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Instrument Business Outlook

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Articles

Companies Implement Internet of Things to Boost Lab Productivity

Two-Thirds of Survey Respondents Plan to Invest in Single-use Bioreactors

New Funding Announcements

Executive Briefing

Techcomp Completes Split into Two Companies

Thermo Fisher Scientific Scoops up BD Business

CRISPR Firm Adds Operational Expertise with Acquisition

CalibreScientific Completes Latest Acquisition

Certara Buys Pharmacometric Modeling Technology

Financial

Second Quarter Results: Bio-Rad Laboratories, Bio-Techne, Hitachi High-Technologies, QIAGEN, Spectris, Tecan

Market Profile

Nanoindentation & Nanotribology

Industry Watch

R&D

Government

Biotechnology

Region Watch

Africa

China

Israel

News Items

Broad-based Companies

Informatics

Surface Science

Materials Characterization

Bottom Line

Reported Financial Results

Companies Implement Internet of Things to Boost Lab Productivity

As more labs move towards finding new methods for increasing efficiency and streamlining workflows, the internet of things (IoT) is proving to have much potential. For the lab, the IoT refers to a network of laboratory devices, such as lab equipment and products, sensors and instruments, that are digitally connected. The information generated from this virtual network generally measures and reports experimental data, which can then be used to further

optimize lab operations and routines.

Companies such as Eppendorf and Thermo Fisher Scientific are amongst the instrument and lab product vendors to embrace IoT, demonstrating their investments in the technology through their respective products: the VisioNize platform, which enables users to link lab equipment to central monitoring and data management software, and the E1-ClipTip (E1-CT) electronic pipette and its complementary web-based pipetting app, My Pipette Creator. Eppendorf and Thermo Fisher are working to accelerate lab productivity by staying focused on the future by providing customers with a central data storage server, intuitive user interfaces and intelligent digital connectivity for their lab devices

As Dr. Tanja Musiol, global marketing manager, Specialty Lab Products, at Eppendorf explained, the adoption of digital solutions, such as device connectivity, in the lab is more determined by a lab's interest in streamlining workflows and operations rather than factors such as lab size or industry segment. "Like in the consumer business, so called 'early adopters' are showing the highest interest to change from paper work and manual steps to digital documentation, monitoring and data management," she said. "Most probably, laboratories across all market segments with a focus to optimize their processes and workflows, and to improve productivity will be such early adopters [of VisioNize]. This is comparable with trends we see for digital documentation, monitoring and data management in general."

Thermo Fisher reports a similar experience, with the flexibility of the E1-CT electronic pipettes and My Pipette Creator platforms appealing to a vast range of applications. "What's really exciting and encouraging for us is that so far the E1-CT and My Pipette Creator connected pipetting solution appears to appeal to a wide variety of customer types, industries and applications," said Tommy Bui, business development manager, Liquid Transfer, at Thermo Fisher. As Mr. Bui indicated, this wide adoption is likely due to the fact that the IoT platforms address issues that exist for any workflow that involves manual pipetting. "For example, some of our customers see the value in being able to quickly develop custom protocols," he explained. "On the other hand, other customers value the ability to standardize processes and distribute protocols across the team."

Digitizing Workflows

Dr. Musiol draws a comparison of adoption patterns between IoT and the emergence of the internet over 20 years ago. "The adoption of solutions like VisioNize is similar to the adoption of the internet in the 90s—customers are convinced that this is the future," she said. The concerns about privacy and security that arise as the internet became a tool of daily use around the globe are also similar to concerns about IoT in the lab, which may affect the adoption rate as well. "Discussions and concerns about topics like data security, protection of data privacy and cyber-crime will strongly influence the adoption rate,"continued Dr. Musiol. "Adoption of digital solutions, connectivity and IoT in the lab will be highly dependent of the availability and level of support and additional technical solutions to eliminate these concerns."

> ***"Having a better understanding of our customers' usage patterns will help us identify areas where we can improve and opportunities to address unmet needs."***

As Mr. Bui explained, the novelty and fundamental changes in workflow that the E1-CT and My Pipette Creator bring about created a learning curve. "We were prepared for a period of market education and missionary selling," he said. "Thus far this year, our adoption numbers have already doubled from where we were at the end of 2017. Even so, we believe there is more opportunity for us to continue to educate the market and effectively communicate the unique benefits of our connected pipetting solution."

Digitization provides a great deal of data that can be useful by many parties, which may raise warranted confidentiality concerns. Because of this, companies such as Thermo Fisher and Eppendorf are careful not to encroach on their customers' data in order to protect privacy and security. "Thermo Fisher Scientific does not have access to our customers' data that is generated using the Thermo Fisher Connected platform," said Mr. Bui. "We take data integrity and security very seriously, and have gone to great lengths to ensure that." Eppendorf has a similar philosophy. "Eppendorf is very aware of our customer's data confidentiality requirements and the protection of customer data," stated Dr. Musiol. "If a customer agrees to share data with us, we will then be able to increase

customer satisfaction by using this additional insight to improve our products and service offerings."

However, customer usage data, which does not contain the actual experimental results that users are working with and instead indicates the patterns and behaviors regarding how customers use the actual IoT platform, can provide a great deal of insight to companies, such as how to improve the platform and technical issues. "From the standpoint of customer population usage data, we believe we can utilize [this data] to ultimately benefit our customers," Mr. Bui explained. "Connected instruments and devices give us better real-time insight on what features are more popular and which ones don't get adopted. Having a better understanding of our customers' usage patterns will help us identify areas where we can improve and opportunities to address unmet needs with innovative products and services."

Prioritizing Customer Needs

Lab equipment is vital to lab workflows, and companies such as Thermo Fisher have zeroed in on what could be changed in order to optimize and streamline the processes in which lab equipment is frequently used. "Pipettes have been used for a long time in virtually every lab across a wide variety of applications so we have plenty of insights from our customers," stated Mr. Bui. "Combined with the fact that pipetting is a very manual process, we felt that we could leverage the unique capabilities of Thermo Fisher to introduce a truly unique, yet compelling, solution that would bring more efficiency and accuracy to not only pipetting, but entire applications and workflows."

> ***"In their private lives, people use advanced technology and global connectivity at its best, whereas lab data processing has hardly advanced over the last years."***

Analyzing where improvements can be made is a key factor in R&D for a new technology. Mr. Bui addressed this by stating, "[Thermo Fisher's] number one criteria to develop any new product is if we believe there is an unmet need that we can address, which will greatly benefit our customers." The case is similar with Eppendorf, which is able to draw on the feedback from its many lab products to ascertain what improvements and changes will benefit customers. According to Dr. Musiol, Eppendorf instruments and products serve as the "backbone" of routine work done in labs, as the company's products are used in virtually all workflow steps, from sample preparation to processing and analysis. Because of this, Dr. Musiol explained, Eppendorf has a solid understanding of how many devices and instruments are actually used. "This deep insight paves the way to map use cases exactly to our customers' needs," she continued. "IoT, connected devices and digital lab management will help to improve lab efficiency in the future."

Of course, introducing a new technology designed to fundamentally change the way labs operate and conduct workflows will not come without its hurdles. "The biggest challenge for us is customer education and awareness," explained Mr. Bui. "This is compounded by the fact that not only do we have to try and explain what our E1-CT and Creator connected pipetting solution does, but oftentimes we have to also explain how the underlying connectivity technology works." Thermo Fisher had anticipated the need for customer education, so the company employed various methods to address concerns and teach customers, in order to ease the transition to the streamlining technology. "Additionally, we sometimes have to interact with customer's IT staff to make them feel comfortable from a data security point of view," he continued. "Since IoT within the lab is still a relatively new concept, not all companies have a fully developed IT strategy for integration of IoT products and services within their own corporate networks."

This need for customer education and the unpreparedness for IoT of lab IT departments may be due to the break between how workflows tend to be executed and the accessibility of digital data technologies, as the life sciences industry is considered far behind when it comes to adopting current digital trends. "The biggest stumbling block continues to be the gap between the actual ways for lab workflow organization and the availability of state-of-the-art data processing technologies," Dr. Musiol stated. "In their private lives, people use advanced technology and global connectivity at its best, whereas lab data processing has hardly advanced over the last years. In addition, current lab IT Infrastructure often does not meet and support the requirements of modern data and device communication."

While there may be a learning curve for researchers to become accustomed to IoT in the lab, digitization is the future when it comes to optimizing lab routines. "Step by step, platforms such as VisioNize will be established in the

lab to simplify and standardize the daily lab routine and to organize equipment, samples and data," said Dr. Musiol. "This will enable faster and easier scientific collaboration and strongly increased productivity in the laboratories of the future."

Two-Thirds of Survey Respondents Plan to Invest in Single-use Bioreactors

According to survey responses exclusive to ***IBO***, use of single-use bioreactors is growing due to increased bioprocessing activity. Bioprocessing is rapidly expanding as the global demand for biomolecule-based therapeutics increases. Bioprocessing is a unique production method that utilizes living cells to produce biomolecules of interest. Cells are grown in bioreactors, which are vessels that are integrated with complex control and monitoring systems to create an environment that supports cellular growth. This unique production method, coupled with the stringent manufacturing requirements for pharmaceutical products, makes contamination a key concern in bioprocessing. Single-use bioprocessing equipment mitigates contamination risk, as the components that contact cell cultures arrive sterile and are discarded after each use.

Single-use bioreactors are equipped with a sterile disposable bag, pouch or rigid plastic vessel in which cells are grown. They offer several advantages over conventional, reusable bioreactor systems in terms of reducing contamination risk, faster turnover between cell batches, fewer maintenance and cleaning requirements, and overall reduction of labor time.

However, single-use models have certain limitations compared to their conventional counterparts, such as

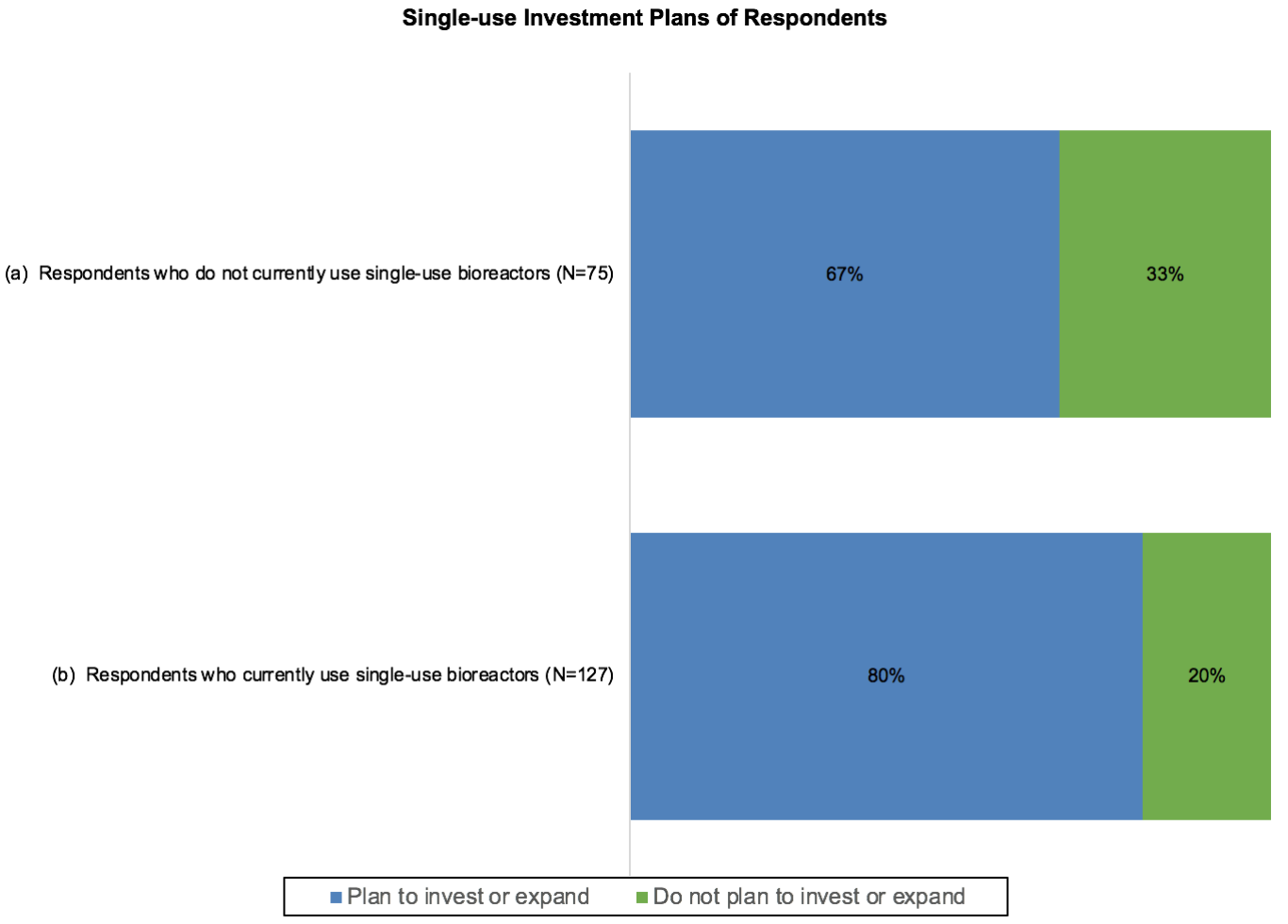
difficulties in scale-up and scale-down, non-customizability, lower rates of oxygen transfer, challenges with efficient mixing and agitation, and disposal issues. While conventional bioreactors can be customized for volumes of 100,000 L or more, single-use bioreactors are generally only available in volumes up to 2,000 L. Despite these trade-offs, many bioprocess users are converting to single-use bioreactors.

Two hundred and twelve users of bioreactors were surveyed in July as part of an SDi report on bioprocessing technologies. This report includes detailed market data, analysis and end-user perspectives for key upstream and downstream bioprocess instruments and consumables.

Respondents Plan New and Additional System Purchases

To gauge expected purchases, respondents were asked about their plans regarding single-use bioreactors within the next two years. Those who do not currently use single-use systems were asked whether they plan to invest in adopting the technology, while respondents who already utilize single-use bioreactors were asked whether they plan to expand their use.

Of the respondents who were not current users of single-use bioreactors, over two-thirds indicated that they were planning on investing in these systems. These investments in single-use bioreactors may represent either the replacement of conventional systems, or expansion of capacity for use in addition to existing conventional systems. Respondents who already utilize single-use bioreactors were very likely to purchase additional systems, as 80% reported that they expect to expand their use of single-use bioreactors in the next two years.



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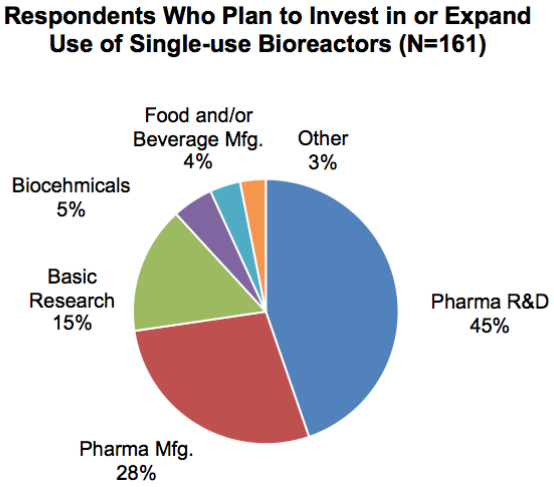
High Demand for Basic Research

Respondents who expect to purchase single-use bioreactors in the next two years were predominantly from the pharmaceutical field. Nearly half participated in pharmaceutical R&D, while over a quarter were involved in the manufacturing side. The pharmaceutical and biotechnology sector is the largest consumer of bioprocessing technologies in general, but demand for single-use technologies is particularly strong given the stringent purity required of therapeutic products.

Basic research was identified as a primary function mainly by respondents from the public sector, though some pharma and biotech, and agriculture and food sector respondents also selected this as their organization's primary function. Participants in basic research accounted for 15% of respondents who indicated that they expected to purchase single-use bioreactors in the next two years.



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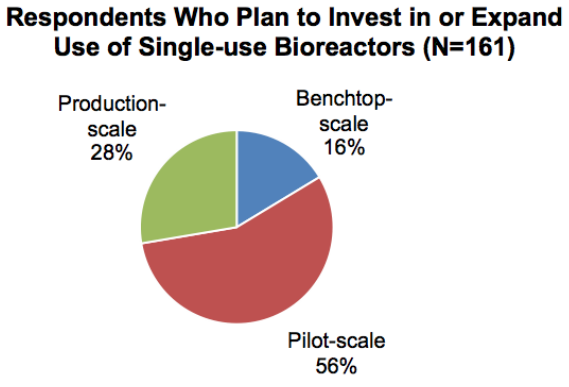
Pilot-scale Bioreactors Most in Demand

Bioreactors can be broadly categorized into three capacity ranges: benchtop scale, pilot scale and production scale. While there is much variation in how suppliers and users define these scales, for the purposes of the bioprocessing technologies report, SDi has defined benchtop-scale as up to 10 L, pilot-scale is 10–100 L and production-scale as greater than 100 L. Pilot-scale single-use bioreactors are the most common capacity range used by respondents. More than half of respondents who expect to make single-use bioreactor system purchases in the next two years use this size range. Pilot-scale bioreactors are suitable for both R&D and smaller-scale production.

Single-use bioreactors are quickly gaining market share in all regions. Demand for single use is expected to exceed that of conventional bioreactors by 2022. Biologics-based therapeutics represent a growing portion of pharmaceutical R&D pipelines, as these products increasingly gain regulatory acceptance and consumer demand grows.



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New Funding Announcements

EU Announces New Research Infrastructure Selections

Amount: €14.4 billion ($16.7 billion = €0.86 = $1)

Recipient: European organizations

Funder: EU

Date Announced: September

The European Strategy Forum on Research Infrastructures (ESFRI) has unveiled its 2018 Roadmap Update. The ESFRI develops policy and strategy for the EU Research Infrastructure (RI). Its Roadmap is used by EU countries to plan for national and EU-wide research infrastructure projects, which are facilities open to all scientists in Europe.

Among the six new facilities announced in the latest Roadmap are three addressing food, environmental and energy research. Addressing the fields of health and food are the Industrial Biotechnology Innovation and Synthetic Biology Accelerator (EU-IBISBA) for advancing industrial biotechnology and METROFOOD-RI for applying metrology to food and nutrition, including food safety.

Serving environmental needs, the Integrated European Long-Term Ecosystem, Critical Zone & Socio-Ecological Research Infrastructure (eLTER) studies ecosystem functions and structure. In the field of energy research, the International Fusion Materials Irradiation Facility-DEMO Oriented NEutron Source (IFMIF-DONES) will study and test materials for use in a fusion reactor.

The new Roadmap envisions €2.9 billion ($3.4 billion) over several years for 18 “ESFRI Projects” and “27 ESFRI Landmarks” (established RIs requiring ongoing support), worth a total of €14.4 billion ($16.7 billion).

Drug Discovery Projects Get an Extra $1 Billion

Amount: $1 billion

Recipients and Funders: Abbvie ($500 million) and Calico ($500 million)

Date Announced: June

Drug company Abbvie and Calico, a Google/Alphabet company addressing health and wellness, including drug discovery and disease treatments, have extended their collaboration by three years, pledging an additional one billion dollars to their joint work on age-related diseases. After 2022, Calico will advance the projects for 3 additional years, including the Phase IIa stage.

University of Colorado Anschutz Medical Campus Receives Record Donation

Amount: $120 million

Recipient: University of Colorado Anschutz Medical Campus

Funder: The Anschutz Foundation

Date Announced: August

The gift will fund new faculty, research, technology transfer and the 390,000 ft^2 (36,232 m^2) Anschutz Health Sciences Building. Future resident programs of the Building include the Colorado Center for Personalized Medicine and the Colorado Clinical and Translational Sciences Institute. The University's focus on faculty recruitment will include the fields of personalized medicine and immunotherapy.

Foxconn Funds Interdisciplinary Research

Amount: $100 million

Recipient: University of Wisconsin—Madison

Funder: Foxconn Technology

Date Announced: August

The electronics giant's donation will be matched by the University, and will create the Foxconn Institute for Research in Science and Technology. Part of the money is designated for the construction of a new building for the College of Engineering. Research conducted at the Institute will cover fields such as AI, semiconductors, computer science and health, including human genomics and immune cells. Foxconn will collaborate closely with the Institute.

$100 Million for Hospital Research Network

Amount: $100 million

Recipient: Rutgers University

Funder: RWJ Barnaas Health

Date Announced: July

In total, healthcare systems company RWJ Barnaas has committed to a 20-year investment of more than $1 billion. The public-private partnership will create an academic health system for patient care, physician education and training, and clinical research, including a new medical group. Specific plans are the addition to Rutgers of 100 new principal investigators over a 10-year period, hiring of world-renowned faculty and a new building for the Rutgers Cancer Institute of New Jersey. Six centers and institutes currently make up the Rutgers Biomedical and Health Science enterprise. According to northjersey.com, fields of investment will include cancer and cardiology.

Techcomp Completes Split into Two Companies

Hong Kong and Singapore 9/11/18; Hong Kong and Singapore 9/12/18—Publicly held scientific instrument supplier Techcomp has completed the separation of its manufacturing and distribution businesses (see ***IBO*** 4/30/18). The original company is now solely focused on the distribution business of scientific instruments in China. In conjunction with the sale, Techcomp announced the resignation of Yat Keung Lo as chairman and CEO, and the appointment of Mr. Zhang Jincan to succeed him. Mr. Zhang is assistant president of Yunnan Provincial Energy Investment Group and chairman of Yunnan Energy Investment. The company plans to change its name.

The separated business consists of Techcomp's former manufacturing business and is controlled by Mr. Lo. The business' brands include Techcomp, Dynamica, Edinburgh Instruments, Frioilabo, Precisa and Scion. In 2017, this business generated sales of $81.6 million, an 11.9% increase, and a net loss before taxation of $3.6 million, down from $13.2 million. This company will not be publicly listed.

Although the original company is currently listed on both the Hong Kong and Singapore stock exchanges, the company plans to list only on the Singapore exchange in the future. The stock has currently suspended trading while the company applies for a temporary waiver for Hong Kong exchange requirements, as only 5% of its common shares are currently held by public shareholders. The company plans to list more shares.

The original company operates 14 offices in China, with more than 300 employees. In 2017, this business generated approximately $144 million in sales, approximately 73% of the formerly combined manufacturing and distribution annual revenues.

Thermo Fisher Scientific Scoops up BD Business

Waltham, MA 9/6/18; Franklin Lakes, NJ 9/7/18—Thermo Fisher Scientific has agreed to acquire Becton, Dickinson's (BD) Advanced Bioprocessing business for an undisclosed amount. With revenues of $100 million, the business provides technical services and a variety of peptones for cell culture-media formulation. The Advanced Bioprocessing business will join Thermo Fisher's Life Sciences Solutions Segment.

"The addition of these new capabilities will complement our bioproduction offering and strengthen our ability to serve this rapidly growing market, from development to large-scale production," commented Mark Stevenson, executive vice president and COO of Thermo Fisher. "BD remains committed to our customers in the clinical, life sciences and industrial segments, and will continue to sell all of our media product offerings to these important partners," stated Patrick Kaltenbach, president of Life Sciences for BD. The transaction is expected to close in early 2019. The Advanced Bioprocess business is anticipated to contribute $0.13–$0.15 to BD's fiscal 2018 EPS.

The Advanced Processing business provides cell culture supplements, peptones (which optimize media performance) and media. Its brands include BD Recharge, BD Resurge, BD Select and BD Cell. The acquisition adds to Thermo Fisher's existing product lines, enhancing its offering for biologics manufacturing.

CRISPR Firm Adds Operational Expertise with Acquisition

Boulder, CO 9/5/18—Inscripta, a supplier of gene editing tools for researchers, has acquired Solana Biosciences. Financial details were not provided. "Inscripta is building the tools to take on the next frontier of gene editing discoveries," said Inscripta CEO Kevin Ness. "The addition of the Solana team brings world-class scientific product development, manufacturing and operations experience to further enable Inscripta to provide the best gene editing tools to both commercial and academic researchers." Tom Russo, one of Solana Biosciences' founders and former vice president of Operations at Illumina, will become vice president of Operations for Inscripta.

Last year, Inscripta released its first products, CRISPR enzymes, announcing that they are available with no up-front licensing fees or so-called "reach-through royalties," which require royalties on products resulting from the use of the technology. In addition to enzymes, the company plans to commercialize software, instruments and reagents.

CalibreScientific Completes Latest Acquisition

Los Angeles, CA 9/11/18—CalibreScientific, which supplies life science instruments and consumables, has acquired PhytoTechnology Laboratories. Financial details were not disclosed. PhytoTechnology Laboratories provides plant molecular biology and plant tissue-culture research products. "We're looking forward to combining PhytoTech Labs' specialized product offerings with our international reach to develop new growth opportunities within the group,"

stated CalibreScientific CEO Dr. Ben Travis.

*Based in Kansas, PhytoTechnology Laboratories was founded in 1997. The company sells both direct and through distributors. Its media manufacturing capabilities include custom manufacturing of dry-powder and liquid medium in 100–40,000 L batch sizes. CalibreScientific announced other acquisitions earlier this year (see **IBO** 5/15/18).*

Certara Buys Pharmacometric Modeling Technology

Princeton, NJ 9/13/18—Certara, a supplier of model-informed drug development products and services, has acquired Pirana, a pharmacometrics modeling workbench. Pirana connects modeling results and provides software interfaces. Pirana was created by Ron Keizer, PhD, 11 years ago. "We are thrilled that Pirana, which has been used by our scientists for years, will now be part of the Certara technology portfolio," commented Thomas Kerbusch, PhD, president of Certara Strategic Consulting. "We look forward to continued collaboration with Dr. Keizer to advance Pirana and nurture a connected pharmacometric environment."

The software is freely available to academic researchers and commercial licenses are available. The purchase enhances the use of Certara's Phoenix PK/PD (pharmacokinetic/pharmacodynamic) modeling and simulation platform. Six thousand researchers use Phoenix, according to Certara.

Second Quarter Results: Bio-Rad Laboratories, Bio-Techne, Hitachi High-Technologies, QIAGEN, Spectris, Tecan

Bio-Rad Life Science Revenues Up Over 20%

Sales for Bio-Rad Laboratories' Life Science segment increased double digits on an organic basis (see ***IBO** 8/15/18*). Highlights were the Droplet Digital PCR, gene expression, cell biology, protein quantitation and food science sales. Process chromatography sales grew on an easy year-over-year comparison. Life Science revenue rose 14% on a currency neutral basis excluding process media sales.

Bio-Rad Laboratories Life Science Q2 2018					
Rev. (M)	Chg.	Currency	Acq./Div.	Organic Chg.	% of Co. Rev.
$217.8	21.4%	2.0%	0.1%	18.9%	38%

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Excluding currency, sales grew double digits in North America, Europe and Asia. The US, Europe and China led regional sales growth.

Bio-Techne's Protein Platforms Division Leads Sales Growth

Bio-Techne fiscal fourth quarter and 2018 revenues each grew double digits, with the company reporting its best fiscal year organic revenue growth in five years (see ***IBO** 8/31/18*).

Bio-Techne Q4 FY18						
	Rev. ($M)	Rev. Chg.	Acq./Div.	Currency	Organic Rev. Chg.	% of Rev
Total	$180.3	15.1%	4%	2%	9%	
Biotechnology	$115.0	18.3%	5%	2%	11%	64%
Protein Platforms	$32.3	20.8%	0%	2%	19%	18%
Diagnostics	$33.1	1.7%	4%	0%	-2%	18%

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Bio-Techne FY18						
	Rev. ($M)	Rev. Chg.	Acq./Div.	Currency	Organic Rev. Chg.	% of Rev.
Total	$643.0	14.2%	3%	2%	9%	
Biotechnology	$421.5	15.6%	4%	3%	9%	66%
Protein Platforms	$111.9	22.3%	0%	2%	20%	17%
Diagnostics	$110.1	2.8%	2%	0%	1%	17%

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Biopharma sales were up high single digits in both the US and Europe in the quarter. In the same period, academic sales rose in the low teens in the US and mid-teens in Europe. For the year, the company reported strong growth in the US academic market and high single digits sales growth in pharma.

Biotechnology division sales were driven by a broad range of products, including sales of proteins, antibodies and assays. Annual product highlights included solid sales for the Human XL Cytokine Discovery Luminex assay. ACD research-only sales rose over 30% for both the quarter and the year.

Bio-Techne FY18		
	Adj. Op. Margin	Chg. (bps)
Total	37.1%	10
Biotechnology	47.2%	90
Protein Platforms	16.1%	560
Diagnostics	25.7%	100

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Within the Protein Platforms division, iCE instruments sales to new customers increased over 25% in the fiscal fourth quarter. Sales of the Simple Western platform grew over 30% for the quarter and more than 25% for the fiscal year to 1,100 units. Simple Plex products sales increased 60% for the quarter and 80% for the year.

Bio-Techne FY18			
	Rev.	Rev. Chg.	% of Rev.
US	$346.3	10.6%	54%
EMEA excl. UK	$148.6	18.8%	23%
UK	$33.7	18.7%	5%
APAC, excl. Greater China	$48.4	16.7%	8%
Greater China	$48.0	22.7%	7%
Rest of World	$18.1	14.7%	3%

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Fiscal and quarterly Diagnostic revenue growth was affected by timing of OEM orders. For the year, highlights were

sales of hematology controls, point-of-care diagnostics kits and reagents manufacturing.

Fiscal 2019 sales are expected to rise in high single digits on an organic basis. The company estimates $30 million in revenue in fiscal 2018 from its acquisition of Exosome Diagnostics, which is also expected to be profitable. The company estimates Protein Platforms sales growth of around 15%.

Microscopy Sales Fall for Hitachi High-Technologies Science & Medical Systems

Fiscal first quarter 2019 revenues increased despite a decrease in electron microscopy sales (see ***IBO*** 7/31/18). However, the company reported demand for the systems from Asian semiconductor and materials manufacturers. Other segment highlights included demand related to rechargeable batteries and RoHS compliance.

Hitachi High-Technologies Science & Medical Systems Q1 FY19			
	Rev. (B)	% Rev. Growth	% of Rev.
Total	¥473	19%	
Medical Products	¥319	67%	67%
Scientific Instruments	¥66	14%	14%
Electron Microscopes	¥58	12%	12%
Biotechnology Products & Other	¥30	6%	6%

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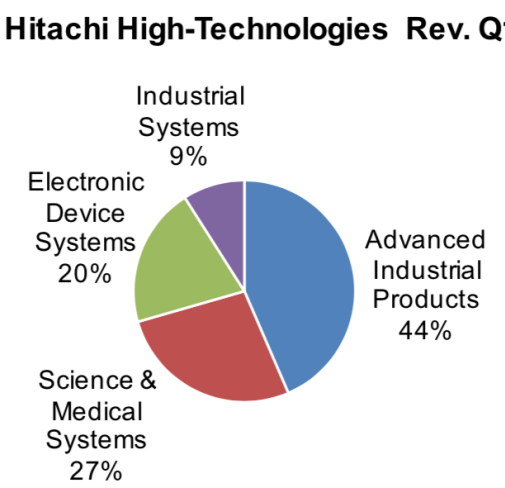
The company forecasts first-half 2019 division sales to increase 13.9% to ¥998 billion ($915 million = ¥109.08 = $1).



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QIAGEN Reports Double-Digit Molecular Diagnostics Growth

QIAGEN reported healthy second quarter sales growth. Instrument sales growth was impacted by lower third-party service revenues as the company reduces service for third-party providers (see ***IBO*** 7/31/18).

QIAGEN Q2 2018				
	Rev. ($M)	% Rev. Chg.	Rev. Chg. Excl. Currency	% of Rev.
Total	$377	8.1%	6%	
Molecular Diagnostics	$187	11.1%	10%	50%
Academia	$83	7.5%	4%	22%
Pharma	$74	5.8%	4%	20%
Applied Testing	$33	-1.1%	-3%	9%

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Molecular Diagnostics posted the fastest sales growth among the company's four customer segments. Strong sales growth was reported for the QuantiFERON-TB test and QIAsymphony consumables. In addition, companion diagnostic agreement revenue rose 81% in constant exchange rates to $14 million.

QIAGEN Q2 2018			
Adj. Op. Profit ($M)	Chg.	Adj. Op. Margin	Chg. (bps)
$101	14.8%	26.8%	156

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Sales to Pharma and Academia customers also increased, with Pharma sales growing the fastest in the Americas. In contrast, Applied Test sales decreased due to the year-over-year comparison and the exit from its veterinary testing portfolio. Excluding the divestment, Applied Test revenues grew in the low single digits.

QIAGEN Q2 2018				
	% Rev. Chg.	% of Rev.	% Rev. Chg.	% of Rev.
	Consumables and Related		Instruments	
Total	7.9%	88%	9.6%	12%
Molecular Diagnostics	10.4%	44%	18%	5%
Academia	6.5%	19%	-7%	3%
Pharma	6.4%	18%	1%	2%
Applied Testing	0.5%	7%	15%	2%

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By region, in the Americas, the company highlighted double digit constant currency sales growth for the US, Brazil and Mexico, led by Molecular Diagnostics sales. In Europe/Middle East/Africa, sales in France and Germany declined slightly. Asia-Pacific sales growth was affected by last year's South Korean tenders for QuantiFERON-TB. Excluding this, Asia-Pacific sales were up 5% in constant currency.

QIAGEN Q2 2018			
	Rev. Chg.	Rev. Chg. Excl. Currency	% of Rev.
Americas	19.0%	10%	54%
Europe/Middle East/Africa	35.2%	4%	25%
Asia-Pacific/Japan	37.2%	1%	14%

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For the year, the company expects companion diagnostics revenue to increase 20% on average. QIA-state sales to new customers are expected to total $7 million for the year.

Spectris Materials Analysis Benefits from Acquisition

Spectris Materials Analysis H1 2018					
Rev. (M)	Chg.	Acq.	Currency	Organic Chg.	% of Rev.
£233.9	17.2%	10%	-4%	3%	32%

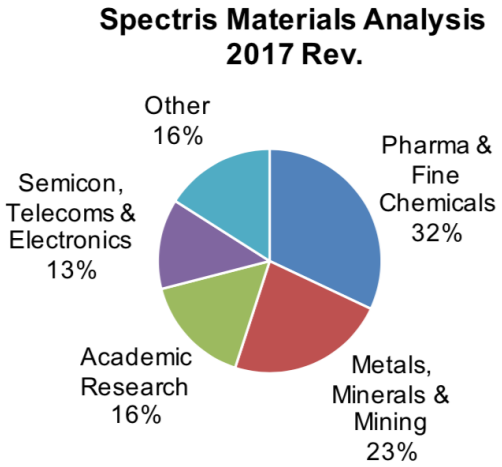
Click to enlarge

The Materials Analysis business revenue increases boosted by a double-digit percentage growth contribution from the purchase of Concept Life Sciences (see ***IBO*** 1/31/18).

Spectris H1 2018			
Adj. Op. Profit (M)	Chg.	Adj. Op. Margin	Chg. (bps)
£27.0	31.7%	11.5%	120%

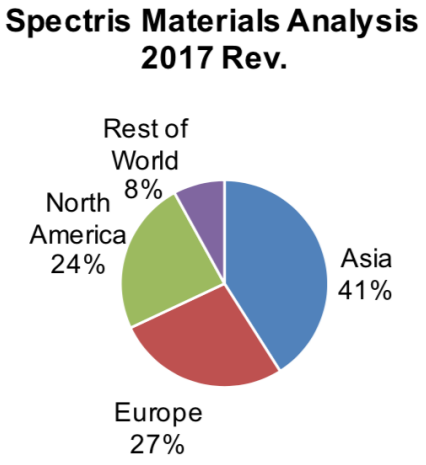
Click to enlarge

Organic sales growth was led by pharmaceutical and fine chemicals end-markets, with particular strength in North America, as well as good growth in Germany and Italy. Semiconductor and electronics revenue remained strong, led by Asia and Particle Measuring Systems sales to semiconductor fabrication plants.



Click to enlarge

Sales to the metals, minerals and mining industries rose, reversing the trend from a year ago, despite a decline in metals sales in Asia and North America. Academic sales also rebound with strong growth in China.



Click to enlarge

OEM Business Fuels Tecan Sales

Tecan H1 2018				
	Rev. (M)	Rev. Chg.	Rev. Chg. Local Currency	% of Rev.
Total	CHF 273.5	8.4%	6.9%	
Life Sciences	CHF 148.7	3.7%	-0.6%	54%
Partnering	CHF 133.7	16.4%	16.1%	49%

Click to enlarge

Tecan's first-half sales were led by its Partnering (OEM) business, with over five projects in development (see ***IBO*** 8/31/18). The company attributes the comparative slower sales growth in the Life Sciences business to a difficult year-over-year comparison and noted strong demand for the new Fluent Gx platform. Life Sciences orders grew double-digits. Total company orders in the first half rose 2.8%, or 1.3% in local currencies.

Tecan H1 2018		
	Op. Profit Margin	Chg. (bps)
Total	13.8%	190
Life Sciences	12.2%	-20
Partnering	19.1%	230

Click to enlarge

Geographically, Partnering sales grew 40% in Europe during the first half, with an easy year-over-year comparison. North America revenue growth benefited from Fluent and Fluent Gx demand as well component sales.

Tecan H1 2018			
	Chg.	Local Currency Chg.	% of Rev.
Recurring Rev.	8.3%	6.8%	45%

Click to enlarge

Tecan H1 2018			
	Rev. Chg.	Local Currency Chg.	% of Rev.
Europe	24.4%	19.9%	44%
North America	-4.5%	-2.5%	39%
Asia	10.6%	5.4%	16%
Other	NA	NA	2%

Click to enlarge

Nanoindentation & Nanotribology

Modern materials are subject to elaborate testing regiments, and nanoindentation and nanotribology are technologies that can help address this. For bulk materials like metal alloys there are long-established test methods for hardness and indentation; however, these methods are not suitable for many materials due to the tiny scale of the samples. As products become miniaturized and coatings become thinner, materials scientists have had to adapt their instrumentation to the nanoscale.

Consequently, a small industry has sprung up to facilitate the nanomechanical testing of materials. The most common type of such testing is nanoindentation, which is primarily used to measure the hardness, modulus of elasticity and creep of materials. The measurement is relatively straightforward, albeit not necessarily simple to achieve at the nanoscale. Nanoindenters function by pushing an indenter made of hard material, such as diamond or sapphire, onto the sample with a prearranged force and time profile. In addition to the force, the displacement of the tip into the sample is carefully measured, either through direct imaging or electromechanical measurements. Software can convert these raw measurements into the various mechanical properties and moduli.

In addition to basic indentation, many other potential measurements can be made. The science of tribology relates to friction and rubbing, and at the nanoscale, surface treatments and coatings can have powerful effects on surface roughness and friction. Consequently, nanotribology has been developed to provide useful measurements for evaluating materials. In addition to measuring the static and dynamic friction of surfaces, systems can be used to measure wear by moving the probe in contact with the surface back and forth over a number of cycles to determine the resistance of the sample to repetitive stresses.

Another mode of analysis commonly used with nanoindentation and nanotribology systems is microscopy. The general setup of these instruments is fairly similar to AFM, and thus AFM capabilities are commonly found with these systems. Optical microscopy is also a relatively frequent addition to these systems to provide a visual inspection of indentations, wear and scratch tests. Some systems are also designed for inclusion within the sample chamber of electron microscopes or FIB systems, providing high-resolution microscopy and other sample preparation possibilities.

Although these systems can be applied to the same kind of bulk samples as their grander-scale brethren, the main utility is for samples that cannot be tested with larger-sized instrumentation. A common example is thin layers placed over a substrate, where the interest is the mechanical properties of the thin layer. Larger instruments would penetrate into the substrate, where the nanoindenter only scratches the surface. Common sample types include paints, elastic coatings, thin films, polymers, fused silica for optics, ceramics, and even soft materials like gels or biological specimens. Tribological applications are similar, but there are more opportunities to study lubricants and lubrication, as well as the opposite, namely adhesives and adhesion properties.

Bruker, which acquired Hysitron in 2017 (see ***IBO*** 1/30/17), is the leader in the nanoidentation and nanotribology market, offering a wide variety of solutions for standalone analysis, process systems and systems geared for use within electron microscopes. Bruker's other businesses in AFM and Raman imaging also enable the a variety of possible hybrid systems. Keysight Technologies (formerly part of Agilent Technologies) had been one of the primary vendors of nanoindentation products, but in April, the company's nanoindentation product lines were acquired by KLA-Tencor (see ***IBO*** 8/15/18). Prior to the acquisition, KLA-Tencor already had an existing business for a specialized system, the Nanoflip, for use inside electron microscopes. The third largest vendor is Fischer Technology, which is a quite specialized firm for the inspection and analysis of coatings and other nanoscale features. A number of other market participants exist, including Anton Paar, Micro Materials, Nanovea, Oxford Instruments, Zwick and Optics 11, the last of which is notable for focusing primarily on biomaterials.

Leading Vendors:

- Bruker
- KLA-Tencor
- Fischer Technology

Largest Markets:

- Coatings
- Polymers
- Metals

Instrument Cost:

- $25,000–$750,000

R&D

Artificial intelligence (AI) tools are helping scientists with not only organizing and managing data, but validating and correlating scientific hypotheses. While most conventional tools serve mainly as citation indexes, AI-based tools offer more in depth information and analysis. For example, AI-based "speed-readers" are useful due to the vast number of papers published, with some estimates that 1 million new papers are published globally each year, or one paper every 30 seconds. These speed-readers utilize algorithms that extract content from papers as well as filtering, ranking and grouping search results. In order to provide more advanced capabilities, algorithms can be customized to create knowledge graphs, which illustrate the relationships between extracted data points, such as an algorithm indicating whether a drug and protein are related if they are mentioned in the same sentence. Organizations developing these types of AI-based tools also plan to provide supplemental information by identifying the hypotheses in the research papers and checking each paper against other relevant scientific documents in order to validate the hypotheses.

AI-based tools are also helpful in niche applications. Simple to use, many AI-based tools have user interfaces that are similar to popular internet search engines, such as Google; however, the AI-based tools provide much more information, such as popularity metrics, datasets, methods and indirect citations, which is when a method or notion is so well-established and commonplace that its origin is not cited by researchers. For all their benefits, AI-based tools require human involvement, as each hypothesis the tool generates must still be tested. Moreover, most AI-based tools are extremely costly and are usually limited in the scope of scientific literature they can search.

Source: *Nature*

Government

The Trump administration announced late last month plans to relocate the Economic Research Service (ERS), a key USDA research office, into the Office of the Secretary, which is a more political branch of the USDA. This move would also drive ERS and the National Institute for Food and Agriculture (NIFA) out of the nation's capital before 2020. According to the government, the reorganization of the USDA is meant to optimize the USDA's general operations, help save taxpayer money, and aid the USDA in finding and retaining expert staff. However, scientists and economists are worried that the move will stagnate important federal research.

The Trump administration has already planned to significantly slash funding for the ERS. Moreover, the administration claims that retaining top employees has been an issue at the ERS and NIFA, and that relocating the agencies will solve this issue. However, some researchers believe that the cuts specifically target scientific funding. While the Trump administration acknowledges that many employees at these agencies may not wish to relocate, it is unclear whether the USDA will address and fill those vacancies. Scientists also believe that the plan will debilitate ERS research projects, specifically by creating a more difficult process for Agency economists to consult with government research offices, lawmakers and policy groups.

Source: *The Washington Post*

Biotechnology

Advances in synthetic biology have led to the engineering of microbes that can treat a rare inherited disease called phenylketonuria (PKU). Generally, engineered bacteria have been used for more industrial purposes, such as for antibiotics production or to develop compounds that are used in textiles. But, recently, researchers have been looking for ways to utilize synthetic biology to treat illnesses. The microbes to tackle PKU has been developed by Synlogic, and may be the first synthetic biology medical product that gets approved by the US FDA.

PKU occurs when the body is unable to break down phenylalanine, an amino acid that is a byproduct of dietary protein. This results in a buildup of phenylalanine in the blood, which can lead to the damage of neurons and the brain. In animal experiments, Synlogic's bacteria treatment showed potential as a treatment for PKU, with researchers now moving forward with a clinical trial that is scheduled to produce initial results next year.

Until now, gene therapy was only studied as a treatment for PKU but had not moved beyond animal studies. While many other researchers and companies are working on similar synthetic biology initiatives, Synlogic has been leading the efforts. Future synthetic biology projects that researchers are collaborating on include engineering bacteria to fight cancer.

Source: *The New York Times*

Africa

A World Bank project called the African Centers of Excellence (ACE) initiative, which loans money to African governments, is planning to double its budget with a third, and likely final, investment totaling approximately $280 million. Launched in 2014 with $165 million in loans, the ACE initiative has established 46 education and research centers in 17 countries on the continent. The latest investment totals more than $500 million on behalf of the World Bank, and French development agency AFD may also eventually contribute an additional $50 million.

Governments of the African nations that receive the loans provide five-year grants to the Centers allowing them to fund infrastructure, staff expansions and student financial support. All research conducted from the grants focuses on pressing local challenges, such as maternal health, plant breeding, sanitation and infectious diseases. So far, the Western and Central African Centers have enrolled 6,500 Master's and 1,600 PhD students, while the Eastern and South African centers have enrolled 1,800 graduate and post-graduate students.

The Centers are expected to be self-sustaining once the World Bank loans run out, and will depend on local governments, philanthropic organizations and national industries to help with funding.

Source: *Nature*

China

Although new regulations in Beijing have required leading global pharmaceutical companies to lower prices for certain products, China has also broadened state insurance and began processes to fast-track approvals that have spiked sales in the country, the second largest drug market in the world. AstraZeneca and Pfizer are among the largest overseas pharmaceutical companies in China in regards to sales, and both companies reported a 24% increase in sales in the last quarter. The American Chamber of Commerce in Shanghai reported an 87% optimism level among US pharmaceutical companies, a 40% increase, over the past year.

Last year, China's pharmaceutical sector brought in $123 billion in sales and is forecast to grow over 5% through

2022 due to a growing wealthy and aging population. In recent years, the sales growth of multinational companies have slowed due to the new pricing regulations, which required hundreds of branded off-patent drugs to be added to state copayment processes; however, drug manufacturers are finding that the state insurance processes are helping grow sales, as they are getting reimbursements for many new products.

The removal of the duplicate clinical trial law, which required foreign drugmakers to re-conduct trials in China to launch drugs that were already approved in their country of origin, has also helped accelerate drug sales in China. In 2017, 39 imported drugs were approved for sale in China, which is more than in the last 3 years combined. So far, in 2018, over 15 imported drugs have been approved.

Source: *Financial Times*

Israel

In 2016, Israel's national civilian R&D expenditures grew 2.3% to total NIS 52 billion ($14.4 billion), or 4.3% of the nation's GDP. This indicates a steady trend of growing R&D in the region, following a 6.1% increase in 2015 and 1.3% growth in 2014. In 2015, Israel's R&D expenditure was 4.3% of its GDP, the highest among all OECD member countries.

The largest contributor to total national R&D expenditure was the business sector, which accounted for 86%, or NIS 44 billion ($12.2 billion), in 2016. The establishment of development centers for multinational companies has helped drive the R&D expenditure growth in the business sector, which grew 2.4% in 2016.

Within the business sector, scientific R&D spending, including spending by startups, international R&D centers, technological incubators and research institutes, jumped 4.4% at constant prices in 2015. The same year, spending for the additional development of multinational companies' centers in Israel totaled NIS 22.3 billion ($6.2 billion), an 8% rise, with all R&D conducted at these centers intended for use overseas.

Higher education represented 12% of total R&D expenditure in 2016, while the general government and nonprofit sectors made up the remaining 2% and 1%, respectively. R&D expenditures within the general government sector grew 3.5% in 2016, while higher education R&D expenditures increased 1.0%. Private nonprofit institutions' R&D expenditures expanded 5.9%.

In 2015, the business sector funded 34% of all R&D expenditures in Israel, while international sources financed 52% of expenditures, which were mostly allocated to the business sector. Through transfers to higher education institutions and self-financing, the general government sector made up 13%, while higher education institutions themselves and private nonprofit institutions represented 0.4% and 1% , respectively.

Source: *Central Bureau of Statistics, State of Israel*

Broad-based Companies

Company Announcements

Sartorius Lab Products & Services' second quarter revenue grew 6.2%, 8.9% in constant currency, to €106.6 million ($126.9 million) (see ***IBO*** 7/31/18). Orders rose 4.3% in constant currency. In the first half, organic sales rose 12% in constant currency, with **Essen BioScience** contributing approximately 5% to segment growth. By region, constant currency first-half sales grew 20.9%, 19.9% and 3.3% for the Americas, Asia/Pacific and EMEA, respectively.

Sartorius announced in August the launch of the nonprofit Life Science Factory in early 2019 to promote startups and attract entrepreneurs from the life science sector. The Life Science Factory strategy provides for the interaction of lab areas, coworking rooms and network offerings, such as mentoring and company financing.

Xylem's second quarter Test revenue totaled $89 million to make up 7% of company revenues.

In August, three researchers filed suit against **Affymetrix** (**Thermo Fisher Scientific**), **Applied Biosystems** (Thermo Fisher), **Illumina** and former executives at the companies, alleging misappropriation of trade secrets under New York common law, racketeering and fraud, among other complaints. The suit concerns "zip code sequences" used to create "Universal DNA Arrays."

Becton, Dickinson named Jeffrey W. Henderson to its Board in August. He was formerly CFO of **Cardinal Health** and currently sits on the Boards of **Qualcomm** and **FibroGen**.

In August, **QIAGEN** named South Africa-based **The Scientific Group**, a subsidiary of **Ascendis Medical**, its exclusive commercial partner for Africa, excluding South Africa, and the Maghreb. QIAGEN currently serves Africa through its office in Johannesburg.

Harvard Bioscience CFO Robert E. Gagnon resigned in August.

In August, **HORIBA** committed $9 million to the **Advanced Power and Energy Program** at the **University of California, Irvine** to establish the **Horiba Institute for Mobility and Connectivity**. The Program will focus on research and education efforts to combine the energy and transportation sectors into an integrated and complementary system.

Diploma CEO Richard Ingram stepped down from his role and as a Board member in August.

In September, **Roper Technologies** named COO Neil Hunn as president and CEO. Former President and CEO Brian Jellison, who stepped down for medical reasons, remains as chairman.

On September 1, **Waters Corporation** appointed Linda Baddour, former CFO of **PRA Health Sciences**, and Gary Hendrickson, chairman, president and CEO of **Valspar**, to its Board.

Techcomp Europe announced in September the expansion of its Scottish operations, purchasing an additional 40,000 ft^2 (3,716 m^2) to add of assembly production, laboratory, R&D and office accommodation as well as house machining, fabrication and warehousing.

In September, **Agilent Technologies** named Christoph Thaiss, PhD, assistant professor of microbiology in the **Perelman School of Medicine at the University of Pennsylvania** as the winner of the 2018 Agilent Early Career Professor Award. Dr. Thaiss' research focuses on the microbiome and how it mediates the response of its host to environmental cues, which strongly influences the organism's health and disease states.

In September, **Waters** opened the International Food and Water Research Center in Singapore. The Center will support scientists throughout the world working in areas such as food authenticity, food fraud discovery, water contamination research, food quality enhancement and new ingredient/formulation studies.

Roland Diggelmann, CEO of **Roche's Diagnostics Division** and member of the Corporate Executive Committee, left the company effective September 30. Until a successor is named, Michael Heuer, Region Head Europe, Middle East, Africa and Latin America for Roche Diagnostics, will assume leadership of Roche's Diagnostics and become a member of the Corporate Executive Committee.

Thermo Fisher Scientific announce that former **Patheon** CEO James C. Mullen will join its Board in November.

Informatics

Company Announcements

In May, **Optibrium**, a developer of software for small molecule design and optimization, entered into a collaboration with **Imperial College London** and the **Drugs for Neglected Diseases** initiative. The collaboration includes student access and training.

Optibrium signed in September a collaboration agreement with AI firm **Intellegens**, whose deep learning tool, Alchemite, improves drug discovery models.

In June, genomics cloud computing company **Ziliomics** received seed financing from the **Prospects Oncology Fund**.

In July, ELN firm **BioData** named Steve Yemm, vice president of Sales, as CEO.

ELN firm **labfolder** entered into a collaboration with **NEC Deutschland**, a company integrating IT and network technologies, in July. NEC and labfolder plan to offer a simple, cost effective and scalable package solution for IT infrastructure.

In July, LIMS firm **Accelerated Technology Laboratories** was named a validated software provider for Marijuana Enforcement Tracking Reporting Compliance (METRC) in California, Colorado, Nevada and Oregon, with additional states in the planning phase. METRC, a regulatory compliance system for the cannabis industry, is designed to track cannabis production from seed to sale.

Simulations Plus, a provider of modeling and simulations solutions, announced in July a one-year funded research collaboration with a large European consortium to further develop and validate the mechanistic Transdermal Compartmental Absorption and Transit model in its GastroPlus platform.

In July, **DILIsym Services**, a **Simulations Plus** company, was awarded a $1.7 million Fast-Track Small Business Innovation Research grant from the **National Institutes of Diabetes and Digestive and Kidney Diseases**. The funding will contribute to the development RENAsym software for the investigation and screening of possible drug-induced kidney damage.

In September, **Simulations Plus** entered into a one-year funded extension to its previous cooperative agreement with the **US FDA** to further develop and validate the mechanistic Ocular Compartmental Absorption and Transit (OCAT) model in GastroPlus.

Google Cloud announced in July that it has joined the **NIH's Science and Technology Research Infrastructure for Discovery, Experimentation, and Sustainability** (STRIDES) initiative for biomedical research. The company plan to make some of the most important NIH-funded datasets available to users with appropriate privacy controls.

In July, **ACD/Labs** announced its continued collaboration using ChemSpider, a chemical database owned by the **Royal Society of Chemistry**, to furnish predicted physicochemical properties and chemical nomenclature. ChemSpider will use ACD/Percepta's prediction algorithms and ACD/Name tools in a batch-wise fashion to populate the database and enhance publicly available chemical intelligence.

In August, ELN firm **Collaborative Drug Discovery** signed a reseller agreement with **Zastra Innovations** for India.

Biomatters announced in August that Geneious, its desktop suite of molecular biology and sequence analysis tools, will be renamed to Geneious Prime later this year.

In September, **Qlucore** and **Nebion** announced an integration of their respective Qlucore Omics Explorer and Genevestigator platforms to provide an end-to-end solution for gene expression analysis.

Eagle Genomics was awarded co-sell status in September as part of the **Microsoft for Startups Program**, which provides access to Microsoft Enterprise customers.

In September, **IDBS**, a **Danaher** company, named Christian Marcazzo as vice president and general manager. He was previously vice president, Analytics & Search, at **PerkinElmer Informatics**.

Product Introductions

In July, **Sage Bionetworks** launched the Agora platform, an interactive, web-based tool that allows researchers to explore curated genomic analyses of Alzheimer's Disease. The content is based on **NIH**-led **Accelerating**

Medicines Partnership—Alzheimer's Disease (AMP-AD) Target Discovery and Preclinical Validation Project.

In August, **LabVantage Solutions** previewed its LabVantage Cannabis platform, a LIMS designed specifically for cannabis testing and certification.

Sales and Order of Note

In August, **Genedata** announced that clinical-stage biotech company **Aptevo Therapeutics** has adopted the company as its preferred bioinformatics solutions provider.

Surface Science

Company Announcements

Leica Microsystems expanded and formalized its partnership with the **Bordeaux Imaging Center**, part of the **Neuroscience Institute of Bordeaux**, in July.

In September**, Leica Microsystems** opened the Leica Microsystems Imaging Center, its first center in San Francisco, California.

In July, **JH Technologies** announced it will distribute **Leica Nano Technology**'s electron microscopy sample preparation product line in 13 western and eastern states in the US.

LIG Nanowise, a developer of super-resolution microscopy technology, completed a £2.6 million ($3.4 million) seed funding round in July. The financing was led by venture capital firm **Phoenix Bridge**.

In its second quarter filing, **Bruker** disclosed a purchase price $15.0 million for **JPK Instruments** (see ***IBO*** 7/15/18) and potential earn-outs.

In August, **Prior Scientific** opened an office in Suzhou, China.

In September, **HORIBA** and **Oxford Instruments** terminated their OEM arrangement for the sales and maintenance of Oxford Instruments' EMAX Series of EDS instruments in Japan and Asia.

Thermo Fisher Scientific and the UK's **Diamond Light Source** announced in September the launch of new cryo-EM capability for use in the life sciences industry. Thermo Fisher will provide two new dedicated microscopes and cryo-EM services designed exclusively for the pharmaceutical industry. New instruments being installed include a Thermo Scientific Glacios Cryo TEM and Krios Cryo-TEM.

Product Introductions

In July, **Oxford Instruments** introduced the Ultim Max 65 mm^2 and 40 mm^2 silicon drift detectors for SEM-EDS, which join three existing models in the series.

Asylum Research released in July the Variable Field Module (VFM4) accessory for its MFP-3D AFM, enabling measurements under applied in-plane and out-of-plane magnetic fields in order to better understand their effects on nanoscale magnetic domain structure.

In July, **MMI**, which provides technologies for microscopy-based single cell isolation, debuted the MMI CellTools 5.0 software platform. Featuring a new interface style and automated handling steps, it is designed to control a microscope platform and MMI tools.

In August, **Leica Microsystems** introduced the ARTOS 3D ultramicrotome (ARray TOmography Solution for 3D imaging applications). The ARTOS 3D solution automatically produces serial bands of consistent sections for array tomographic reconstruction of sample volumes at the nanometer range. Transparent carrier materials can also be used, allowing for use with correlative microscopy.

Nikon Instruments launched in August the N-SIM S Super Resolution Microscope, incorporating the ECLIPSE Ti2-E Inverted Research Microscope, for imaging of live cells. It features high-speed imaging of approximately 0.067 sec/frame.

In August, **Nikon Instruments** debuted the A1 HD25/AIR HD25 confocal microscope with a 25 mm field of view, calling it the world's largest field of view, and an imaging speed of up to 720 fps.

In August, **CAMECA** introduced the SxFive-TACTIS electron probe microanalyer with touchscreen interface. It features additional BSE detection, a fully integrated EDS hyper-mapping module, and the capability to acquire real-time WDS and EDS x-ray images.

Thermo Fisher Scientific debuted in August the Thermo Scientific Lumis EBSD detector, stating that it collects more than 2.2 megapixels, the largest number of pixels of any EBSD detection on the market.

In August, **Thermo Fisher Scientific** introduced the new Phenom Pharos desktop SEM with a a field emission gun, a first for the company.

Thermo Fisher Scientific launched in August the **Thermo Scientific** S-CORR probe corrector for its Themis Z S/TEM, featuring an improved probe size and shape.

In August, **ZEISS** debuted the APEER cloud-based digital microscopy platform for automatic image processing in the cloud that can be used for 3D reconstructions, staining and segmenting.

Filmetric announced in September the extension of the cloud-based ProfilmOnline, its free 3D surface-image analyzer, to AFM and other scanning probe applications. It is designed for analyzing images from 3D profilometers and 2D microscopes.

In September, **Olympus** introduced in the US the NoviSight 3D Cell Analysis Software for use with its confocal laser scanning microscopes. Its 3D cell analysis technology has the ability to analyze 3D cell cultures down to the nuclei.

In September, the **University of California, San Diego** opened the **Nikon Imaging Center**, the third such center in North America. Nikon has provided UC San Diego with over $2.5 million worth of its products.

Sales and Orders of Note

In September, the **University of Exeter's Bioimaging Centre** installed **Leica Microsystems**' TCS SP8 FALCON microscope for fast fluorescence lifetime imaging and fluorescence correlation spectroscopy.

The BBC reported in September that the **Scottish Centre for Macromolecular Imaging** now houses the JEOL Cryo ARM 300, the system's first installation in Scotland.

The *Sydney Morning Herald* reported in September that the **University of Sydney's Sydney Microscopy and Microanalysis** has installed **Thermo Fisher Scientific**'s Thermo Scientific Themis Z TEM.

Materials Characterization

Company Announcements

In June, due to the sale of **Quantachrome** (see ***IBO*** 2/15/18), the independent German company **Quantachrome**

GmbH restructured and changed its name to **3P INSTRUMENTS**.

This summer, **KLA-Tencor** acquired nanoindentor instrument firm **Nanomechanics**.

In July, Dr. Rossana Pasquino, associate professor at the **University of Naples Fredrico II**, received **TA Instruments**' Distinguished Young Rheologist award. She was recognized for her work in the rheology of complex fluids, using it as a tool to detect morphology and microscopic properties.

Halo Labs, which is developing the HORIZON system for high-throughput, low-volume subvisible particle analysis, named Robert Wicke as CEO. He previously held a senior leadership position at **Pall ForteBio**. He succeeds Dr. Robert Hart who is transitioning to CTO.

In September, **Micromeritics Instruments** signed a collaborative sales partnership with **Malvern Panalytical**. In several markets, Micromeritics will serve as a distributor for Malvern Panalytical's Zetasizer family of instruments.

Product Introductions

PAC launched in March the Phase Technology DFA-70Xi Diesel Fuel Analyzer, calling it the world's first 4-in-1 analyzer that tests diesel fuel viscosity, density, cloud and pour point. It performs all 4 tests in less than 25 minutes.

Shimadzu introduced in April the KPR-300 Kalnew precision refractometer in North America, designed to measure the refractive indices of transparent samples for optical applications.

In June, **Spectro Scientific** debuted the TruVu 360 Enterprise Fluid Intelligence Platform, an all-encompassing web-based fluid analysis data management system. It integrates the MiniLab onsite oil analysis hardware. The company plans to transfer all of its fluid analysis instruments to the platform.

In July, **Schmidt+Haensch** launched the VeriRef refractometer series, consisting of two models. The double-isolated Peltier systems allows fast temperature control.

AMETEK Process Instruments released in July the model 5100P system, based on tunable diode laser absorption spectroscopy, for measuring moisture content in natural gas and featuring an integrated sample system. The introduction adds a portable model to its 5100 Series gas analyzers.

In September, **HORIBA** introduced the nanoPartica SZ-100V2 series nanoparticle analyzer, which measures the quantity, size and surface charge of nanoparticles using zeta potential measurement. It features a particle-diameter measurement range of 0.3 nm–10,000 nm.

Reported Financial Results

$ USD in Millions	Period	Ended	Sales	Chg.	Op. Prof.	Chg.	Net Prof.	Chg.
Brooks Automation	Q3	30-Jun	$223.5	23.0%	$26.7	42.1%	$22.6	30.3%
Brooks Automation (Brooks Life Sciences)	Q3	30-Jun	$49.7	35.2%	$2.0	79.4%	NA	NA
Kewaunee Scientific	Q1	31-Jul	$42.2	24.4%	$1.7	1.4%	$1.4	18.8%
Meridian Bioscience	Q3	30-Jun	$51.7	3.2%	$8.7	103.0%	$6.8	NM
Meridian Bioscience (Life Science)	Q3	30-Jun	$15.4	8.3%	$3.6	7.6%	NA	NA
Quanterix	Q2	30-Jun	$8.6	65.8%	($7.3)	-13.0%	($7.3)	-13.5%
Other Currencies in Millions								
Abcam	FY	30-Jun	£233.2	7.4%	£68.8	24.9%	£62.2	46.7%
Olympus (Scientific Solutions)	Q1	30-Jun	¥21	5.6%	-¥0.4	34.6%	NA	NA

Click to enlarge

NA = not available, NM = not meaningful