Science: It’s a Conversation” focused on aligning the interests of buyers and sellers to create a buying process that benefits both parties and is resolved as quickly as possible, underlining the importance of collaboration.

Marketers got to see what is hot in social media from Dan Markham, the host of the wildly successful YouTube channel “What’s Inside?,” as well as experienced how virtual reality will impact life science, and discovered how content creation and better use of Google Analytics will lead to more revenue for their companies.

Helping members succeed and grow in their careers is the core of the ACP-LS mission. Sessions on “Becoming an Extraordinary Leader” and “Managing Up: How to Influence Your Boss” showed attendees the skills they need to work in every direction on the org chart. In “Managing Up”, Gwen Acton, CEO of **Vivo Group**, pointed out that aligning your goals with your boss’ doesn’t mean doing what he or she says. It means the path to a good outcome is positioning your needs as complementary.

The first Annual SAMI (Sales And Marketing in the [Life Science] Industry) Award for Mentorship was presented to Kurt Mussina, general manager**, Frenova**. Joe Dustin, principal, Mobile Health, **Medidata Solutions**, and a protégé of Mr. Messina’s said, “He helped me chart out a career path when no path was being charted for me, and gave me the mindset to consider things I wouldn’t have otherwise. A good boss cares about you, and not just what’s on a spreadsheet.”

Hamid Ghanadan, founder of **The Linus Group**, received a Special Recognition Award for his contribution to the life science industry. Mr. Ghanadan has long served the community by providing insights into strategies and procedures for marketing to scientists. Those insights and his passion have influenced many if not most of the

marketers in the industry and their careers as well.

Beyond the formal agenda, attendees valued most the opportunity to network with their peers and understand they are not alone in their challenges. The relaxed, open environment ensured that everyone walked away with new friends and new ideas.

Automated ELISA firm Quanterix Files for IPO

Washington, DC 11/9/17—Quanterix, a provider of the Simoa (SIngle MOlecule Array) automated digital ELISA technology, has filed for a US IPO. Pricing has not yet been announced. For the nine month period ending September 30, revenues grew 49.3% to $16.3 million (see Bottom Line), with 161 Simoa HD-1 Analyzer systems sold to 110 customers. Products, Service, and Collaboration and License revenues accounted for 62%, 33% and 5% of sales, respectively. Adjusted operating loss was $18.3 million. As of September 30, the company had cash and cash equivalents of $18.7 million, and the company's total accumulated deficit stood at $136.6 million. (For more on automated ELISA systems, see Market Profile).

By geography, Quanterix's sales to North America, EMEA and Asia Pacific represented 54%, 31% and 15% of sales, respectively, for the nine month period. The Simoa system, and accompanying assays, were launched in 2014. The company now offers over 80 Simoa digital biomarker assays. Homebrew assays can also run on the system.

Advantages of the Simoa system, according to the company, include higher sensitivity compared to conventional sandwich ELISA, multiplexing and the ability to detect nucleic acids. Although Quanterix's current focus in the research market, it plans to expand into the diagnostics market and has signed a development agreement with bioMérieux. The company lists its competition as Bio-Techne, Gyros, Luminex, Meso Scale Discovery, NanoString Technologies and Singulex (sold by MilliporeSigma).

Mettler-Toledo Acquisition Expands Consumables Products and Channels

Columbus, OH 11/2/17; Columbus, OH 11/2/17—Mettler-Toledo, a supplier of precision instruments and services, has acquired Biotix for $105 million, according to the company's quarterly conference call. A manufacturer and distributor of plastic consumables related to pipettes, California-based Biotix generates annual revenues of $35 million. Biotix's products include tips, tubes and reagent reserves for the life science market. The acquisition complements Mettler-Toledo's Rainin subsidiary, which sells pipettes and tips. "This acquisition is a great complement to Rainin as we will gain access to indirect distribution channels with strong secondary brands," stated Mettler-Toledo President and CEO Oliver Filliol on the call. "Our strategy is to run a dual-channel, dual-brand strategy, with Rainin focused on direct sales and service, and Biotix focused on indirect distribution channels and OEMs." The acquisition is acquisition is expected to add 1% to 2018 revenue growth.

Mettler-Toledo expects double-digit growth for the business over the next three years, according to the call, following growth of 10%–12% over the past 12 months for the standalone company. The price was 10x EBITDA. As Mr. Filliol described on the call, the dual-channel strategy has been successful for Mettler-Toledo's balance business. He also noted that Biotix's strong OEM business will benefit from the addition of Rainin's product. In addition, nearly 70% of Biotix's sales are domestic, so Mettler-Toledo will be able to expand the company's geographic sales. Biotix has manufacturing facilities in Mexico. Expected synergies include R&D and supply chain resources.

New Company Joins Tunable Diode Laser Absorption Spectroscopy Market

Helsingborg, Sweden 10/15/17 and 11/7/17; Skedsmokorset, Norway 10/26/17—Sweden-based Nederman, a supplier of environmental technology products, has acquired Norweigan firm NEO Monitors for NOK 402 million ($49 million @ NOK 8.16 = $1) in cash from Norsk Elektro Optikk. NEO supplies tunable diode laser spectrometers with an installed base of over 11,000 instruments. NEO generated 2016 revenues of NOK 108 million ($13 million), and revenues are expected to grow this year. "We see great complementary value in combining Nederman's global solutions and strong aftermarket services with the portfolio and advanced capabilities provided by NEO Monitors," commented Nederman President and CEO Sven Kristensson.

The acquisition indicates the continued growth of the TDLAS market for process monitoring, albeit with a new entrant, as major gas measurement suppliers Endress+Hauser (see Executive Briefing and ***IBO*** *6/30/12) and Environnement SA (see* ***IBO*** *10/31/16) have also made acquisitions in the space. NEO Monitors provides tunable diode laser spectrometry–based process systems for gas and dust measurement, including 36 individual gases. NEO Monitors has almost 40 employees.*

Publicly listed Nederman provides industrial filtration and recycling solutions, recording 2016 revenues of SEK 3,107.3 million ($363.0 million @ SEK 8.56 = $1). Analytical instrumentation is a new market for the company but many of its customers in industrial markets utilize process analyzers.

Endress+Hauser Adds to Spectrometry Businesses

Reinach, Switzerland 11/8/17—Endress+Hauser, a provider of measurement solutions, has purchased Germany-based Blue Ocean Nova for an undisclosed amount. Blue Ocean Nova manufactures in-line UV-Vis, NIR and MIR spectrometers for monitoring process parameters in liquids, gases and solids. The spectrometers can be directly integrated in the measurement probe. "The intelligent process sensors developed by Blue Ocean Nova will enhance our offering in the field of process analytical measurement, adding a strategic building block," commented Dr. Manfred Jagiella, managing director of Endress+Hauser Conducta GmbH+Co. Blue Ocean Nova will join Endress+Hauser's center of competence for liquid analysis. All 15 employees of Blue Ocean Nova will be retained, including management.

Blue Ocean Nova currently has 15 employees, according to a spokesperson for Endress+Hauser. Asked about product line overlap, the company told ***IBO****, "There is no overlap with Endress+Hauser's existing analytical portfolio for the process industry. But there are a lot of synergies with our technologies and products. Blue Ocean Nova's systems enhance the Group's technological portfolio, which already encompasses Raman spectroscopy, Tunable Diode Laser Absorption Spectroscopy (TDLAS) and process photometers."*

Discussing Blue Ocean Nova's product lines, the spokesperson told ***IBO****, "Blue Ocean Nova is most well known for their process spectrometer concept, which integrates the complete system including process interface in one explosion-proof sensor housing and avoids therefore external glass fibers and the use of industrial PCs during operation."*

Synthetic Biology Company Lists on Chinese Exchange

Suzhou, China 11/13/17—Gene synthesis and synthetic biology company Synbio Technologies has listed its stock on China's NEEQ (National Equities Exchange and Quotations) over-the-counter exchange. The company stated that the listing will supply it with the resources to grow, and that is the first DNA manufacturing firm listed on the NEEQ.

Synbio provides services for gene synthesis, plasmid preparation, PCR cloning, subcloning, site-directed mutagenesis and vector construction. It calls its Syno Synthesis Platform a Genotype-Phenotype-Synotype (GPS) platform for DNA manipulation and synthesis. According to China Daily, 2,240 companies have newly listed on the NEEQ so far this year. The market is designed to provide financing for small- and medium-sized firms.

Third Quarter Financial Results: Danaher, Illumina, PerkinElmer and Thermo Fisher Scientific

Life Sciences Boost Danaher Results

Danaher reported third quarter revenues of $4,528.3 million, a 9.5% increase. Operating margin remained unchanged at 16.9%, maintained by higher core sales volume, continued productivity improvement and a weakened US dollar. Overall, currency exchange rates positively affected sales by 1.0% while acquisitions added 5.5% to sales growth. As such, company sales grew 3.0% organically for the quarter.

Selected Danaher Segments Q3 2017

	Rev. ($M)	Rev. Growth	Curr.	Acq./Div.	Org. Growth
Life Sciences	$1,392.6	5.1%	1.0%	1.0%	3.1%
Environmental & Applied Solutions	$992.9	8.1%	3.0%	2.0%	3.1%

Click to enlarge

Danaher's Life Sciences segment (LS) generated $1,392.6 million in revenue, signifying a 5.1% gain. Organically, segment sales advanced 3.1%. Operating profit also experienced improvement, growing 20.6% to $246.8 million. Additionally, operating margin increased by 2.3 percentage points to 17.7% due to the continued reduction of costs.

Beckman Coulter Life Sciences (BCLS) recorded organic revenue growth in the high single digits for the quarter. The business experienced strong revenue growth due to continued expansion across all major product lines and regions. BCLS' automation revenue was boosted by continued demand for Biomek i-Series Workstations. Additionally, the business' flow cytometry sales were lifted by improved CytoFLEX sales. Strong demand in North America, China and Western Europe also bolstered sales for flow cytometry products.

Leica Microsystems' organic sales growth was led by positive growth in North America and Western Europe. The increased strength in the applied and medical end-markets also lifted segment sales. Overall, the business delivered mid-single digit organic revenue for the quarter.

Similarly, SCIEX MS organic revenues also rose mid-single digits, with especially strong growth in China and Western Europe. The segment's applied end-market sales were led by food and forensic testing, while the pharmaceutical end-market sales were driven by China's raised regulatory requirements in pharmaceutical testing.

Organic growth for Pall, however, declined due to the impacts of the recent hurricanes in Florida and Puerto Rico. Even so, Pall's microelectronics and single-use businesses presented strong growth for the quarter, along with double-digit growth in its biopharma business. For the fourth quarter, the company expects Pall's organic revenue to improve substantially as the business regains traction and moves past the hurricanes' negative impacts.

For Danaher's Environmental and Applied Solutions segment (EAS), sales grew 8.0% to $992.9 million. Currency exchange rates and acquisitions positively impacted sales by 3.0% and 2.0%, respectively. Overall, organic sales advanced 3.0% for the quarter. Operating profit for the segment fell 0.3% to $222.8 million, leaving operating margin at 22.4%. down 1.9 percentage points. EAS' margin decline came primarily from the negative impacts of recent acquisitions and investments.

Organic revenue for EAS' water quality business grew in low single digits for the quarter, supported by solid

demand in China and Western Europe. However, sales growth was held back by weakness in Latin America. Hach's organic revenue also increased by low single digits, driven by a healthy performance in its core municipal and industrial end-markets. Continued advancement in China also added to Hach's steady organic growth.

For the fourth quarter, Danaher expects its organic growth to accelerate.

Illumina Lifts Full-Year Revenue Guidance

Illumina's third quarter revenues surged 17.6% to $714.0 million, largely driven by revenue growth across both its sequencing and microarray portfolios. In particular, strong growth in sequencing consumables and instruments, along with a solid performance in microarrays, lifted the company's sales growth. Shipments to the company's clinical customers rose 35%, driven by liquid biopsy customers. Gross margin, however, fell 2.7 percentage points to 67.5%, primarily due to lower instrument margins from the NovaSeq.

Illumina Q3 FY17			
	Rev. ($M)	% Rev. Growth	% of Rev.
Consumables	$451	13.9%	63%
Instrument	$140	25.0%	20%
Other Products	$5	-16.7%	1%
Service & Other	$118	26.9%	16%

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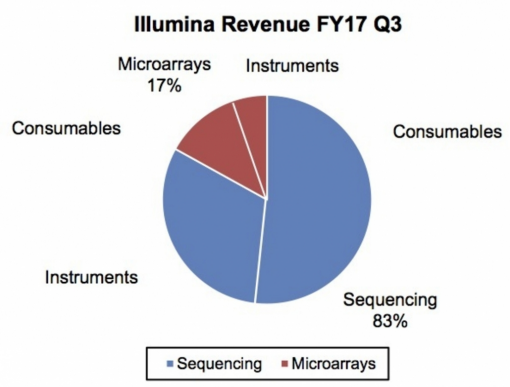
Consumables sales increased 13.9% to $451.0 million, driven by growth in the sequencing installed base. Between the two consumables type, sequencing and microarrays, sequencing consumables sales increased more, up 14.1% to $380.0 million. Sequencing consumables' strong increase came from growth in the company's installed base and NextSeq utilization. Also, HiSeq consumables provided better-than-expected revenue, as sales increased sequentially, driven by large clinical commercial customers. Microarray consumables sales also grew in double digits, increasing 12.7% to $71.0 million.



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The company reported that around 200 NovaSeq systems are in place as of the third quarter. In the third quarter alone, around 80 NovaSeq systems were delivered to customers. To the company's expectations, the majority of NovaSeq orders this quarter came from existing HiSeq customers. Also, NovaSeq shipments increased sequentially, as expected, and will continue to do so as manufacturing capacity constraints have decreased. HiSeq X sales recovered slightly, on a sequential basis, due to increased sales for translational studies and growth in China. However, both HiSeq X and HiSeq consumables are expected to decline in the coming quarters as more customers switch to NovaSeq.

Diagnostic Sales Lead PerkinElmer's Growth

Third quarter revenues for PerkinElmer increased 7.7%, 4.6% organically, to $554.3 million(see Bottom Line). In specific, the company's Discovery & Analytical Solutions segment (DAS) revenue increased $20.3 million, while its Diagnostics segment increased its revenue by $19.5 million.

PerkinElmer Q3 FY17						
	Rev. ($M)	% of Rev.	% Rev. Growth	Currency	Acq./ Div.	Org. Growth
Discovery & Analytical Solutions	$385.4	70%	5.6%	1%	0%	4.6%
Diagnostics	$168.9	30%	13.0%	1%	7%	5.0%

Click to enlarge

Sales for DAS increased 5.6% to $385.4 million, representing 70% of total company sales. Currency exchange rates positively impacted sales by 1%, while acquisitions had no impact. As such, organic sales growth for the quarter was 4.6%. DAS adjusted operating income and margin for the segment was $62.2 million and 16.1%, representing a 5.2% increase and 10 basis points decrease, respectively.

Overall segment growth was driven by strong growth in the food, pharma and biotech, and environmental end-markets. Also, new product introductions, as well as an improving macro environment, added to segment growth. The segment experienced solid sales growth due to a $15.7 million increase in its OneSource laboratory service sales, as well as a $7.9 million increase in its environmental, food and industrial market sales. However, the segment continued to post declining sales of radioactive reagents in its radio-nucleotide business.

PerkinElmer's Diagnostics segment experienced significant sales growth of 13.0% to $168.9 million for the quarter. Sales were in line with company expectations as organic revenue grew 5.0% to account for 30% of total company sales. Exchange rates and acquisitions positively impacted sales by 1% and 7%, respectively. Segment adjusted operating income for the quarter was $56.7 million, a 12.3% increase. Despite the increased operating income, adjusted operating margin fell 30 basis points to 33.5%.

The segment's sales growth for the quarter was driven primarily by continued expansion of the newborn and infectious disease screening business. Furthermore, the segment's clinical labs business also experienced strong growth, along with the Tulip business, predominantly operating in the Indian market. Overall segment growth was accelerated by the company's emerging markets diagnostic offerings, along with its applied genomics solution sales. Additionally, sales growth in the advanced genomics front-end sample prep business was especially robust in the Americas.

Geographically, all major regions sustained robust organic revenue growth for PerkinElmer, as Asia led with high single-digit growth. China led the region's increase, delivering mid-teen percentage growth. The Americas produced mid-single digit sales growth, with healthy growth across all areas. Europe had low-single digit organic sales growth, with particular strength in pharmaceuticals. Europe's industrial end-market performance started to show signs of recovery, with the food end-market still robust.

By end-market, food sales growth was very strong, advancing over 20% for the quarter. The main drivers for the food business came from Perten, along with a particularly strong performance from recently introduced products. Pharmaceutical & biotech sales were driven by a strong performance from OneSource. Environmental and industrial end-market sales both grew low-single digits, as positive growth in Asia and the Americas was offset by falling sales in Europe. In the academic end-market, sales also rose low-single digits as it began to recover from a slow start to the year.

For the fourth quarter, the company expects revenues to be $613–$618 million, signifying a 4%–5% organic growth. With its fourth quarter guidance projected, PerkinElmer expects its full-year organic revenue growth to be on track at 4%.

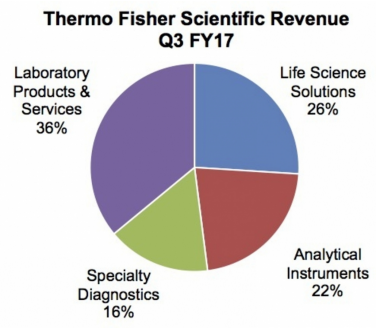
Thermo Fisher Scientific's Analytical Instruments Revenue Up Double Digits

Third quarter sales for Thermo Fisher Scientific advanced 13.9% on a reported basis to $5,116.2 million. Organic sales beat company expectations, rising 5.1% due to increased demand from all end-markets, along with strong operational execution. Currency effects positively impacted sales by 1%, while acquisitions added 8% to sales. In dollars, this translates to a $44 million bump to sales due to currency effects and a $378 million addition in sales due to acquisitions. Third quarter operating income rose 17.6% to $636.0 million while operating margin also grew, up 40 basis points.

Thermo Fisher Q3 FY17				
	Rev. ($M)	% Rev. Growth	% of Total Rev.	% Organic Growth
Life Sciences Solutions	$1,382.0	5.3%	26%	4%
Analytical Instruments	$1,189.6	32.5%	22%	11%
Specialty Diagnostics	$843.7	5.6%	16%	4%
Laboratory Products & Services	$1,933.0	15.4%	36%	3%

Click to enlarge

Thermo Fisher's Life Sciences Solutions segment (LSS) experienced an increase of 5.3% in revenue, raising sales to $1,382.0 million. Segment revenue increased $70 million, with $56 million coming from existing businesses, $9 million from positive currency effects and $5 million due from acquisitions. Organically, segment sales rose 4%, primarily driven by increased demand for biosciences, genetic sciences and bioprocess production products. LSS' third quarter adjusted operating income grew 16.8% to $453.0 million, lifting adjusted operating margin by 3.2 percentage points to 32.8%. Operational profit grew in large part due to productivity improvements, volume pull-through, and price increases.



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The Analytical Instruments segment's revenue vaulted 32.5% to $1,189.6 million largely due to acquisitions. FEI delivered double-digit sales growth in the third quarter, as the electron microscopy product line, part of the materials science business, grew alongside the segment's chromatography and MS businesses. Additionally, the segment's chemical analysis business continued to show growth, back on track with expectations. Organic revenue also increased in the double digits, up 11%, primarily driven by increased sales in the materials and structural analysis business. Adjusted operating margin grew 35.0% to $256.6 million, driven by the company's PPI Business System and acquisitions. Adjusted operating margin also grew, up 40 basis points to 21.6%.

In the Specialty Diagnostics segment, sales grew a healthy 5.6% to $843.7 million. In dollar amounts, sales increased $32 million from existing businesses, $10 million from favorable currency effects, and $4 million from acquisitions. As such, organic revenue growth increased 4%, driven by strengthened sales of immunodiagnostics products and increased sales from the health care market channel. Segment adjusted operating income grew 2.1% to $218.8 million, while adjusted operating margin decreased 90 basis points to 25.9%.

Laboratory Products & Services (LPS) segment revenue advanced 15.4% to $1,933.0 million, accounting for 36% of total company revenue. LPS sales increased a total of $259 million, for which acquisitions represent $192 million of the increased sales. Organically, however, sales only grew 3%, driven by the segment's channel business. Adjusted operating profit inched higher by 1.4% to $243.4 million. Yet adjusted operating margin fell 170 basis points to

12.6%, as a result of the weakened clinical trial business.

By end-market, pharmaceutical and biotech sales grew in the mid-single digits. Academic and government sales were also up in mid-single digits, as strong growth in China and Europe sales. In the industrial and applied end-market, sales grew in the mid-single digits due to continued strength in the Asia-Pacific. Diagnostics and healthcare sales grew by low-single digits, but flat for the year.

Geographically, the Asia Pacific region continued to produce a strong quarterly sales performance, up low-double digits, with China's sales increasing in the high teens. South Korea and India also delivered robust growth as well. European sales grew in the mid-single digits, while sales in North America grew in the low-single digits. Additionally, sales in the US have begun to recover slowly.

For the full year, Thermo Fisher raised its revenue guidance to $20.50–$20.66 billion from the previously projected $19.71–$19.89 due to the addition of Patheon (see ***IBO*** 5/15/17), a strong quarterly performance and more favorable currency effects. The new guidance reflects a 12%–13% growth in revenue.

Healthy Gains for Waters in Third Quarter

Waters delivered third quarter sales growth of 7.4%, lifting sales to $565.6 million. Currency effects positively impacted sales by 1%, while acquisitions added little to sales. Operating income increased 5.0%, primarily driven by higher sales volume and controlled spending.

Waters Q3 FY17			
	Rev. ($M)	% Rev. Growth	% of Total Rev.
Waters Div.	**$503.9**	**7.0%**	**89%**
Instrument Systems	$238.4	5.4%	42%
Chemistry	$92.9	10.4%	16%
Service	$172.6	7.5%	31%
TA	**$61.7**	**10.3%**	**11%**
Instrument Systems	$44.2	11.9%	8%
Service	$17.4	6.4%	3%

Click to enlarge

By end market, pharmaceutical sales increased 7.0% on a reported basis and 5.0% on a constant currency basis. Pharmaceutical sales were mainly driven by strength in large molecule and biomedical research applications. However, revenues were negatively affected by the declining sales in the US. Industrial end-market sales grew 6.0% on a reported basis, 5.0% in constant currency, led by strong growth in material characterization. Additionally, increasing needs for food quality and safety also helped lift industrial sales for the quarter. In the governmental and academic end-market, sales rose 15.0% on a reported basis due to increased spending by academic institutions. On a currency neutral basis, governmental and academic sales increased 13.0%.

Waters Q2 FY17			
	Rev. ($M)	% Rev. Growth	% of Total Rev.
Group Total	**$565.6**	**7.4%**	**100%**
Asia	$209.3	7.1%	37%
Americas	$203.0	-0.1%	36%
Europe	$153.2	19.5%	27%

Click to enlarge

Waters Division segment sales advanced 7.0% to $503.9 million. On a constant currency basis, sales rose 6.0%,

driven by Waters chemistry sales. Waters Division's product and services revenue grew 6.2% to $411.0 million. Instrument system revenue, which increased 5.4%, 4.0% on a constant currency basis, to $238.43 million, was primarily driven by strong sales of LC instrument systems, along with other LC MS systems. Additionally, the segment's benchtop LC tandem mass spec systems, the GVO TQXS and GVO TQX Micro, added to instrument sales growth. Recurring revenues, service sales and chemistry sales together, grew 8.0% and accounted for 50% of segment revenue. The recurring revenues' growth was driven by HPLC and UPLC application kits. Service revenue rose 7.5% due to higher sales of service plans and service demand billings. Waters Division's chemistry sales grew the most, increasing double digits, up 10.4% to $92.9 million. Chemistry consumable sales were higher due to continued demand for application-specific testing kits. Geographically, Waters sales in Asia increased 7.1%, 8.0% in constant currency, to $209.3 million due to strong pharmaceutical and industrial sales in China. However, sales in India were negatively impacted by lower customer demands. Sales in Europe leaped 19.5%, 13.0% in constant currency, to $153.2 million primarily driven by strong demand from pharmaceutical customers. Sales in the Americas were flat, with sales in the US increasing 1.0% for the quarter. Sales in the rest of the world fell 7.0%, negatively impacted in part by the recent natural disasters.

For Waters' TA segment, sales grew in double digits, increasing 10.3% to $61.7 million. On a constant currency basis, segment sales rose 9.0%, driven by the company's new Discovery line of thermal analyzers. High-temperature thermal systems also added to the segment's strong quarterly performance. TA instrument sales advanced 11.9% to $44.2 million, while TA service sales grew 6.4% to $17.4 million. Together, overall TA sales account for 11% of total company revenues. Geographically, TA sales in Asia increased 19.0%, driven by strong sales growth in China. Sales in Japan, however, fell 1.0% due to unfavorable currency effects. In the US, TA sales increased 10.0%, while in Europe, sales rose 11.0%. However, TA sales for the rest of the world fell 32.0%.

For the fourth quarter, Waters expects reported sales to increase between 5% and 8%, given the company's currency neutral guidance of 3%–5% sales growth along with a positive 2%–3% currency effect. For the full year, the company expects constant currency sales to be 5%–6%, unchanged from the previous guidance.

Automated ELISA Systems

Enzyme-Linked ImmunoSorbent Assays (ELISA) are tests that use antibodies or enzymes to detect the presence of an antigen or other substance. These tests are generally done with microplates and some level of automation, including liquid handling and robotics. Multiplex and high-throughput ELISA systems are the next generation of ELISA-based automation that takes assay efficiency to another level.

Systems can be categorized into three groups: xMAP, multiplex, and high-throughput or single-plex technologies. The xMAP platform, made popular by Luminex and its strategic partners, is a suspension bead–based technology that multiplexes up to 500 analytes per sample. The system employs color-coded beads that are coated with a reagent specific to a particular bioassay, allowing the capture and detection of specific analytes.

Non-xMAP multiplex technologies, the second category, encompass a range of proprietary techniques and formats that allow multiple-analyte detection from a single sample. These systems generally employ microfluidics or microarray-like technologies that provide higher throughput (e.g., Somalogic's SOMAscan platform) or increased sensitivity compared to the Luminex xMAP platform. Some systems, like SOMAscan, can analyze more analytes than Luminex systems.

As for high-throughput and single-plex systems, oftentimes they require significantly less sample volumes and reagent consumption, therefore lowering the cost per assay. Each analyte is typically measured in parallel through multiple channels of a microfluidic device. Single-plex systems also perform parallel analysis but normally with a lower throughput. These systems are typically designed to provide more sensitivity for a focused panel of analytes.

Almost half of the market for automated ELISA platforms belongs to hospitals and clinics, driven by the demand for clinical applications. Companies are investing in developing infectious disease and genetic ELISA-based assays, focusing primarily on oncology, respiratory ailments, diabetes and angiogenesis. Sales of multiple and high-throughput ELISAs, like Meso Scale Discovery's (MSD) systems, are growing in this diagnostics market, as they require fewer reagents and in some cases less sample than xMAP platforms.

In 2016, the total automated ELISA market was over $560 million. Luminex is the market leader, accounting for more than a third of it. The company offers an open platform, and allows its more than 55 partners to develop assays and sell its instruments. The growth of Luminex and its partners has largely been fueled in recent years by replacement of traditional ELISA assays with their faster multiplexing solutions, as well as the increasing number of new assays related to human health and disease.

MSD and Thermo Fisher Scientific are also prominent suppliers. MSD's non-xMAP multiplexing technology, called MULTI-ARRAY, is planar based. This technology offers increased dynamic range and improved sensitivity, as well as a decreased need for reagents. Thermo Fisher has over 800 ELISA kits, xMAP multiplex assays and hundreds of Invitrogen assays developed for the Luminex platform, as well as for high-throughput and single-plex systems.

Leading Vendors:

- Luminex
- Meso Scale Discovery
- Thermo Fisher Scientific

Largest Markets:

- Hospital and Clinical
- Pharmaceutical
- Academia

Instrument Cost:

- $20,000–$300,000

R&D

Although the US contributes 33% of the publications covered by the *Nature* Index and releases as many papers as China, Germany and the UK combined, the total number of US publications, as well as the country's global share and its contribution to authorship of papers, has been declining since 2012. In China, the number of publications and author contributions have been steadily increasing since 2012, when the US' global share began to decrease, making China a top contender for leading scientific paper authorship in the Index by 2027.

Virtually all 50 states have contributed to the decline in paper authorship, with waning contributions from California, Massachusetts, New York and Maryland making the biggest impact in *Nature*'s weighted fractional count Index methodology since 2012; simultaneously, however, these states have also increased their contributions by a few points. R&D expenditures as a share of US GDP has been on the decline since the 1960s and without an increase in funds, US science research will continue to falter.

Source: *Nature Index*

Clinical

The MyCode Community Health Initiative, run by Pennsylvania-based Geisinger Health System, is working to bring clinical genome sequencing results to patients as a form of preventative care for the nonprofit organization's 3.3 million patients. In 2014, Geisinger formed a partnership with Regeneron for free use of its burgeoning DNA sequencing capabilities. Over 166,000 people have enrolled to participate in the study so far, and the initiative has so far provided genomic results for 92,400 people. Approximately 85% of participants have also agreed to be part of an experimental program entitled GenomeFIRST Return of Results, which contacts participants whose DNA

sequences suggest a risk for a particular disease.

On top of accumulating sequencing data in order to prevent and treat illnesses, the Geisinger project also hopes to educate primary care physicians with little to no genetic knowledge on informing patients of genetic mutations, as well as "cascade-testing," which entails following up with relatives who may also be at risk.

Geisinger is focusing not only on the ethical and medical issues of genome sequencing, but also whether genomic testing and screening is cost effective as a preventative measure. This cost for genetic screening would likely be the responsibility of insurance companies, which are likely to only embrace the measure as long as costs stay sustainable.

A major factor affecting costs is the unpredictability of human behavior. Based on recent data, about 50% of people informed of a genetic disease mutation meet with a genetic counselor, 25% go to a primary care provider and the remaining 25% do not act immediately. For carriers who do nothing, the cost of the genetic screening is wasted, whereas carriers who overreact out of fear may end up consuming excessive health services.

Another factor is the reluctance of many patients to allow their DNA to be sequenced, due to a lack of trust of health care establishments. Geisinger researchers will work to address the issues surrounding clinical genomic screening, as well as develop a counseling system providing additional support to families in which children have been found to have genetic mutations.

Source: *Science*

Genomics

As part of a the National Cancer Moonshot Initiative (see ***IBO*** 2/15/16, 7/15/16, 10/31/16 and 12/31/16), the National Cancer Institute is funding a three-year pilot project involving sequencing precancerous growths in order to better understand how they evolve into diseases. The goal of the pilot project is to create a "pre-cancer genome atlas" by DNA sequencing from precancerous growths, as well as by RNA sequencing from individual tumor cells and examining the immune cells penetrating the lesions.
Additionally, a $5 million project funded by Stand Up to Cancer, the American Lung Association and LUNGevity was set up in late October to accelerate lung cancer research through sequencing DNA from precancerous lesions in the airway. The project will be funded over a five-year period.
Advancements in sequencing technologies have made it possible to sequence DNA from small samples, which is significant due to medical professionals usually making tiny biopsies of precancerous growths and the lack of tissue samples leftover after pathological analyses.
Source: *Nature*

Spain

Late last month, the Spanish government took control over higher education and research institutes in Catalonia. After much political turmoil, Catolonia declared its unilateral independence on October 27, and now, after dimissing the Catalan government, the government of Spain will be in charge of decisions relating to Catalonian research centers and universities. Specifically, the Madrid-based Ministry of Education, Culture and Sport will oversee Catalan universities, while the Ministry of Economy, Industry and Competitiveness will take over research policy, effective immediately.

Catalonia is a research-intensive region, with universities in the region winning 210 grants totaling €334 million ($391.8 million) from the European Research Council between 2007 and 2015. For the past 32 years, the Catalan government established and financed university budgets in the region. Out of an approximately €1 billion budget for universities and science research, universities were allocated around €700 million ($814 million) in 2017.

Source: *Nature*

Greece

In 2016, Greek R&D expenditures totaled €1,733.1 million ($2,013.5 million), a 29.3% jump. The R&D Intensity indicator, representing R&D expenditure as a percent of GDP, increased two percentage points, as R&D expenditure accounted for 0.99% of GDP in 2016.

The business enterprise sector led R&D expenditures for the first time in Greece, with €722.9 million ($839.9 million), representing 0.41% of GDP. The public education sector followed, spending €566.6 million ($658.3 million) on R&D to represent 0.32% of GDP, while R&D expenditures in the public sector amounted to €428.9 million ($498.4 million), representing 0.25% of GDP. The private nonprofit sector contributed €14.8 million ($17.2 million) to R&D expenditures, making up 0.01% of GDP.

In total, public funding represented the majority, or 43%, of total 2016 R&D activity funding in Greece, accounting for €737.1 million ($856.4 million), and was the main source of funding for the higher education and public sectors. Funding from the business sector followed closely, contributing €691 million ($802.8 million), or 40%, of total R&D. The vast majority of this figure, €633.7 million ($736.2 million) was invested in R&D by businesses, while €42.1 million ($48.9 million) went towards funding R&D activities in the higher education sector, €14 million ($16.3 million) to the public sector and €2.2 million ($2.6 million) going to private nonprofit organizations. Funding from the EU increased due to the Horizon 2020 program, providing €207.6 million ($241.2 million), or 12%, of total R&D funding in 2016.

Source: *Greek News Agenda*

India

New national reference labs are scheduled to be set up in the near future up by the Food Safety and Standards Authority of India (FSSAI). The labs will work on method development and validation, as well as complete proficiency testing and training by national or international labs that are signatories to the International Laboratory Accreditation Cooperation, the Asia Pacific Laboratory Accreditation Cooperation or an equivalent accreditation cooperation. Notices for lab certification of Food Safety and Standards regulations have been issued by the labs. No new labs are being built to be national reference labs; rather, reference labs will be identified and chosen from the leading existing labs in India.

The labs will be responsible for developing nationwide standards for routine testing procedures and reliable testing methods, and will serve as central resource institutes for procuring certified and regular reference materials. Technical support and data collation in their areas of expertise, as well as performance evaluations of other notified labs will also be provided by the new reference labs. They are also expected to collaborate with other labs in their network and perform other functions as directed by the FSSAI.
Source: *FNB News*

Broad-based Companies

Company Announcements

Half-year revenue for **Spectris' Materials Analysis** (MA) segment rose 13.6%, with a 3% increase in organic sales, to £199.5 million ($249.4 million), or 28% of company sales, and adjusted operating profit declined 2.4% to £20.5 million ($25.6 million). Acquisitions contributed 0.5% to segment growth. Organic sales declined in North America, but European sales showed a small increase and strong growth in Asia. Pharmaceutical sales were strong, as sales to the metals, minerals and mining sectors grew except in North America. Academic research sales also declined. In contrast, electronics, semiconductor and telecom sales rose. Aftermarket sales accounted for 38% of MA sales.

Eva van Pelt, a member of **Eppendorf**'s Management Board, assumed responsibility for the area of Commercial Organization, effective October 1.

In October, **Eppendorf India** announced the expansion of a training facility in Ambattur, Chennai.

In October, **Tecan** nominated Dr. Lukas Braunschweiler, CEO of **Sonova Holding**, and Dr. Daniel R. Marshak, formerly senior vice president and CSO at **PerkinElmer**, to join its Board. Rolf Classon will stand down from the Board in April 2018. Dr. Braunschweiler has been proposed to be chairman.

Mars launched in October an aflatoxin food safety initiative to crowdsource solutions for addressing aflatoxin, a foodborne toxin, using the gamers' website fold.it. The initiative builds upon a collaboration between **Thermo Fisher Scientific**, **the Partnership for Aflatoxin Control in Africa**, the **University of California, Davis**, the **University of Washington**, **Northeastern University** and **Mars**. The top website designs will be synthesized using synthetic biology techniques and materials donated by Thermo Fisher.

In November, **Thermo Fisher Scientific** established a strategic partnership with **Cellular Biomedicine Group** (CBMG) to build a joint Cell Therapy Technology Innovation and Application Center at CBMG's Shanghai Zhangjiang GMP facility. The partnership focuses on the research and development of an automated cell therapy manufacturing system.

In October, **Illumina** announced that it has raised $230 million for **Illumina Ventures**, its first fund. The fund was launched in 2016 (see ***IBO*** 5/31/16) with an initial investment of $100 million. Focused exclusively on genomics and precision medicine, the fund has invested in seven companies.

Illumina announced in October the appointment of Marc Stapley as executive vice president of Strategy and Corporate Development. He formerly served as chief administrative officer.

In November, **Illumina** announced that Gary S. Guthart, PhD, will join its Board, effective December 1, expanding the Board from 9 to 10 members. He is president and CEO of **Intuitive Surgical**, a provider of robotic solutions for minimally invasive surgery.

VWR announced in October a collaboration with **Scientist.com**, an online marketplace for research services, under which US customers can purchase custom VWR products from the website.

In October, **BioSurplus**, a provider of preowned lab equipment, announced a collaboration with **BanBio**, an equipment reseller and repair company based in Maryland.

Anton Paar announced in October that it plans to increase revenues 20% next year, resulting from 5% increase from product line acquisitions, new hires and a regionalized strategy. The company plans to open local offices in Los Angeles, California, and Houston, Texas, to manage the Western and Southern regions, respectively.

In October, **Anton Paar** opened a training laboratory at **VLB**, the Research and Teaching Institute for Brewing in Berlin, Germany. Anton Paar and VLB have worked together for years.

In October, **Waters** announced that Chairman Douglas A. Berthiaume will retire from the Board effective December 31. President and CEO Christopher J. O'Connell will replace him as chairman.

On **GE**'s third quarter conference call, the company reported Life Sciences sales grew 10%. Life Sciences orders grew 14%, led by a 17% increase in bioprocess orders.

In October, **Harvard Bioscience** named Katherine Eade, director of M&A Law and Transactions at Corning, and Thomas Loewald, president of the Extrusion and Laminations Division of **ProAmpac**, to its Board.

ZAGENO, an online platform for lab product purchases. announced in October the closing of a $8 million Series A investment led by **Capnamic Ventures**. Currently, over 250 researchers use the site.

In October, **Bio-Techne** elected Dr. Alpna Seth and Dr. Joe Keegan to its Board. Mr. Seth serves as COO of **Vir Biotechnology**. Dr. Keegan is an advisor to and director for several life science tools companies, and was most recently president and CEO of **ForteBio**. Board member Dr. Karen Holbrook will retire in December.

PerkinElmer elected Pascale Witz, MBA, MSc to its Board in October. Most recently, she served as executive vice president, Global Diabetes and Cardiovascular for **Sanofi**.

Judges Scientific named Mark Lavelle as director and COO, effective November 15. He replace David Barnbrook. Mr. Lavelle has 15-years experience with **Halma**.

In November, **Bruker** announced the merger of its Swedish subsidiaries to form **Bruker Nordic**.

In November, **HORIBA** announced several promotions, effective January 1, 2018. Masayuk Adachi was named president and COO. He assumes the position of president from Atshushi Horiba, who retains his positions as Chairman and CEO. Juichi Saito, currently executively vice president, added the position of Group COO.

On its third quarter conference call, **Teledyne Technologies** reported that Environmental sales rose 21.8% to $77.7 million, with double digit organic growth, largely due to sales of industrial air monitoring instruments, lab and life science instruments related to the acquisitions of Hanson Research (see ***IBO*** 12/15/16) and SSI (see ***IBO*** 7/15/17).

In the third quarter, **Metttler-Toledo** Lab sales rose 9% in local currencies to total 48% of sales, or $335.4 million, with strength in China. Acquisitions contributed 1% to Lab sales growth.

QIAGEN announced in November the appointment of Mark Gladwell, who replaces senior vice president, Global Operations. Most recently, he served as senior vice president, Global Operations at **Alere**. Also announced was the departure of Dr. Laura Furmanski as senior vice president of the Bioinformatics Business Area. A replacement has yet to be named.

Agilent Technologies announced the Professor Jiandong Jiang received an Agilent Thought Leader Award in support of his studies on cancer stem cells differentiation induced by natural products. He is director of the **Institute of Materia Medica**, **Chinese Academy of Medical Sciences** and **Peking Union Medical College**. He uses Agilent MS technologies, Seahorse XF technology, and MassHunter and VistaFlux software.

Product Introduction

In October, **Beekr** launched an open online marketplace for science-related products. It is free for sellers to join.

QIAGEN launched in October its Custom Solutions business, which will offer custom and OEM sample technologies, oligo and enzyme product options for PCR, qPCR and NGS product development, and a broad range of other platform technologies.

Sales/Orders of Note

In November, **QIAGEN** announced the placement of its 2,000th QIAsymphony system with molecular testing services firm **Caris Life Sciences**.

Surface Science

Company Announcements

In October, **Leica Microsystems** and Spain-based **ICFO—The Institute for Photonic Sciences** announced a three-year collaboration agreement to promote and establish ICFO as a new European Nanoscopy Imaging Reference Site for Leica. Services will be offered on the Leica TCS SP8 STED 3X STED system.

ZEISS announced in October a €300 million ($330 million) investment in an expansion of its site in Jena, Germany, which will integrate existing ZEISS sites. The site's number of employees is expected to increase from 2,000 to

2,500. Construction will begin in 2019 and is expected to be completed by the end of 2023.

In November, AFM company **Park Systems** announced the grand opening of the Park NanoScience Center at **SUNY (State University of New York) Polytechnic Institute** in Albany, New York.

In November, **ZEISS** acquired a majority stake in the **Optec**, its sales and service partners for Russian, the Ukraine, the Commonwealth of Independent States and Georgia. Optec has 300 employees.

Product Introductions

In October, **HORIBA Scientific** launched the HORIBA CLUE Series of detectors for SEM, consisting of the: i-CLUE fast cathode-luminescence imaging system; the F-CLUE imaging and hyperspectral CL solution; the H-CLUE imaging and hyperspectral CL solution and the R-CLUE, which combines the cathodoluminescence, Raman spectroscopy and photoluminescence with one fiber-coupled solution.

Bruker introduced in October the *NanoMechanicsLab*, a suite of force-mapping modes that enables its Dimension FastScan and Icon AFM systems to performance quantitative nanoscale characterization, extending from soft hydrogels and polymers to stiff metals and ceramics. Modes include the ForceVolume, new PeakForce QNM, FASTForce Volume and FASTForce Volume Contact Resonance modes.

In October, **Oxford Instruments** released the Photovoltaic Option for its MFP-3D Infinity AFM. The PV Option provides researchers a turnkey solution for a wide range of sample heights and illumination sources.

ZEISS debuted in November the new generation of EVO SEMs. It features various vacuum modes and detector technologies. The ZEISS SmartSEM Touch is a simplified user interface developed for the occasional operator with limited SEM knowledge. It can be configured to be part of a semi-automated multimodal workflow.

Anton Paar released in November the Tosca analysis software, based on **Digital Surf**'s Mountains surface analysis technology, for its Tosca 400 AFM. It features real-time 3D multichannel imaging with overlays.

Sales

In October, **Hitachi High-Technologies** announced the sale of more than five thousand Critical Dimension–SEMs. The system was launched in 1984.

Life Science instruments

Instrumentation for Gene-based Analysis

Company Announcements

In September, **Tetracore** announced that its T-COR 8 portable real-time PCR thermocycler has achieved CE-IVD status.

Product Introduction

In September, **Bionano Genomics** released updated algorithms, analysis tools and visualization software for the Saphyr genome mapping system. This release focuses on mapping the order and orientation of the genome by improving the ability to identify inversions of 30 kbp up to megabases in size. In addition, the algorithms now identify tandem duplications.

Thermo Fisher Scientific and **Wellcome Trust Sanger Institute** introduced in October the Applied Biosystems Axiom African Array for medical and population genomics. The array provides capture of genome-wide variation in African populations, as well as Asian and European populations. It contains 925,000 variants.

In October, **NanoString Technologies** announced a research agreement with the **NSABP Foundation** to jointly characterize the immunophenotypes of colorectal cancer samples using its PanCancer IO 360 Gene Expression Panel and nCounter Analysis System.

In November, **GNA Biosolutions** launched the Pharos V8 platform, based on Lacer PCR technology. The technology uses nanomaterials to control temperature cycles at the nano scale, accelerating reaction times.

Sales/Orders of Note

In October, **PrimusLabs** announced plans to transition to **Hygiena**'s PCR-based BAX System for microbiological testing at all its labs in the US and Mexico.

Bionano Genomics announced in October that **Beijing Grandomics** will use its Saphyr System to develop novel assays for genetic diseases in China, including tests for facioscapulohumeral muscular dystrophy.

Instrumentation for Cell-based Analysis

Company Announcements

In September, **Sphere Fluidics**, a provider of single-cell analysis technology, announced a distribution agreement with **I&L Biosystems** for Germany, Austria and the Netherlands.

Cytonome/ST announced in October an exclusive sales partnership with **Inabata & Co.** for Japan for is GigaSort cell sorter technology.

In October, **Fluidigm** entered into a distribution agreement to offer the **University of Zurich**'s CAT software for multiparameter tissue analysis. The agreement provides the rights to distribute the software in conjunction with the Fluidigm Hyperion Imaging System.

In November, **Fluicell** entered into a license agreement with **Cellectricon** granting it exclusive rights to sell Cellectricon's Dynaflow Resolve technology, designed for secondary ion channel screening.

MR Solutions announced in October a restructuring. The company, consisting of **MRR Systems**, which supplies spectrometers and OEM assembly, and **MR Solutions**, which develops and supplies preclinical imaging system, has created a new division. The new **MRS Magnetics** division will supply cryogen-free and dry magnet technology for MR Solutions, which will also continue to use its existing magnet suppliers. In addition, Nicky Doughty was named CEO of MR Solutions.

In November, **Fluxion Biosciences** appointed **Harvard Bioscience** as a distributor for North America for its Ion Flux and BioFlux systems.

Product Introductions

In October, **Fluidigm** launched the CyTOF technology–based Hyperion Imaging System for highly multiplexed protein detection in tissues. The system enables the simultaneous imaging of 4–37 protein markers with minimal background, and has the ability to utilize up to 135 channels to detect additional parameters. It is offered as a complete workflow solution, which includes the Maxpar imaging antibody portfolio.

TTP and **Sphere Fluidics** introduced in October the Cyto-Mine Single Cell Analysis System, calling it "the first integrated device to automatically perform all of the techniques routinely used in the biopharmaceutical discovery and development workflow." It can deliver up to 10 million tests per day using Sphere Fluidics' picodroplet

technology to encapsulate a single cell in growth media and trap secreted molecules from the cell as it grows.

In November, **Molecular Devices** released pCLAMP Software Suite 11 for patch clamp electrophysiology. New features include the Clampfit Advanced Analysis Module to improved automated event detection and batch analysis of data.

Sales/Orders of Note

In October, **IsoPlexis**, the developer of the IsoLight single-cell, secreted protein analysis system, received a $1.8 million grant from the **National Cancer Institute's Small Business Innovation Research Development Center**. The grant will be used to develop an automated assay platform and informatics suit that can be used in larger clinical trials to test CAR-T patient product potency and toxicity, pre-infusion.

In November, **Phasefocus** announced that the **Translational Research Institute** became the first center in Australia and the Asia Pacific region to adopt its Livecyte Cell Imaging and Analysis system.

Instrumentation for Protein-based Analysis

Company Announcements

Intabio announced in September the receipt of $2 million in seed financing in a round led by Jenny Rooke, PhD, managing director at **5 Prime Ventures**. Intabio is developing the Blaze system for detection and indentification of subtle protein modifications. The system is designed for use prior to MS detection.

CERTUS announced in October that it will distribute **Solus Scientific**'s Solus Pathogen Testing System, an automated ELISA system, in the US.

In October, **Gyros Protein Technologies** signed an agreement to distribute **Euro Diagnostics**' *iLite* assay-ready cell lines in Europe and North America.

Product Introductions

In October, **Unchained Labs** launched Hunky, which measures ΔG to quantify biologic stability and predict aggregation.

Molecular Spectroscopy

Company Announcements

In October, UK-based **Photonic Solutions**, a supplier of laser and photonics systems, announced an employee-backed buyout with the support of **Panoramic Growth Equity**.

NevadaNano, the developer of Molecular Property Spectrometer gas sensing solutions, announced in October the closing of an $18 million Series B Funding led by Chairman Ray Stata. NevadaNano had raised $1.5 million in Series A financing.

In November, **TOPTICA Photonics** announced the opening a new US headquarters and manufacturing facility in Farmington, New York.

Princeton Instruments announced in November a distribution agreement with **Quantum Design UK and Ireland** (formerly **LOT UK**) for its FERGIE line of imaging spectrographs.

Product Introductions

X-Rite, a **Danaher** company, released in August the MetaVue non-contact imaging spectrophotometer for retail paint matching. It features live video preview.

In September, **X-Rite** debuted the MA-T12 multi-angle spectrophotometer, a 12-angle device, and the MA-T6, a 6-angle device, calling them "the first instruments to combine color imaging and multi-angle spectral measurement to quantify color, sparkle and coarseness."

In September, **CRAIC Technologies** introduced the GeoImage Vitrinite Reflectance Measurement System, which is designed to determine the thermal maturity of coal and coke. Features include the acquisition of high-color images of the reflectance and fluorescence of coal samples.

CRAIC Technologies released in November UV laser sources for use with its 20/30 PV^{T} microspectrometer. The major application is to serve as an excitation source for fluorescence and photoluminescence microspectroscopy. This adds to the company's product line of Vis and NIR lasers.

Spectro Scientific launched in September Microlab software 11.0 and new MicroLab Companion Kits for on-site oil analysis. Version 11 features new signal processing methods.

In October, **Bruker** unveiled the new ALPHA ll compact FT-IR spectrometers, featuring a new optical touch panel OC and OPUS-TOUCH touchscreen software.

Shimadzu introduced in September the compact IRSpirit Series of FT-IR spectrophotometers, consisting of the IRSpirit-T and IRSpirit-L systems. The company calls them "the smallest (installation footprint) and lightest FT-IR spectrophotometers in the world that can be used with optional products from other manufacturers." Features include the IR Pilot Program of 23 application-specific workflow without a complicated parameter setup process.

In October, **Ocean Optics** released the Ocean FX miniature spectrometer, featuring acquisition speeds of up to 4,500 scans per second and integration times as low as 10 µs.

Metrohm introduced in October turnkey NIR solutions for testing the quality of commodities such as diesel gas, jet fuel, polyols, palm oil and wood pulp.

Edinburgh Instruments debuted in November a stopped flow accessory for its FLS1000 Fluorescence Spectrometer, which enables reaction kinetics to be recorded with microsecond time resolution.

In November, **Hitachi High-Technologies** announced that three peripheral systems of its UH4150 UV-Vis-NIR spectrophotometer are now available as standalone systems: the automatic variable-angle absolute reflectance measurement system, the automatic polarization measurement system and the 5 Degrees reflectance/transmittance measurement system with automatic X-Y stage. The systems can now be purchased individually.

Princeton Instruments announced in November the introduction, with **McPherson**, of a new add-in for its 64-bit Lightfield Software for control of McPherson's deep UV and soft x-ray spectrometers, and Princeton Instruments' software x-ray cameras.

In November, **Parker Kittiwake** launched its new IB-based Attenuated Total Reflection analyzer for the simultaneous testing of base number, total acid number, insoluble, soot loading, viscosity, FAME and water content of oil samples on a ship.

In November, **Thermo Fisher Scientific** announced the addition of 45 new substances, including 14 new forms of fentanyl, to its library of substances detected by the Thermo Scientific TruNarc handheld narcotics analyzer.

Sales/Orders of Note

In October, **Bruker** announced that Israel's **Weizmann Institute Department of Chemical Research** had

completed its installation of a Biospec 15.2 Test USR preclinical high-field MRI system. The lab's instruments include the Bruker BioSpec 4.7 Tesla MRI and the Bruker 400WB (wide-bore) spectrometer.

AMRI, a contract solid state and analytical testing service, installed in October the Cobalt Light Systems TRS100 Transmission Raman Spectrometer.

Reported Financial Results

$ in Millions USD	Period	Ended	Sales	Chg.	Op. Prof.	Chg.	Net Prof.	Chg.
AMETEK	Q3	30-Sep	$1,084.8	14.8%	$232.8	15.8%	$153.5	17.5%
AMETEK (Electronic Instruments)	Q3	30-Sep	$671.6	15.9%	$164.4	15.2%	NA	NA
Bio-Rad Laboratories	Q3	30-Sep	$535.0	5.2%	$46.4	65.1%	$27.4	NA
Bio-Rad Laboratories (Life Sciences)	Q3	30-Sep	$193.6	8.7%	$7.8	NM	NA	NA
Bruker	Q3	30-Sep	$435.6	10.6%	$49.9	8.7%	$37.0	-20.4%
Bruker (Scientific Instruments)	Q3	30-Sep	$390.6	8.0%	$43.1	-0.5%	NA	NA
Fluidigm	Q3	30-Sep	$24.7	11.5%	($15.6)	15.6%	($15.9)	19.4%
Mettler-Toledo	Q3	30-Sep	$698.8	7.4%	$139.6	4.7%	$105.0	3.6%
NanoString Technologies	Q3	30-Sep	$27.0	12.9%	($10.0)	-18.6%	($11.4)	-13.0%
Pacific Biosciences	Q3	30-Sep	$20.3	12.7%	($21.6)	-28.9%	($22.0)	-25.9%
PerkinElmer	Q3	30-Sep	$554.3	7.7%	$79.8	5.3%	$91.1	56.7%
PerkinElmer (Discovery & Analytical Solutions)	Q3	30-Sep	$385.4	5.6%	$47.6	3.4%	NA	NA
PerkinElmer (Diagnostics)	Q3	30-Sep	$168.9	13.0%	$44.1	5.9%	NA	NA
QIAGEN	Q3	30-Sep	$364.0	7.5%	$63.9	32.3%	$48.5	39.4%
Quanterix	9 Mo.	30-Sep	$16.3	49.3%	($18.9)	-26.9%	($19.6)	-23.8%
Quanterix	FYE	31-Dec	$17.6	44.4%	($21.7)	-49.5%	($23.2)	-45.3%
Teledyne (Instrumentation)	Q3	30-Sep	$662.2	25.7%	$92.9	35.0%	$69.0	32.7%
Other Currencies (in Millions)								
Biotage	Q3	30-Sep	SEK 177.7	6.4%	SEK 29.3	7.7%	SEK 31.1	12.3%
GL Sciences	Q2	30-Sep	¥10,818.0	15.8%	¥1,083.0	58.6%	¥773.0	80.2%
HORIBA	Q3	30-Sep	¥44,961.0	21.8%	¥4,911.0	70.5%	¥4,326.0	37.2%
HORIBA (Process & Environmental)	Q3	30-Sep	¥3,955.0	-1.4%	¥101.0	-60.4%	NA	NA
HORIBA (Scientific)	Q3	30-Sep	¥6,260.0	8.5%	-¥52.0	70.8%	NA	NA
JEOL	Q2	30-Sep	¥40,699.0	-8.4%	¥1,311.0	51.9%	¥731.0	-71.5%
JEOL (Scientific & Measurement Instruments)	Q2	30-Sep	¥26,831.0	-7.7%	-¥1,549.0	-58.1%	NA	NA
Merck KGaA (Life Science)	Q3	30-Sep	€3,727.0	0.1%	€901.0	33.3%	€645.0	41.1%
Oxford Instruments	H1	30-Sep	¥132.1	-0.2%	¥12.6	35.5%	¥55.6	NM
Prescision System Science	Q1	30-Sep	¥806.0	3.2%	-¥132.0	22.8%	-¥131.0	26.8%
Shimadzu	Q2	30-Sep	¥96,263.0	13.2%	¥11,864.0	10.5%	¥8,917.0	23.0%
Shimadzu (Analytical & Measuring Instruments)	Q2	30-Sep	¥57,923.0	13.0%	¥9,621.0	4.1%	NA	NA

NA = not available, NM = not meaningful
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