
Strategic Directions International, Inc.

INSTRUMENT BUSINESS OUTLOOK



Strategic Information for the Analytical & Life Science Instrument Industry

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NGS Tertiary Analysis: Companies Craft New Approaches for Clinical Labs

The computational analysis of DNA sequencing data is often labeled “the bottleneck” in the NGS workflow.

Encompassing the identification, classification and interpretation of genetic variants, secondary and tertiary analysis (see table below) are the most challenging steps in translating NGS results into meaningful and accurate data for research, clinical and diagnostic applications, including patient care decisions. But it is tertiary analysis that has proven the most difficult, requiring specialized expertise, the evaluation and synthesis of information from multiple data sources, and relatively few standards and guidelines to assist scientists.

Primary Analysis	Base calling
	Quality scoring
Secondary Analysis	Filtering
	Alignment
	Assembly
Tertiary Analysis	Scoring
	Annotation
	Interpretation
Clinical Reporting	

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A 2013 article in *Genetics in Medicine*, [“Informatics and Clinical Genome Sequencing: Opening the Black Box”](#) by Sowmiya Moorthie, PhD, et al., defines tertiary analysis as “analyzing variants to assess their origin, uniqueness and functional impact.” For example, tertiary analysis sets out to answer questions such as, “Which variants are biologically significant for the desired analysis, in what way are they significant and how certain are researchers of that significance?”

Scientists, including bioinformaticians and geneticists, rely on databases, algorithms and phenotypic data to complete the task. However, tertiary analysis remains complicated, time consuming and labor intensive. In a [recent survey](#) of NGS scientists conducted by BioInformatics, LLC, “determining significant mutations” and “linking variants to treatments,” both tertiary analysis steps, were the only 2 out of 15 categories across the NGS data analysis cycle rated as “highly challenging” by over 30% of respondents each.

Commercial vendors of tertiary analysis platforms, which are often bundled with their secondary analysis software, have provided solutions, but many gaps remain in the market. And the market itself has its own set of challenges. Not only are there a number of platforms available from public, academic, open source as well as commercial providers, the evolution of NGS from research to clinical to diagnostic applications is ongoing, creating uncertainty and increasing complexity.

Commercial participants in the market include specialized bioinformatics firms (e.g., Fabric Genomics, Sophia Genetics, WuXiNextCode), NGS product vendors (e.g., Agilent Technologies, Illumina, Thermo Fisher Scientific) and lab information companies (e.g. Sunquest Information Systems). For this article, **IBO** spoke with three companies, each of which is addressing the market by meeting some of its more pressing needs, namely usability, comprehensiveness and clinical dedicated solutions.

QIAGEN

QIAGEN is the leading NGS informatics vendor, supplying NGS software, in addition to NGS sample preparation, instrumentation and assay products. QIAGEN Clinical Insight (QCI) Interpret software for tertiary analysis is part of the company’s QCI platform, which it refers to as an integrated clinical-decision support solution. “[T]here is a great deal of innovation for companies in this space, especially companies that focus more on the analytics side, machine learning, etc., but there’s very few proven business models and monetization,” explained Sean Scott, vice president of Market Development at QIAGEN.

As Mr. Scott told **IBO**, part of the challenges facing the development of the market has been an emphasis on instrumentation investments. “I think it is safe to say there’s no other company in the industry that has invested more in developing out what you might refer to as tertiary analysis, but what we refer to, more broadly speaking, as

either dry lab capabilities or interpretation capabilities,” noted Mr. Scott. This commitment includes the acquisitions of four companies (Ingenuity Systems, CLC Bio, Biobase and Omicsoft), and ongoing investments. As a result, QIAGEN provides solutions for data analysis across the NGS informatics lifecycle.

Such a commitment and range of product offering contributes to the company’s position in the market. “I think, in summary, QIAGEN’s differentiation in tertiary analysis is largely based on the diversity of the product portfolio, the experience across the life cycle from early-stage research and discovery through clinical-decision support, and how we build out solutions that combine content, content-aware analytics, data sets and software,” he told *IBO*.

“I think we also have a philosophy that we don’t want to in any way be perceived as competitive with our customers, which is different from a number of other companies where they are diversifying their business more.”

Another distinguishing factor he highlighted is a company desire to serve all NGS technologies. “[W]e take a platform-agnostic approach in that we build solutions for whatever technology platforms, instruments or assay technologies our customers may be using,” he explained. This openness also extends to its customers. “I think we also have a philosophy that we don’t want to in any way be perceived as competitive with our customers, which is different from a number of other companies where they are diversifying their business more.”

But QIAGEN also values open source software and other free tools. “[W]e also understand that embracing and integrating the open source tools, public databases [and] public data sets, where there are standards, is important because what we’re trying to do is take the burden off our customers for having to acquire, integrate and validate all these moving parts,” noted Mr. Scott. The company also sponsors standardization and validation efforts. This is necessary for the practical application of the technology. “The question is, can we get to a model where there’s more public-private collaboration where more sustainable solutions can be developed.” And the current use of public databases and open source solutions for clinical and diagnostic application can be problematic. “The reality is, for clinical, they simply are not sufficient, and we’re providing evidence through some of the benchmarking studies we’re doing,” he noted.

For clinical diagnostic labs especially, the benefits of NGS informatics are far from being fully realized. “On the diagnostic side, we still see a great deal of variability in the reporting products across a wide range of labs,” he stated. “When you talk to the customers that our customers serve, when you talk to the molecular pathologists and oncologists, and the patients (as we move to a more to consumer genetics model)—people quite frankly are still perplexed with genomics data and the implications of certain findings.”

A segment of the diagnostics market that QIAGEN is focused on is small- and mid-sized hospitals. “One, they can’t just buy an instrument because, for the most part, they’re NGS-naïve. And, two, they simply can’t take on the burden of assembling all the necessary components to be able to provide a service offering,” noted Mr. Scott. “From that perspective, we’re really focused on serving unmet market segments at present.”

In the US, the diagnostic lab challenges also extend to lack of reimbursement by insurance companies. “There is no CPT [Current Procedural Terminology] code [which enables billing for diagnostic testing services] for dry lab. The CPT codes are largely based upon the nature of the assay that a particular lab is running,” said Mr. Scott. Consequently, QIAGEN is also working to meet payers’ needs as well. “[T]he reality is there’s also a need for these payers to be able to make timely decisions based on available evidence, which they don’t always have uniform access to. It’s equally important to build out these types of solutions for the payers, so that they can make the right reimbursement decision, and not restrict access to a particular drug or treatment that a patient could potentially benefit from.”

Roche

Like QIAGEN, Roche Sequencing Solutions, part of diagnostics firm Roche, provides NGS sample preparation tools and assays. In 2015, Roche acquired Bina Technologies (see [IBO 12/31/14](#)), entering the NGS informatics market. Bina Technologies, today known as Roche Sequencing Solutions Belmont, traditionally offered a secondary analysis platform but is extending it to include tertiary analysis. “Roche Sequencing Solutions Belmont intends to offer an NGS platform tertiary analysis that provides a large breadth of coverage with respect to classifying and interpreting

variants in the context of disease. This will be achieved by providing annotations and interpretations for thousands of variants that take into consideration local drug-approval agency labels and local medical guidelines,” stated Narges Bani Asadi, PhD, founder of Bina Technologies and Lifecycle Leader, Roche Sequencing Solutions Informatics.

The offering will capitalize on Roche’s well-established position and expertise serving clinical diagnostics labs. “[L]abs are seeking an end-to-end tertiary analysis solution designed explicitly for clinical NGS testing,” explained Dr. Asadi. “Roche Sequencing Solutions aims to develop a solution—initially focused on somatic oncology testing—that supports the tertiary analysis workflow by presenting all the information relevant for variant assessment within a user interface that streamlines, rather than complicates the process,” she explained. “Key to the solution is including comprehensive curated content that qualifies variants both with respect to variant classification, as well as with the patient management options that are available for patients in the context of variant and patient indication. Finally, presenting the results in a report that facilitates oncologists’ understanding and adequately projects the professionalism of the lab, is also key.”

“[R]elying on a vendor to provide up-to-date curated content for thousands of variants occurring with high-to-moderate frequency can offer the scalability labs need moving forward, as well as offer the opportunity to significantly reduce turnaround time.”

As Dr. Asadi told **IBO**, the solution will address the tertiary analysis issues involving time and labor. “Labs offering NGS tumor testing today typically have internal curators charged with classifying each variant, qualifying its biological relevance and clinical actionability upon its first detection in a patient sample,” she commented. “[R]elying on a vendor to provide up-to-date curated content for thousands of variants occurring with high-to-moderate frequency can offer the scalability labs need moving forward, as well as offer the opportunity to significantly reduce turnaround time.”

Dr. Asadi asserted that available solutions do not address clinical labs’ specific needs. “Current tertiary analysis solutions—whether offered as freeware or for a cost—have been developed largely for researchers or for working with data from older testing modalities,” she noted. “As a consequence, clinical labs find themselves having to piece together solutions that are best-in-class in different components of the workflow. Due to lack of integration, however, the resulting user experience is unsatisfactory for many.”

A more integrated solution is the answer, according to Dr. Asadi. “Labs that are currently running NGS-based tests are still looking for an end-to-end solution that meets their needs in terms of the analysis tools they seek, quality control reporting, tertiary analysis and an excellent user experience,” she explained. “Many labs’ workflows still include cumbersome manual steps filling in the gaps that their current solutions leave open, consequently leaving them more prone to manual errors. Even solutions currently promoted as turnkey are not deemed satisfactory to many labs we’ve spoken with.”

Such integration must extend throughout the lab. “Clinical labs seek solutions that integrate well with existing solutions upstream and downstream of NGS testing. This includes Lab Information Systems (LIS), as well as with Electronic Health Records (EHR) Platforms,” noted Dr. Asadi. “Labs, for instance, often manually upload reports in PDF format to the institutional EHR, but look forward to the automated upload of such results in a structured format.”

Privacy is an issue especially relevant to clinical diagnostics labs. “For lower-frequency variants, sharing information about variants that have been observed across the user community in a HIPAA-compliant mode can further inform clinical labs on how to qualify variants,” noted Dr. Asadi. “Thus, Roche Sequencing Solutions would like to facilitate anonymized variant data sharing for the purpose of leveraging prior work to benefit the larger user base. Machine learning-based methods can also be exploited for smarter ways to share knowledge from multiple labs across the user community.”

Dr. Asadi told **IBO** that Roche Sequencing Solutions is also working to address regulatory issues through collaborations with industry partners and regulatory authorities, in addition to multi-modal testing. “[A]s labs look to report results from tests spanning multiple modalities (gene amplification by FISH and single nucleotide variant [SNV] detections by NGS, for example), Roche can use its prior experience supporting multiple testing modes to support such testing.”

Fabric Genomics

Fabric Genomics, formerly Omicia, provides secondary and tertiary analysis solutions for NGS data analysis. Launched earlier this year, the company's Fabric Enterprise platform supports alignment and variant calling, annotation, curation, guideline-driven variant classification, interpretation and clinical reporting. Fabric Genomics' software is used by over one thousand academic and clinical labs.

Earlier this year, Fabric Genomics purchased Spiral Genetics, adding secondary analysis and structural variant tools to its solutions (see [IBO 1/31/17](#)). "We acquired a company earlier in the year, so now Fabric Genomics can perform the tertiary analysis, which includes the interpretation and the clinical reporting of NGS data, and also perform the secondary analysis, which is the alignment and variant calling," explained Vanessa Sawyer, director of Global Marketing for Fabric Genomics. "We're one of the only companies that do both [secondary and tertiary analysis]. We also do clinical reporting,"

Ms. Sawyer told **IBO** that the company's software also differentiates itself by working with multiple types of data. "Fabric Genomics' software interprets data from panels, exomes and genomes. There are some companies that only interpret panels," she said. "We're one of the only companies that also performs analysis of germline and somatic NGS data." In addition, the types of variants analyzed is comprehensive. "One thing to keep in mind is not only can we detect single variants or multiple variants or translocations or indels, but we also have the capability to detect structural variants. There are very few companies who can do that."

Applications in oncology include clinical trials and personalized medicine. "In terms of our somatic panels analysis product, we interpret SNVs, indels, CNVs and structural variants. We match variants to clinical information including approved drugs and clinical trials that are specific to a patient's cancer," explained Ms. Sawyer. "This can help doctors determine which medications are targeted for the patient's variants."

Ms. Sawyer echoed the need for more integrated, complete solution that are fully supported and HIPAA compliant, especially for clinical labs. In this way, open source and freeware solutions are not always a complete solution. "A benefit of our platform is that we offer many data analysis functionalities in one place, plus our platform is secure, scientifically accurate, fast, and integrates with EMRs [Electronic Medical Records] and LIMS," she explained. "We integrate with over 90 data sources that are updated monthly, as well as have proprietary algorithms for exome/genome analysis. Home-built systems may not be secure, regulatory-compliant and updated regularly."

"A lab or a hospital wants to start doing NGS testing, so they purchase their instrument. They understand how to prepare the sample but may not have a good way of understanding how to interpret all of [the data]"

This can be especially attractive for labs new to NGS, such as many clinical labs. "A lab or a hospital wants to start doing NGS testing, so they purchase their instrument. They understand how to prepare the sample but may not have a good way of understanding how to interpret all of [the data]," explained Ms. Sawyer. "You need somebody who not only has a genetics or biology background but also understands the basics of software—how to upload software or clean the data. Fabric Genomics can partner with clinical labs to help them get up and running quickly, in terms of their NGS data analysis workflows."

In addition to the expertise, such support can also benefit productivity. "[T]here are not as many clinical geneticists to interpret the variants, so that is a bottleneck in labs. Our software has lots of automation and scoring tools to help data scientists interpret variants faster and more efficiently," commented Ms. Sawyer. And support is needed at all stages of NGS implementation. "Once labs purchase NGS sequencers, they may need help with integrating data analysis software tools. We're here to help them because not only do we have our end-to-end solution, but we have a lot of experts on staff to help get labs up and running, and integrate various APIs."

In addition, such productivity can result in lower overall costs. "It is definitely more cost effective for a customer to partner with us versus building their own data analysis pipeline because we have many years of experience, we update our scientific content regularly, we integrate with EMRs and LIMS, we have proprietary algorithms, and we have personal PhD customer support," Ms. Sawyer told **IBO**.

Despite the informatics progress, reimbursement remains a challenge. “What has surprised us is how [long] it has taken the insurance companies to really embrace NGS testing from both a health point of view and an economic point of view,” said Ms. Sawyer. “This is changing, though, with the introduction of low-cost sequencers and sample prep tools. It is now very cost effective to sequence your whole genome.” In addition, the lack of lab personnel with the desired skill set has also been a surprise.

The 2017 Market for Single-Cell Analysis Products: Convergence of Microfluidics and Omics Platforms

This report focuses solely on the analysis of single cells using omics applications. It dives into the details of the single-cell workflow, including cell enrichment, cell isolation, sample preparation, analysis and bioinformatics.



The report is based on a 45-question survey of 225 users of omics applications for single-cell analysis. It provides insight into:

- Purchasing Habits and Spending
- Brand Awareness
- Budgets
- Applications
- Customer Needs
- Market Outlook

With many different methodologies in play, changing cost expectations and a wide variety of instruments becoming available for this field, the report provides timely information and insight.

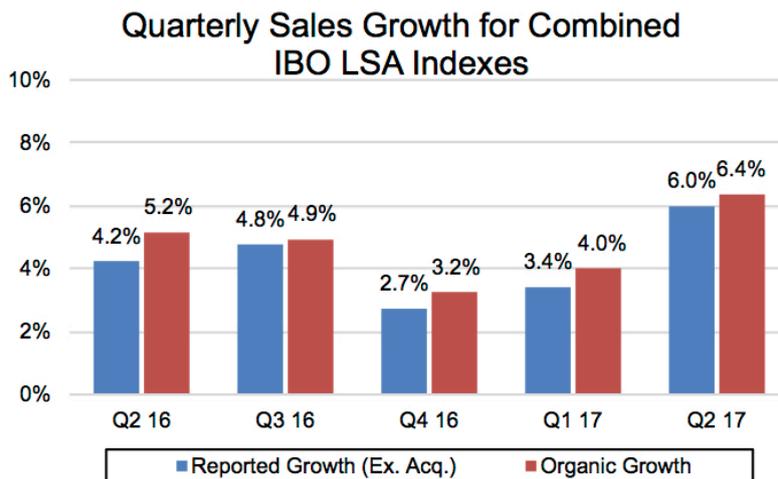
Purchase the report by September 15 and receive a special IBO discount by using the code "ibo17008." For more information, visit <https://www.gene2drug.com/product/the-2017-market-for-single-cell-analysis-products/>.

IBO Sales Indexes Show Growth: Industrial Markets Continue Their Comeback

For the second quarter of 2017, sales growth remained solid for publicly held instrument and lab products businesses as a result of continued strength in the biopharmaceutical and applied markets. Second quarter performances were better than companies expected, primarily backed by demand for LC and MS products, and services. Revenue for life science products continued to increase due to a rise in pharmaceutical and academic demand. Sales for analytical instruments advanced as well, driven by an improved industrial market and a strong biopharmaceutical performance. Geographically, strong demand in China lifted sales for the Asia Pacific region, while Europe and Americas sales rallied due to strong industrial and environmental sales.

Combined calendar year second quarter sales for the 22 companies or business units in the **IBO Life Science and Analytical Instrument Indexes (LSA Indexes)** grew 6.0% on a reported basis. Compared to the first quarter, sales growth increased 2.6 percentage points from 3.4%, whereas growth increased from a year ago by 1.8 percentage points. Organic growth for the **LSA Indexes**, which excludes acquisitions and currency and is based on constant

exchange rates for non-US companies when converted into US dollars, increased 6.4%, compared to 4.0% in the first quarter and 5.2% in the previous year.



[Click to enlarge](#)

Biopharmaceutical Markets

Sales in biopharmaceutical markets for companies in the *LSA Indexes* grew nearly 7%. These sales for the majority of the companies in the *Index* grew in the low- to mid-single digits, with only a few businesses’ revenues growing at double-digit rates. Agilent Technologies, Biotage, Bio-Techne Biotechnology and Protein Platform (Bio-Techne), and Shimadzu Analytical & Measuring Instruments (AMI) were the strongest performers, driven by Asian and European markets. QIAGEN experienced solid growth in the mid-single digits, primarily due to strong growth in consumables-related revenue. However, biopharmaceutical sales were less robust for PerkinElmer, for which sales were flat.

Academic and Government Markets

Academic and government sales for companies in the *LSA Indexes* remained steady, growing moderately at around 2%. Sales for the majority of the companies in the *Index* grew in the low single digits, as Waters and Bio-Techne’s revenues for this sector both increased in the high single digits, driven by strong demand in the US market. However, a few companies, Bruker Scientific Instruments (BSI), Merck KGaA Life Science, PerkinElmer, performed below expectations, with sector revenues decreasing by low single digits due to softer-than-expected demand in Europe and Asia Pacific. Agilent performed moderately, with flat growth rates for this end-market. Overall, academic sales for the *Index* advanced from the previous quarter.

Industrial Markets

For industrial end-markets, companies in the *LSA Indexes* experienced a solid increase in sales, growing more than 4%. Growth for the quarter was driven by steady aftermarket and service revenues, along with a strengthened chemical & energy segment for Agilent. Sales growth remained steady, maintaining strength from the first quarter. Continuing from the first quarter into the second was the strengthening recovery of the chemical and energy segment, for which Agilent experienced a turnaround in segment growth of around a 7%–8% increase in sales. Additionally, Agilent’s sales in industrial markets grew in the high single digits primarily due to solid gains in the chemical and refining market, which accounts for 60% of its chemical & energy segment’s sales. Overall, industrial sales for most of the companies in the *Index* finished in positive territory, increasing in the mid-single digits. Bruker, however, continued its skid, with its industrial sales decreasing in the low single digits.

Applied Markets

Applied sales for the companies in the *LSA Indexes* increased over 8%, driven by strength overseas, particularly in China and emerging markets. All company sales for this market in the *Index* finished in positive territory, as most advanced by mid- to high-single digits. QIAGEN, with applied sales advancing double digits for the quarter, experienced strong sales growth from its human ID forensic solutions. Additionally, sales in applied markets for most geographic regions for the company performed strongly, with Asia Pacific and Japan in double-digit growth territory. Overall, applied sales for the *Index* remained solid and continues to increase from the first quarter from the first quarter and a year ago.

Food sales for companies in the *LSA Indexes* advanced over 6%, with all companies in positive territory except for PerkinElmer, for which the sales decreased by low single digits. PerkinElmer, however, performed well in the environmental market, with sales increasing mid-single digits. Similarly, Thermo Fisher Scientific Analytical Instruments and Waters both experienced mid-single digit growth in food-related sales, driven by sales in Europe. Overall, environmental sales for the *LSA Indexes* grew roughly 6% as well due to robust demand in China and Europe.

Geographic Markets

Geographically, Asia Pacific remained the strongest region, as sales climbed more than 10%, including double digit-growth for BSI, Bio-Techne, Shimadzu AMI and Waters. Within the Asia Pacific, sales in China were again strong, advancing over 12% for the companies in the *LSA Indexes*, primarily due to solid demand for life science, biopharmaceutical and environmental products. Companies within the double-digit sales growth range in China included BSI, PerkinElmer and Shimadzu AMI. Sales in Japan were also notably strong, increasing over 9%, with Biotage, HORIBA and Shimadzu AMI leading with double-digit sales growth.

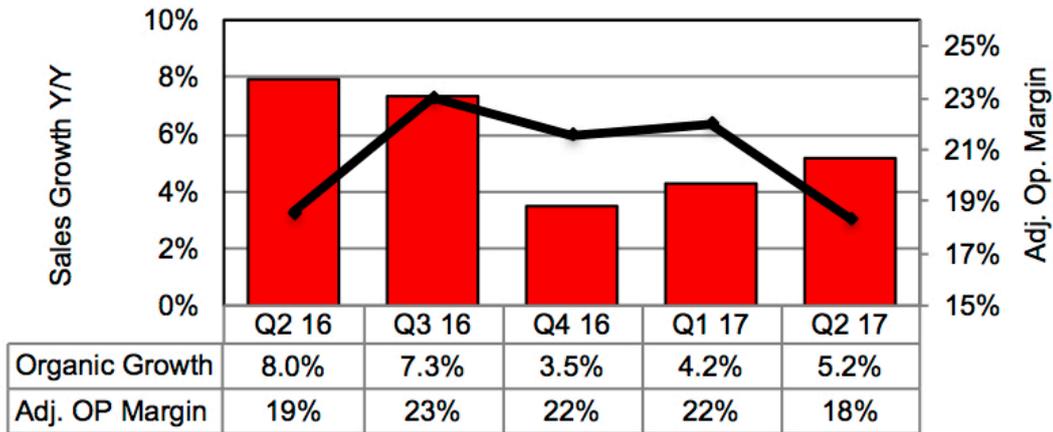
European sales for the *LSA Indexes'* companies increased by over 3%, led by strong biopharmaceutical, diagnostics and academia sales. Along with the strong overall market growth, extra selling days during the quarter also led to an increase in European sales, for which Agilent, Biotage and Bio-Techne saw solid double-digit sales growth.

LSA Index sales in the Americas climbed nearly 3%, with most companies performing in the mid-single digits. Sales in this region for Shimadzu AMI and Waters, however, decreased, and double-digit growth was limited, as only Biotage revenue advanced more than 20% in the region.

Life Science Sales Index

Second quarter **IBO** Life Science Index sales grew 4.9% on a reported basis to \$5,062.8 million. Organically, sales grew 5.2%, driven by strong demand in the biopharmaceutical and applied markets. Against the first quarter, sales were up 1.2 percentage points on a reported basis. Organically, sales advanced by 100 basis points against the first quarter. However, compared to last year, both organic and reported sales growth decreased. *Index* adjusted operating profit advanced 10.2% to reach \$929.1 million, whereas adjusted operating margin contracted 20 basis points to 18.4%.

Quarterly *IBO* Life Science Sales Index

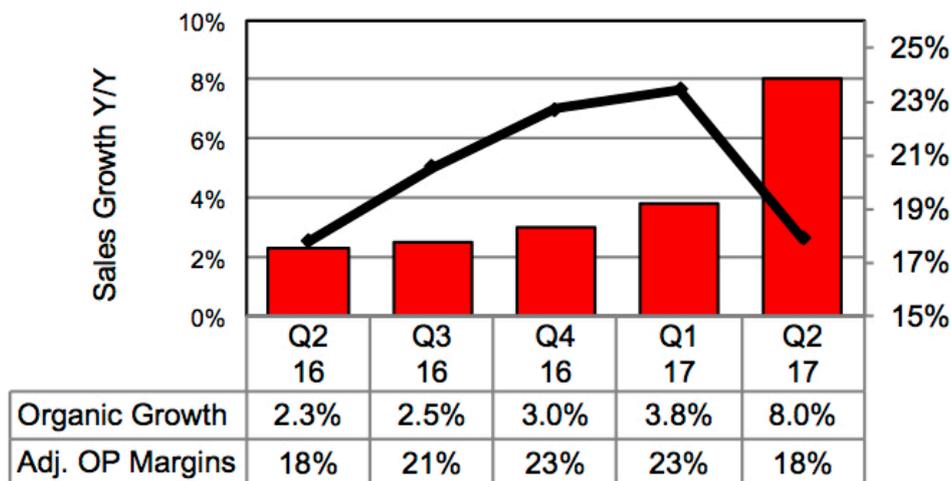


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Analytical Instrument Sales Index

Second quarter sales for the *IBO Analytical Instrument Index* jumped 7.5 % on a reported basis to \$4,167.9 million. Organically, sales grew 8.0% due to strong growth in Europe and a recovering industrial market. Additionally, stabilized academic and strengthened biopharmaceutical markets lifted sales. Compared to the first quarter, reported sales growth increased 2.3 percentage points, while organic sales growth increased by 3.3 percentage points. Against the second quarter of last year, both reported and organic sales growth were up, rising 6.2 and 5.7 percentage points, respectively, due to robust sales for Agilent, Thermo Fisher and Shimadzu AMI. Adjusted operating profit advanced 20.4% to \$746.4 million, while adjusted operating margin increased by 10 basis points to 17.9%.

Quarterly *IBO* Analytical Instrument Sales Index



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Onward and Upward: Germany's 2017 Targets for

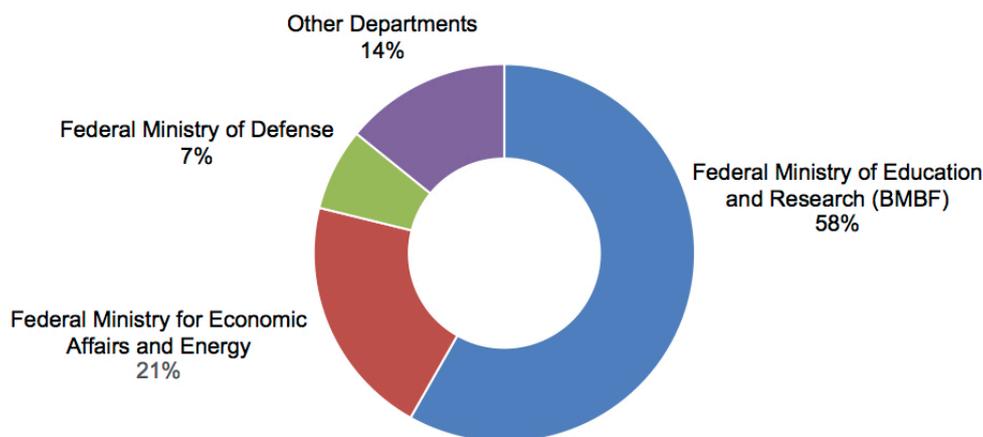
Government Science R&D Spending

Government science R&D in Germany has been on a steady increase for the last decade, with the country making large investments in scientific and technological innovations. According to the “Education and Research Figures 2017” report released by Germany’s Federal Ministry of Education and Research (BMBF), the German government’s expenditures on science R&D is estimated to total €17.2 billion (\$19.1 billion at €0.90 = \$1) in 2017, up 8.9% from the estimated 2016 target of €15.8 billion (\$17.6 billion). In 2017, R&D alone makes up 75% of total science R&D spending (total R&D) by the government. “Total R&D” as defined by the report includes R&D as well as “academic teaching and education, and other related scientific and technological activities,” such as feasibility studies and information services.

German Government R&D Expenditures by Funder

The vast majority of the German government’s 2017 expenditures on science R&D will be by the Federal Ministry of Research and Education (BMBF), while the Federal Ministry of Defense will have the smallest R&D expenditure (see pie chart below). Among “Other Departments,” the largest R&D expenditure will come from the Federal Ministry of Food and Agriculture, which has a target investment of €780 million (\$867 million). Much smaller in comparison is the Federal Ministry of Health’s R&D expenditures, which are targeted at €210 million (\$233 million) this year, and the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, whose target is €230 million (\$256 million).

**2017 Target Federal Govt. R&D Expenditures
R&D by Department**



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German Government R&D Spending by Sector

Health Research and the Health Industry is the sector that accounts for the largest portion of the German government’s science R&D expenditures. The sector’s 2017 science R&D spending is targeted to be €2.4 billion (\$2.7 billion), a 6.4% increase from 2016’s target, and 91% of the “total R&D” spending projected for this area in 2017. Figures for three other notable research segments that impact analytical instrument and lab product usage are shown in the table below.

German Federal Govt. R&D Funding by Research Area				
	2016		2017	
	R&D (€M)	% of "Total R&D"	R&D (€M)	% of "Total R&D"
Health Research and Health Industry	€ 2,273.8	90%	€ 2,419.1	91%
Energy Research and Energy Technologies	€ 1,307.2	75%	€ 1,482.9	77%
Large-scale Equipment for Basic Research	€ 1,252.2	100%	€ 1,281.1	100%
Nanotechnologies and Materials Technologies	€ 655.7	96%	€ 697.8	96%

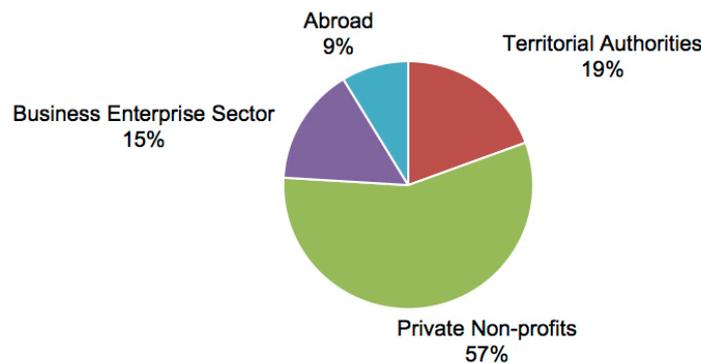
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Federal R&D programs in Germany account for the vast share of government funding and include the High-Tech Strategy initiative and sustainable energy programs. The Federal Ministry of Education and Research's (BMBF) expenditure on science R&D is also mostly within the Health Research and Health Industry sector, with a 2017 target of €2.2 billion (\$2.4 billion), up 5.9% to make up 100% of the Ministry's "Total R&D" in that sector. Also topping €1 billion (\$1 billion) in 2017 target for the BMBF's science R&D expenditure is Climate, Environment and Sustainability at €1.1 billion (\$1.2 billion) a 7.0% increase from 2016's target expenditure, and Large-scale Equipment for Basic Research at €1.3 billion (\$1.4 billion) a 2.3% increase. BMBF's science R&D spending target for Energy Research and Energy Technologies is expected to leap 9.9% in 2017 to €716.5 (\$796.1 million), while for Nanotechnologies and Materials Technologies it should rise 7.0% to €630.9 million (\$701.0 million).

German Government R&D Spending by Recipient

Private nonprofit organizations, including research funding organizations and the Helmholtz Association of Germany Research Centers, receive the most federal government science R&D funding in Germany. In 2015, the latest year covered in the report, by recipient groups, private nonprofit organizations received 57% of such funding, collecting €8.5 billion (\$9.4 billion). Territorial authorities, such as federal-owned research institutes, universities/university hospitals, and Länder (states) and communities, accounted for €2.9 billion (\$3.2 billion). Businesses and foreign sources received €2.3 billion (\$2.6 billion) and €1.3 billion (\$1.4 billion), respectively, that year. (See graph below.)

2015 German Govt. Expenditures on Science R&D by Recipient



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Combined, the R&D expenditures, including science and other fields, of the government and the Länder totaled €26.8 billion (\$29.8 billion) in 2016 measured by research objectives. Industrial Production and Technology received, €3.4 billion (\$3.8 billion), the highest among 13 categories of research objectives. This was followed by Health Research, which accounted for €1.4 billion (\$1.6 billion). The same year, Energy and Agriculture Research received €1.3 billion (\$1.4 billion) and €894.6 million (\$994.0 million), respectively, while Environment Research represented €795.1 million (\$883.4 million) of the government and Länder's total R&D expenditures.

German Government R&D Spending by Region

By region, the vast majority of science R&D expenditures are distributed in the southwestern region of Baden-Württemberg, in which €21.5 billion (\$23.9 billion) was invested in 2014. Bavaria followed, with R&D expenditure of €16.7 billion (\$18.6 billion), and the North Rhine-Westphalia region had expenditures of €12.6 billion (\$14.0 billion).

R&D Personnel in Germany

According to the Ministry's report, the number of R&D personnel is an important marker of R&D resources, and the number of R&D workers in Germany has been steadily increasing in all sectors over the last 10 years. In total, there were approximately 600,000 R&D workers in Germany within businesses, research institutions and universities as of 2014. The number of R&D personnel in Germany has significantly risen, with 99,000 more full-time workers in 2014 compared to 2007, with approximately a 12% increase in 2015. R&D personnel figures include people involved in actual research, as well as people in supporting or technical positions.

In 2014, there were almost 375,000 R&D personnel in the business sector, approximately 100,000 in the government sector and a little over 125,000 in the educational sector. By region, the Baden-Württemberg area had the highest number of R&D personnel at over 140,000, correlating with the high research activity and GERD in the region. Bavaria followed with approximately 115,000 R&D personnel in 2014, while North Rhine-Westphalia had almost 100,000.

Compared to selected OECD countries, such as Finland, France, Japan, the UK, Sweden, Canada and Italy, Germany is succeeded only by Sweden and Finland in regards to R&D personnel in 2014, meeting and overcoming France since 2011. With R&D personnel and GERD on the rise, Germany is steadily solidifying its place as a leader in global scientific innovation

Agilent Sues Former Chinese Employees

Beijing, China 8/22/17—In a civil lawsuit filed in China, Agilent Technologies alleges that Shanghai Echrom Electronic Technology and former Agilent employees infringed trade secrets related to its GC technology. According to Agilent, the complaint alleges that after leaving Agilent, the former employees started Echrom and used Agilent trade secrets to produce similar technology. Agilent is seeking to stop the use of its proprietary technology as well as compensation for its losses. "As a leading provider of scientific instruments and solutions for most of the world's 265,000 analytical laboratories, our intellectual property is at the core of our company's success," commented Michael Tang, Agilent's senior vice president and general counsel. "We are encouraged by the enactment of China's 2013 National Intellectual Property Strategy that protects the rights of all companies to pursue protection of intellectual property through China's judicial system."

In fiscal year 2016, China accounted for about 20% of Agilent's sales, or \$821 milion. Hewlett-Packard (now Agilent) established a joint venture in China in 1985. Recent foreign company plaintiffs that have won IP cases in Chinese courts include Apple, BMW and New Balance.

MilliporeSigma Invests in Single-use Chromatography

Billerica, MA 8/28/17—MilliporeSigma, the US and Canadian scientific product business of Merck KGaA, has agreed to acquire Natrix Separation for an undisclosed amount. Natrix develops and supplies hydrogel membrane products for single-use chromatography. It provides both anion exchange and cation exchange membranes. "The Natrix technology platform, and the development options and capabilities that this brings for single-use and rapid cycling chromatography, will allow us to accelerate our offering in mAb and vaccine manufacturing," stated MilliporeSigma

CEO Udit Batra. The transaction is expected to close in the third quarter.

MilliporeSigma and Natrix has previously partnered for product development, including development of membrane purification products for Protein A resins (see [IBO 12/15/16](#)). According to Natrix, advantages of its HD membranes, which utilize convective mass transfer and a microporous hydrogel-filled support matrix, include high flow rates, simultaneous bonding of proteins by multiple charge sites and use with higher-concentrate feed streams. Although single-use technology has experience greater adoption for upstream bioprocessing, the number of downstream solutions are also growing. In 2015, Pall (now Danaher) acquired Targon Biosystems and its BioSMB (Simulated Moving Bed) technology (see [IBO 4/15/15](#)), another form of single-use chromatography for continuous processing.

Shiseido Sells LC Business

Tokyo, Japan 8/29/17; Osaka, Japan 8/29/17—Japanese firm Shiseido has agreed to sell its chromatography business, Shiseido Irica Technology, to chemical maker Osaka Soda for an undisclosed amount. Both companies provide LC products. For the nine months ending December 31, 2016, Shiseido Irica sales totaled ¥601 million (\$5.5 million at ¥108.76 = \$1), while operating profit was flat at ¥11 million (\$0.1 million). Based in Kyoto with a Chinese subsidiary, the business has 27 employees. Osaka Soda stated that the purchase will allow it to offer a wider range of chromatography products and to increase sales in China. The transaction is expected to close in December.

Shiseido Irica offers the silica-based Capcell Park and core-shell Capcell Core columns, as well as other column types for analytical LC. It also sells the Nanospace micro-HPLC system. Osaka Soda's LC business consists of bulk silica gel media and columns for preparative, analytical and process LC. Osaka Soda's other chemical products include APIs and intermediates.

Brooks Acquires Biobank Software

Chelmsford, MA 8/22/17; Frederick, MD 8/24/17—Brooks Life Sciences, a provider of sample lifecycle management solutions for bioscience, has acquired certain assets from software provider RURO, including the FreezerPro web-based software. Financial details were not provided. Brooks Life Sciences has also entered into an exclusive license agreement to sell RURO's BioBankPro software, which integrates the functionality of FreezerPro with external data sources and instruments. "These biorepository software tools are a natural fit into our life sciences portfolio as informatics integrates our services, consumables and infrastructure products by capturing comprehensive sample management information for customers globally," stated Brooks Life Sciences President Dusty Tenney.

A company with 40 employees and approximately 800 customers, RURO supplies software for the management of biorepository samples. "What's next for RURO? LimitLIS, RURO's Laboratory Information System (LIS), continues to grow its market share, especially among laboratories in the field of toxicology," said RURO CRO Vlad Lebedev. "Combined with our ISO 9001-certified deployment service for Limfinity enterprise laboratory software solutions and our suite of validation and compliance services, RURO is poised to spring up everywhere."

Brooks Life Sciences' software offerings currently include the ISIDOR (Integrated Sample Intelligence Data Online Repository) BioStudies platform for biobank data management and integration. This acquisition further adds the company's offerings for biobanks. In the company's fiscal third quarter conference call in August, Brooks Automation President and CEO Steven Schwartz noted the Life Sciences Systems segment's interest in informatics acquisitions, which have a favorable margin.

Illumina Spins Off Forensics Business

San Diego, CA 8/24/17— DNA sequencing and array-based technology firm Illumina has partnered with Telegraph

Hill, a venture capital and growth equity company, to form Verogen. The independent company will have certain exclusive rights to Illumina's NGS technology for forensics customers, and will be the sole provider of the system as well as the ForenSeq DNA Signature Prep Kit and the ForenSeq Universal Analysis Software. Illumina will continue to manufacture the MiSeq FGx system and consumables. "The MiSeq FGx Forensic Genomics System continues to lead the transition to NGS, and we believe the best way to realize the full potential of this business is to create a company with a management team dedicated to using genomics to make a safer and more just world," stated Dawn Barry, vice president, New and Emerging Markets at Illumina. Related Illumina staff and infrastructure will transition to the new company. Kirk Malloy, former senior vice president of Applied Genomics at Illumina, will serve as the new company's CEO.

With this decision, Illumina is pursuing the spin off strategy it employed with Helix for consumer NGS testing and GRAIL for cancer testing. Seemingly, the company is focusing on its core initiatives and product markets. Illumina launched the MiSeq FGx system in 2015.

USITC Initiates Investigation of 10x Genomics on Behalf of Bio-Rad

Washington, DC 8/31/17—The US International Trade Commission (USITC) has announced that it has begun an investigation involving 10x Genomics' microfluidic devices following a July complaint by Bio-Rad Laboratories and Lawrence Livermore National Security. The complaint concerns the import of certain devices that infringe the complainants' patents. Bio-Rad and Lawrence Livermore are requesting a limited exclusion order and a cease and desist order.

Also in July, Bio-Rad and Lawrence Livermore filed a patent infringement complaint against 10x Genomics in US District Court seeking damages for infringement of seven patents related to Bio-Rad's Droplet Digital (ddPCR) technology and products for digital PCR by 10x's Chromium drop-based emulsion system. According to the complaint, 10x Genomics was founded by former Bio-Rad employees. The complaint states, "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. The plaintiffs are requesting injunctive relief, compensation and enhance damages.

Roka Bioscience Prepares for Liquidation

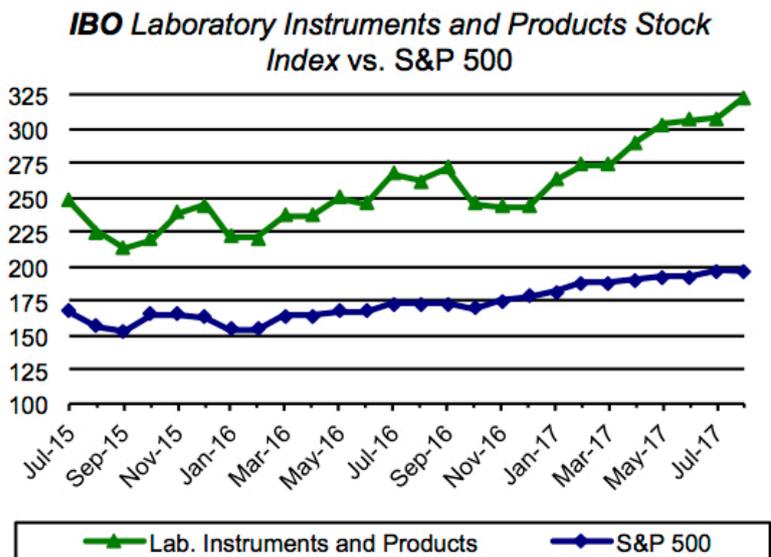
Warren, NJ 8/17/17—Publicly held Roka Bioscience, a provider of food safety testing solutions, has agreed to sell its assets to Rokabio, a newly formed subsidiary of the Institute for Environmental Health (IEH), for \$17.5 million in cash. IEH supplies risk management services for the food industry. Roka stated that this is the first step in a possible plan to liquidate the company.

The company's Atlas Detection Assays and Atlas instrument for fully automated foodborne pathogen by testing rRNA, mRNA and DNA. In 2016, the company generated revenues of \$7.2 million, a 21.0% increase, and an operating loss of \$29.5 million, but its stock price has plunged from a high of \$46.90 per share in the first quarter 2015 to a low of \$1.43 as of August 25. For the six months ending June 30, Roka recorded a 66% increase in operating loss to \$24.7 million. The company completed an IPO in 2014 (see [IBO 7/31/14](#)).

IBO Lab Instrument Stock Index Surprises in August

Despite the recent disaster caused by Hurricane Harvey, the US national economy remains strong as estimated GDP increased 3.0% in the second quarter, revised upwards from 2.6%, exceeding analysts' expectations of a 2.7% increase. The growth in GDP reflected strong consumer spending. Furthermore, US equity markets finished in

positive territory for the month, as the NASDAQ Composite led the surge, climbing 1.3%. The Dow Jones Industrial Average (DJIA) increased 0.3%, while the S&P 500 closed nearly flat, at 0.1%. Year to date, the NASDAQ composite is up 19.4%, leading the US equity markets in percentage growth. The DJIA is up 11.1% year to date, while the S&P 500 follows closely at 10.4%.



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Laboratory Instruments and Products Stock Index

For August, the *Index* advanced 5.2% to 323.22, while increasing 33.0% for the year. **Pacific Biosciences** led the *Index*, leaping 51.8% for the month. Conversely, **MTS Systems** posted a loss of over 8%, closing at \$48.40 for the month.

Agilent Technologies' shares grew 8.2% for the month. On August 15, the company reported fiscal third quarter adjusted EPS of \$0.59, surpassing analysts' expectations of \$0.52 and its own expectations of \$0.50. Year over year, Agilent's shares have increased 20.4%, as strong earnings were backed by sales growth in the pharmaceutical, consumables and chemical end-markets (see [Second Quarter Results](#)). For the fiscal fourth quarter, Agilent expects adjusted EPS to be \$0.60-\$0.62. As for the full fiscal year, Agilent projects an adjusted EPS range of \$2.29-\$2.31, an upgrade from the previously projected \$2.13-\$2.18.

Becton, Dickinson shares fell 1.0% for the month. On August 3, the company reported fiscal third quarter adjusted EPS of \$2.46, a 4.7% increase. Compared to analysts' expectations, Becton, Dickinson outperformed by \$0.02 for adjusted EPS. The company raised its fiscal year adjusted EPS to \$9.42-\$9.47 from the previously projected \$9.35-\$9.45 due to favorable foreign currency movement.

Shares for **Bio-Rad Laboratories** declined 7.6% during August, as the company's second quarter sales declined 2.3%. Sales slipped for the quarter due to a slowdown in productivity and a decline in volume. The company reported an adjusted EPS of \$0.58, falling short of analysts' expectations of \$0.63. Year over year, adjusted EPS declined as well, decreasing 4.9%. For the full year, Bio-Rad reaffirmed its organic sales growth projection of 4.0% but downgraded its currency-neutral operating margin projection from 7% to 6%-6.5%.

Bruker shares remained steady for the month, growing 1.4%. On August 3, the company recorded second quarter adjusted EPS of \$0.23, representing a 15.0% increase. Bruker surpassed analysts' adjusted EPS expectations of \$0.20 by \$0.03. For the year, Bruker forecasts adjusted EPS to be \$1.08-\$1.12, an upgrade from its previous projection of \$1.05-\$1.09.

Fluidigm shares vaulted 21.5% despite the company having negative quarterly earnings. On August 3, the company reported sales figures for instruments and consumables, in which each declined by 25.0% and 16.5%, respectively. However, the company improved its product margins and earnings year over year. Fluidigm expects third quarter

revenues to be around \$24-\$26 million, an upgrade from the previously projected \$22-\$24 million.

Shares for **Illumina** leaped 17.6% in August. However, earnings for the company declined year over year, as adjusted EPS reached \$0.82, falling \$0.04 short of last year's second quarter adjusted EPS. On August 1, the company reported its earnings, exceeding analysts' expectation of \$0.68 adjusted EPS by \$0.14. For the full year, Illumina projects its adjusted EPS to be \$3.60-\$3.70.

Kewaunee Scientific reported a 13% increase in its quarterly cash dividend to 17 cents per share outstanding. On August 29, the company reported its fiscal first quarter results, in which adjusted EPS fell short of last year's adjusted EPS. However, shares for the month still rose 2.8%.

Luminex shares slipped 5.4% despite the company beating analysts' EPS expectations. Luminex reported second quarter earnings on Aug 7, for which adjusted EPS reached \$0.20, topping analysts' expectations of \$0.09 by \$0.11. The slip was primarily due to the 23.1% decline in adjusted EPS. For the third quarter, Luminex expects revenues to be between \$73-\$75 million. As for the full year, Luminex maintained its previous sales projection of \$300-\$310 million.

MTS Systems shares slid 8.2% for the month. The company reported fiscal third quarter earnings on August 14, surpassing adjusted EPS estimates of \$0.46 by \$0.10, reaching \$0.56 for the quarter. However, adjusted EPS declined 28.2% year over year. Even so, MTS Systems raised its full-year GAAP EPS guidance to \$1.15-\$1.30 from \$0.80-\$1.20.

Despite a 53% year-over-year revenue growth, **NanoString Technologies'** shares remained flat. Adjusted EPS beat analysts' expectations by \$0.15 to hit -\$0.26, as the company reported its second quarter earnings on August 8. The company upgraded its full-year revenue forecast to \$114-\$118 million, versus the previously projected \$100-\$105 million. Net loss per share was upgraded to -\$2.03- -\$2.20 from -\$2.51- -\$2.69.

Pacific Biociences shares soared nearly 52% for the month to close at \$66.99 per share. On August 3, the company reported a strong second quarter performance from its product and services segment. However, EPS for the quarter was -\$25.5 million, declining even further from last year's -\$18.5 million. Adjusted EPS for the quarter, -\$0.26, missed analysts' expectations by two cents, which declined 23.8% year-over-year.

Shares for **PerkinElmer** grew slightly by 1.8% for the month. On August 3, the company reported its second quarter earnings, in which adjusted EPS grew 6.3% to \$0.67, in line with analysts' expectations. Adjusted operating margins rose 70 basis points to 18.2%. For the full year, PerkinElmer upgraded its adjusted EPS guidance to \$2.84-\$2.92 from \$2.80-\$2.90.

Bio-Techne, which rose 6.8% for the month, reported fiscal fourth quarter earnings on August 8. Adjusted EPS increased 18.5% to \$1.09, beating analysts' expectations of \$0.99 adjusted EPS. For the full fiscal year, adjusted EPS totaled \$3.72, representing a 3.0% increase. Adjusted operating margin fell 20 basis points to 38.8% for the quarter, primarily due to negative impacts from the mix of acquisitions.

Similarly, **VWR** also beat analysts' expectations, surpassing them by \$0.05 to \$0.49 adjusted EPS, an increase of 16.7%. However, shares remained flat for the month.

Company	Date Rep.	Fiscal Quarter	2017 Adj. EPS	Analyst Consensus	Vs. Estimate	YOY Growth	2016 Adj. EPS
Laboratory Instruments and Products Stock Index							
A	15-Aug	Q3	\$0.59	\$0.52	↑	\$0.07 20%	\$0.49
BDX	3-Aug	Q3	\$2.46	\$2.44	↑	\$0.02 5%	\$2.35
BIO	3-Aug	Q2	\$0.58	\$0.63	↓	-\$0.05 -5%	\$0.61
BRKR	3-Aug	Q2	\$0.23	\$0.20	↑	\$0.03 15%	\$0.20
FLDM	3-Aug	Q2	(\$0.39)	(\$0.60)	↑	\$0.21 17%	(\$0.47)
ILMN	1-Aug	Q2	\$0.82	\$0.68	↑	\$0.14 -5%	\$0.86
KEQU	29-Aug	Q1	\$0.42	NA		NA -13%	\$0.48
LMNX	7-Aug	Q2	\$0.20	\$0.09	↑	\$0.11 -23%	\$0.26
MTSC	14-Aug	Q3	\$0.56	\$0.46	↑	\$0.10 -28%	\$0.78
NSTG	8-Aug	Q2	(\$0.20)	(\$0.35)	↑	\$0.15 64%	(\$0.55)
PACB	3-Aug	Q2	(\$0.26)	(\$0.24)	↓	-\$0.02 -24%	(\$0.21)
PKI	3-Aug	Q2	\$0.67	\$0.67	→	\$0.00 6%	\$0.63
TECH	8-Aug	Q4	\$1.09	\$0.99	↑	\$0.10 18%	\$0.92
VWR	31-Jul	Q2	\$0.49	\$0.44	↑	\$0.05 17%	\$0.42
Diversified Laboratory Stock Index							
AME	2-Aug	Q2	\$0.65	\$0.62	↑	\$0.03 10%	\$0.59
TDY	3-Aug	Q2	\$1.74	\$1.25	↑	\$0.49 32%	\$1.32
XYL	1-Aug	Q2	\$0.59	\$0.57	↑	\$0.02 23%	\$0.48

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Diversified Instrumentation Stock Index

The *Index* increased 0.8% in August to 239.54 and is up 16.5% year to date. Most companies in the *Index* traded higher for the month, except for **Illinois Tool Works** and **Corning**, which fell 2.3% and 1.3%, respectively.

On August 2, **AMETEK** reported its second quarter earnings. Company shares grew 2.7%, as adjusted EPS rose above analysts' expectations, as well as prior-year figures. For the third quarter, AMETEK expects adjusted EPS of \$0.60-\$0.62, an increase of 7%-11%. As for the full year, the company projects adjusted EPS to be between \$2.46 and \$2.52, an upgrade from its previous projection of \$2.40-\$2.48.

Shares for **Teledyne Technologies** rose 10.1% for the month, primarily due to strong sales figures in each of the company's segment and in all major product lines. On August 3, the company reported its quarterly earnings, as adjusted EPS reached \$1.74, topping analysts' estimates of \$1.25, increasing 31.8% year-over-year. For the third quarter, the company expects adjusted EPS to be in the range of \$1.60-\$1.65. As for the full year, Teledyne projects adjusted EPS to be between \$6.15 and \$6.25, an upgrade from its previous projection of \$5.76-\$5.86.

Xylem shares expanded 9.4% for the month, as adjusted net income rose 23.0% to \$106 million, translating into \$0.59 adjusted EPS. Analysts' estimates for adjusted EPS were topped, as Xylem experienced a better-than-expected second quarter due to strong organic sales growth. For the full year, Xylem upgraded its adjusted EPS guidance \$2.23-\$2.38 to \$2.30-\$2.40.

International

Asia Pacific equity markets traded moderately this month, with China's Shanghai Composite and Hong Kong's Hang Seng leading the *Index*, growing 2.7% and 2.4%, respectively. Similarly, Thailand's SET Index traded at 2.5% higher for the month. Conversely, India's Sensex30 and South Korea's Kospi Index traded 2.4% and 1.6% below last month's figures, respectively.

Shares for the Pacific Rim companies in the **IBO** Stock Table finished mostly in negative territory, with only **GL**

Sciences and **Techcomp** on positive grounds. On August 17, **GL Sciences** recorded a strong fiscal 2018 first quarter, in which sales increased 20.7%, lifting company shares by 13.4%. Techcomp's shares climbed 8.0% for the month due to a solid quarterly performance. The company increased revenues by 2.2% for its first half (see [Bottom Line](#)), lifting company shares by 45.7% for the year. **Precision System Science** led the decline with a 22.4% contraction in share price. Similarly, **JEOL**'s shares fell 13.8% for the month, due to a 17.2% decrease in total revenues. However, company shares still remain positive for the year, up 1.8%. **HORIBA**'s shares fell slightly, down 0.3%, while its total second quarter increased by 7.6%. For the year, company shares are up 24.6%. **Shimadzu**'s shares also fell into negative territory, down 7.0%. However, the company reported a sales growth of 8.5% primarily due to its LC/MS products. For the year, Shimadzu's shares are still in positive territory, up 8.5%.

All of the European equity markets performed negatively, with the exception of the UK's FTSE 100, which increased 0.8% for the month. **Tecan** led European shares in the **IBO** Stock Table with an increase of 6.3%, and **Abcam** came in second, with a 3.6% bump. On August 16, Tecan recorded a strong first half result, with total revenues rising 7.7% and Life Science sales increasing 16.4% (see [Bottom Line](#)). For the year, Tecan shares are up 20.6%. **Merck KGaA** reported second quarter earnings on August 3, in which company revenues rose 4.6%, or 4.2% organically. Share price slipped 0.6% for the month and is down 6.8% for the year. **Spectris** and **Horizon Discovery** slid the most, decreasing 5.9% and 5.2%, respectively.

Company: Exchange	Market Value (US M)	52 Week Range		Price 8/31/17	Change 1 Month	Change YTD	P/E (ttm)	EPS (ttm)
		Low (\$)	High (\$)					
Laboratory Instruments and Products								
Agilent Technologies: n	\$19,432	42.92	61.84	\$64.72	8.2%	42.1%	33	1.99
Becton, Dickinson and Company: n	\$43,878	161.29	206.63	\$199.44	-1.0%	20.5%	58	3.44
Bio-Rad Laboratories: n	\$7,048	143.39	239.91	\$217.82	-7.6%	19.5%	436	0.50
Bio-Techne: o	\$4,346	95.68	117.42	\$123.78	6.8%	20.4%	67	1.86
Bruker: o	\$4,603	19.59	27.85	\$29.09	1.4%	37.3%	29	1.00
Enzo Biochem: n	\$503	4.88	9.68	\$11.25	3.7%	62.1%	16	0.71
Fluidigm: o	\$110	4.31	11.05	\$4.57	21.5%	-37.2%	NM	-2.46
Harvard Bioscience: o	\$97	2.25	3.90	\$3.10	10.7%	1.6%	NM	-0.13
Illumina: o	\$25,556	119.37	189.48	\$204.46	17.6%	59.7%	41	4.99
Kewaunee Scientific: o	\$69	16.38	27.60	\$25.75	1.8%	5.3%	16	1.66
Luminex: o	\$878	17.64	23.75	\$19.33	-5.4%	-4.4%	60	0.32
Mettler-Toledo: n	\$15,236	343.61	582.20	\$605.09	5.6%	44.6%	83	7.32
MTS Systems: o	\$1,007	41.53	59.00	\$48.40	-8.2%	-14.6%	38	1.27
NanoString Technologies: o	\$328	11.89	23.45	\$15.45	1.6%	-30.7%	NM	0.00
Pacific Biosciences: o	\$303	3.46	10.40	\$4.95	51.8%	30.3%	NM	-0.91
PerkinElmer: n	\$7,255	45.35	63.03	\$66.99	1.8%	28.5%	20	3.31
QIAGEN: o	\$7,713	20.73	33.06	\$32.17	-2.0%	14.8%	101	0.32
Thermo Fisher Scientific: n	\$69,176	139.07	173.64	\$187.14	6.6%	32.6%	33	5.74
VWR: o	\$4,356	24.42	37.25	\$33.02	0.1%	31.9%	31	1.08
Waters: n	\$14,009	131.35	179.07	\$183.48	5.8%	36.5%	28	6.63
Diversified Laboratory								
AMTEK: n	\$14,096	43.28	61.37	\$63.25	2.7%	30.1%	28	2.28
Corning:	\$27,238	18.88	29.72	\$28.76	-1.3%	18.5%	13	2.20
Danaher: n	\$59,942	73.42	88.01	\$83.42	2.4%	7.2%	27	3.13
Honeywell	\$101,485	105.25	135.00	\$138.27	1.6%	19.4%	21	6.45
Illinois Tool Works: n	\$49,286	98.32	142.82	\$137.51	-2.3%	12.3%	22	6.18
Roper Technologies: n	\$23,419	159.28	228.21	\$230.66	-0.8%	26.0%	35	6.68
Teledyne Technologies: n	\$4,748	92.52	137.00	\$150.06	10.1%	22.0%	28	5.43
Xylem: n	\$9,422	42.52	54.99	\$62.07	9.4%	25.3%	40	1.55
Laboratory Instruments and Products				323.22	5.2%	33.0%	68	
Diversified Laboratory				239.54	0.8%	16.5%	27	
Dow Jones Industrial Average				21,948.10	0.3%	11.1%		
S&P 500				2,471.65	0.1%	10.4%		
NASDAQ Composite				6,428.66	1.3%	19.4%		
Region	Market Value	52 Week Range		Price	Change	Change	P/E	EPS
Company	(Local M)	Low (L)	High (L)	8/31/17	1 Month	YTD	(ttm)	(ttm)
Pacific Shares								
GL Sciences: t	¥17,076	557	1,494	¥1,526	13.4%	72.4%	21	¥72.92
Hitachi High-Technologies: t	¥540,625	3,360	5,040	¥3,925	-3.6%	-16.8%	15	¥254.49
HORIBA: t	¥286,671	4,305	7,440	¥6,740	-0.3%	24.6%	21	¥320.44
JEOL: t	¥50,714	356	648	¥519	-13.8%	1.8%	84	¥6.17
Precision System Science: os	¥13,077	334	1,011	¥630	-22.4%	54.8%	NA	¥71.44
Shimadzu: t	¥598,358	1,394	2,254	¥2,021	-7.0%	8.5%	23	¥89.79
Techcomp: hk	HKD 521	1.07	3.21	HKD 1.88	8.0%	45.7%	1	¥0.37
European Shares (London)								
Abcam: l	£2,168	7.14	10.34	£10.64	3.6%	38.7%	53	£0.20
Halma: l	£4,144	8.79	11.82	£10.93	-0.5%	21.8%	32	£0.34
Horizon Discovery: l	£231	1.05	2.71	£2.44	-5.2%	69.4%	NA	-£0.12
Oxford Instruments: l	£601	6.10	11.39	£10.49	0.0%	43.3%	NA	-£0.36
Scientific Digital Imaging: l	£22	0.13	0.31	£0.25	0.0%	32.4%	14	£0.02
Spectris: l	£2,757	18.40	28.69	£23.14	-5.9%	0.0%	269	£0.09
European Shares (Other)								
Biotage: st	SEK 3,818	33.90	67.50	SEK 59.00	1.3%	28.5%	36	SEK 1.63
Datacolor: s	CHF 124	538.00	800.00	CHF 750.00	0.0%	15.4%	18	CHF 41.39
Merck KGaA: g	€ 11,946	88.20	115.20	€ 92.43	-0.6%	-6.8%	26	€ 3.59
Sartorius: g	€ 6,028	65.01	90.12	€ 80.50	2.2%	10.6%	51	€ 1.58
Tecan: s	CHF 2,159	148.80	187.30	CHF 191.70	6.3%	20.6%	41	CHF 4.66

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Second Quarter Results: Agilent, Danaher, Merck KGaA and Shimadzu

CY Q2 2017 Results									
Company	Revenues			Rev. Growth Summary			Adj. Operating Profit		
	Rev. (M)	% of Co. Rev.	Growth	Curr.	Acq./Div.	Org. Growth	(\$M)	% Growth	
Agilent Technologies	\$1,114.0	100%	6.7%	-0.9%	0.1%	7.5%	\$239.0	11.2%	
Danaher	\$4,510.1	100%	6.3%	-1.5%	5.8%	2.0%	\$683.7	-3.7%	
Merck KGaA (Life Science)	€ 1,495.0	38%	4.5%	0.1%	0.3%	4.2%	€ 221.0	33.1%	
Shimadzu AMI	¥46,112.0	61%	8.6%	1.3%	0%	7.3%	¥3,884.0	-13.8%	

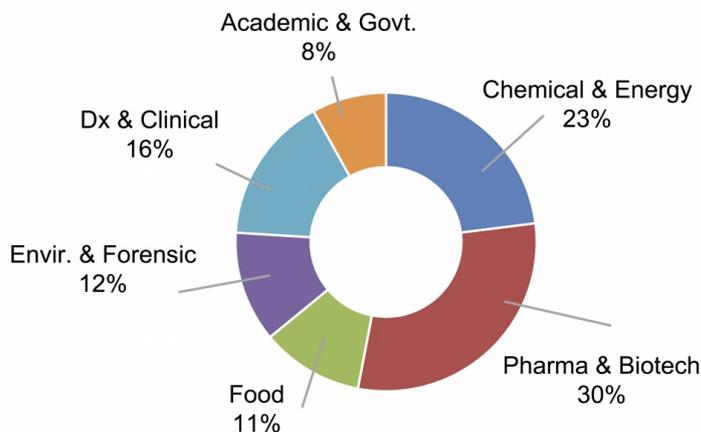
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Agilent Raises Full-Year Forecast

Agilent Technologies continued its solid growth, with fiscal third quarter sales increasing 6.7%, 7.5% organically, to \$1.11 billion. The company's operating profit reached \$236 million, an 11.3% increase, whereas its operating margin increased by 90 basis points to 21.2%. The company noted its strong third quarter performance was due to its Chemical & Energy and Pharmaceutical end-markets, for which sales to both increased by 10%.

In the Analytical Laboratory end-market, revenues grew 8% organically, while the Academia & Government end-market sales experienced a 3% increase, driven by a strong quarter in Europe and double-digit growth in the cell analysis, spectroscopy and services markets. Revenue for the Food business expanded 2% due to sound market growth and strong European performance. Environmental & Forensics sales grew a substantial 7%, driven by the Americas and Asia Pacific markets. In the Diagnostics and Clinical end-markets, revenue grew 6% organically, led by strength in Europe, pathology and companion diagnostics.

**Agilent Revenues Breakdown
Q3 FY17**



[Click to enlarge](#)

By segment, Life Sciences and Applied Markets Group (LSAG) sales advanced 5.4% to \$531 million, led by the Chemical & Energy, Environmental and Pharmaceutical end-markets. Organically, LSAG sales grew 7.0%, as Europe and China both saw double-digit organic growth. Operating margin for the segment jumped 220 basis points to 21.3%.

Sales for the Agilent CrossLab Group (ACG) grew 7.2%, 7.5% organically, reaching \$386 million. The segment continued its strong sales performance, led by the Pharmaceutical, and Academia & Government end-markets. Additionally, both services and consumables continued their healthy sales growth across all end-markets and regions. Operating margin increased by 70 basis points to hit 23.4%.

Agilent Technologies Q3 FY17				
	Rev. (\$M)	% of Rev.	% Rev. Growth	Org. Growth
Life Sciences & Applied Markets	\$531.0	48.0%	5.4%	7.0%
Agilent CrossLab	\$531.0	34.0%	5.4%	7.5%
Diagnostics & Genomics	\$386.0	18.0%	7.2%	8.3%

Click to enlarge

Agilent's Diagnostics and Genomics Group (DGG) recorded 9.4% growth in sales, reaching \$197 million. Organically, sales for the segment increased 8.3%, as currency effects negatively impacted sales growth. The segment's robust growth came largely from the Pharmaceutical, and Diagnostics & Clinical end-markets. DGG's solid performance extended across all markets and regions, led by strong demand for pathology products and companion diagnostics services, as well as double-digit sales growth in Nucleic Acid Solutions. In particular, Asia and Europe both produced double-digit organic sales growth, leading regional gains. DGG's operating margin followed company expectations, decreasing 190 basis points to 16.9%.

For the company as a whole, Americas revenue grew 4%, reaching \$378 million to account for 34% of the company's total sales. Sales growth in Europe was better than expected, increasing 12% to \$326 million. The Asia Pacific region experienced moderate sales growth, rising 5% to account for 37% of total company revenues. Within Asia Pacific, sales for Japan decreased 4%, while China continued its strong growth, leading the region's sales with a 9% increase. Sales for the rest of Asia Pacific increased 1%.

For the fiscal fourth quarter, Agilent expects revenues to be \$1.15-\$1.17 billion, a 3.6%-5.4% increase, with organic revenue up 3.5%. As for fiscal year 2017, Agilent projects revenue to be between \$4.435 billion and \$4.455 billion, an upgrade over its previous \$4.36-\$4.38 billion projection. The company expects 6% organic growth in sales, and an adjusted operating margin of 21.8%, a 110 basis points increase.

Danaher Life Science Sales Exceed Expectations

Danaher reported sales growth of 6.3%, 1.8% organically, to \$4.5 billion. Exchange rates negatively impacted sales growth by 1.5%, while acquisitions added 6% to sales growth.

Selected Danaher Segments Q2 2017					
	Rev. (\$M)	Rev. Growth	Curr.	Acq./Div.	Org. Growth
Life Sciences	\$1,384.3	4.2%	-2.0%	2.5%	3.7%
Environmental & Applied Solutions	\$983.2	4.5%	-1.5%	3.0%	3.0%

Click to enlarge

For Danaher's Life Sciences segment (LS), revenue grew 4.2% to \$1.38 billion. Organically, segment sales increased 3.5%, faster than expectations. LS operating profit grew 15.3% to \$221.6 million, resulting in a 16.0% operating margin. LS operating margin increased 150 basis points, while organic operating margin grew 120 basis points. The continued operating margin expansion was mostly driven by consistent execution across the LS platform.

SCIEX sales organically increased by mid-single digits, due to strong performances in the pharmaceutical and food testing end-markets. In the academic market, demand was steady. MS sales grew primarily due to strong sales growth in China and in Western Europe. MS sales showed strength across various markets, including food, pharmaceutical and academia.

Similarly, Beckman Coulter Life Sciences (BCLS) sales grew mid-single digits as well, driven by the centrifugation

and automation product lines. Additionally, several key automation projects contributed to strong results in North America. Overall, BCLS maintained a positive performance across all major product lines. China, in particular, continued its strong performance as a result of increased investments in biopharmaceutical and life science research.

Leica Microsystems' organic sales grew slightly, in the low single-digits, primarily due to a strong performance across high-growth markets. However, sales in developed markets were less robust.

Organic growth for Pall increased in the low single-digits. For Pall Life Science, growth was particularly strong in the biopharmaceutical market, with sales increasing by double-digits for single-use technologies. For Pall Industrial, sales grew moderately, driven by microelectronics and aerospace sales.

For Danaher's Environmental & Applied Solutions segment, sales grew 4.5% to \$983.2 million. Organically, revenue rose 3.0%, while organic operating profit increased by 120 basis points. The segment's water quality business grew low single-digits. Organic revenue at Hach also increased low single-digits, primarily due to strong quarter performance in China, in addition to an expanding industrial end-market. Other businesses that contributed to the segment's sales growth included product identification, ultraviolet water disinfection and chemical treatment solutions. Segment operating margin increased 70 basis points to 23.9%. Geographically, segment revenue growth was led by China, partially offset by Latin America.

For the remaining half of 2017, Danaher expects organic sales growth to be higher compared to the first half. For the third quarter, the company projects 3% organic growth in sales.

Process Solutions Leads Merck KGaA Life Science Growth Once Again

Merck KGaA's Life Science sector (LS) sales advanced 4.6% in the second quarter to reach €1.49 billion (\$1.76 billion at €0.85 = \$1). Organically, segment sales grew 4.2%, as foreign currency effects and acquisitions positively impacted sales by 0.1% and 0.3%, respectively. However, divestment of business activities in Pakistan offset acquisition sales growth. Organic growth remained above market levels, driven by Process Solutions. The sector continued its strong growth due to increased demand in the biopharmaceutical industry.

Merck KGaA Life Science Q2 FY17						
	Rev. (€M)	% of Rev.	% Rev. Growth	Currency	Acq./ Div.	Org. Growth
Research Solutions	€ 526.0	35%	1.4%	0.1%	-0.4%	1.7%
Process Solutions	€ 570.0	38%	7.3%	0.0%	-10.0%	7.5%
Applied Solutions	€ 399.0	27%	5.2%	0.1%	1.9%	3.1%

[Click to enlarge](#)

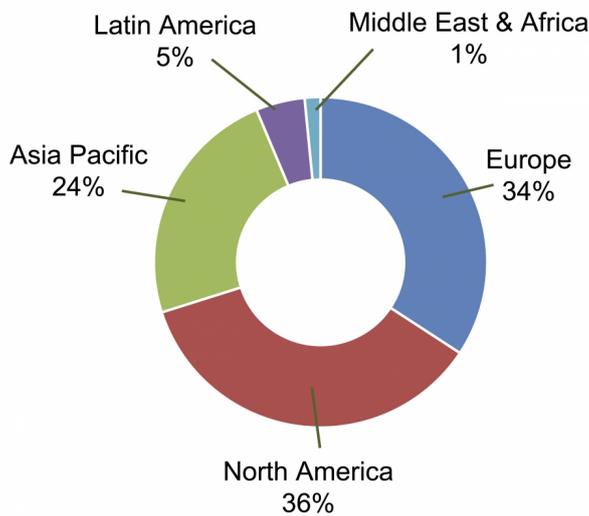
Sales for the Process Solutions segment of LS grew 7.3%, 7.5% organically, to €570 million (\$673 million). With the highest growth rate among LS businesses, Process Solutions represented 38% of total LS sales. The strong second quarter performance came primarily from growth across all businesses and portfolios within the segment. Specifically, ongoing strength in single-use and service activities, as well as an improved small molecule business, contributed the most to segment performance.

Applied Solutions sales increased 5.2%, 3.1% organically, to €399 million (\$471 million), accounting for 27% of total LS revenue. Organic sales growth was primarily driven by bio-monitoring products in the pharmaceutical business as well as the expanding demand in the Lab Water business. Acquisitions increased sales by 1.9%, driven by a strong performance from BioControl Systems, a food safety testing company.

Research Solutions sales increased 1.4%, 1.7% organically. Segment revenue reached €526 million (\$621 million) to account for 35% of total LS sales. The slight growth came from strong demand in China and steady demand in the US.

Geographically, North America accounted for 36% of LS’s total revenue. Sales in the region grew 3.6%, 2.0% organically, to reach €536 million (\$633 million). The steady growth was driven by the Research Solutions segment, which recorded higher sales in the pharmaceutical market. Additionally, Lab Separation & Workflow Tools in the pharmaceutical market also added to the region’s strong sales growth. Europe, the second largest regional segment, accounting for 34% of total LS sales, experienced strong organic sales growth of 5.1% to €512 million (\$605 million). Sales growth was driven by Process Solutions, for which demand for the Actives & Formulation and Services businesses increased.

Merck Revenue Life Science By Region Q2 FY17



Click to enlarge

In Asia Pacific, LS organic sales grew 6.8%, primarily driven by biopharma materials sales and Process Solutions sales. In particular, the Filtration & Chromatography business, part of the Process Solutions segment, performed better than expected to lift sales in Asia Pacific. Sales for the region reached €353 million (\$417 million) to account for 24% of the LS sector’s total revenue.

LS sales in Latin America advanced 5.3% organically to €71 million (\$84 million), driven by the Upstream & Systems business and the Process Solutions segment. Sales in the Middle East & Africa region, however, decreased 5.6% organically to €23 million (\$27 million) due to weak demand in the Research Solutions and Applied Solutions segments.

For 2017, Merck expects LS revenue of €15.3 billion and €15.7 billion (\$18.07 billion and \$18.55 billion). Organically, sales are projected to increase by 4%, unchanged from previous guidance.

Chinese Sales Lift Shimadzu AMI

For its fiscal 2018 first quarter ending June 30, sales for Shimadzu’s Analytical and Measuring Instrument (AMI) business segment climbed 8.6% to ¥46.1 billion (\$420 million at ¥109 = \$1), accounting for nearly 61% of total company revenues. The segment’s operating income, however, decreased 4.0% to ¥4.7 billion (\$40 million), leaving its operating margin 130 basis points lower at 10.3%. On a currency neutral basis, AMI sales grew 7.3%, while operating profit increased 3.9%.

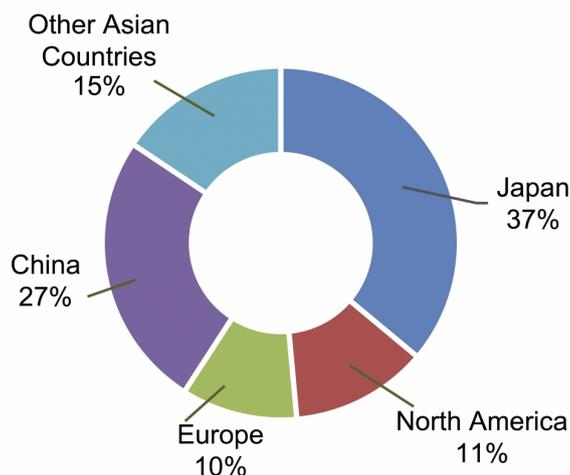
Shimadzu Analytical & Measuring Instru. Q1 FY17			
	Rev. (¥B)	% Rev. Growth	% Rev. Growth Excl. Currency
LC	¥13.7	5.2%	3.3%
MS	¥7.8	9.0%	8.4%
GC	¥5.0	7.5%	5.8%
Other	¥19.6	11.3%	10.2%

[Click to enlarge](#)

Instrument sales in the AMI segment advanced 8.1% to reach ¥32.4 billion (\$300 million). Similarly, the segment's Aftermarket sales grew 9.8% to ¥13.8 billion (\$130 million). Increased demand for instruments lifted sales for LC and MS, while GC sales were driven by surging demand in China. Instrument sales accounted for 70% of total AMI sales, while Aftermarket revenue made up the remaining 30%.

Geographically, AMI sales in Japan grew 11.1% to ¥16.8 billion (\$150 million), driven by increased private sector demand for LC, MS and testing machine products. In China, AMI sales leaped 16.8%, 13.7% on a constant currency basis, to ¥12.4 billion (\$110 million). LC, MS, GC and environmental testing instrument sales grew double digits in China. However, for other Asian countries, AMI sales slumped 4.8%, 7.2% on a constant currency basis, to ¥5.2 billion (\$50 million), as MS sales grew but LC sales declined. Together, the three Asian regions combined for an overall 10.6% increase in AMI sales.

Shimadzu AMI Revenue Q1 FY18



[Click to enlarge](#)

AMI sales in Europe continued to grow as well, increasing 8.9% to ¥4.8 billion (\$40 million), driven by LC sales. MS and GC revenues remained strong and expanded in the pharmaceutical, food safety and environmental testing markets. On a constant currency basis, AMI sales in Europe grew 9.4%. Conversely, in North America, AMI sales dropped 7.4%, 8.4% on a constant currency basis, to ¥4.8 billion (\$40 million). The decrease in AMI sales was due to lower demand and delays in customer-based installations.

For the fiscal year ending March 2018, Shimadzu reiterated its forecast of total company revenue of ¥355.0 billion (\$3.24 billion), signifying a 5.1% increase on a constant currency basis. The company also reaffirmed its total operating income forecast of ¥38.0 billion (\$350 million), representing a 7.0% increase on a constant currency basis. As for the AMI segment, Shimadzu forecasted sales growth of 4.2% to ¥218.0 billion (\$200 million), with no changes from its previous forecast. Similarly, Shimadzu reconfirmed AMI operating income growth forecast of 4.7%, resulting operating income of ¥34.6 billion (\$320 million).

Biotechnology

This month, Novartis' Kymriah became the first gene-therapy drug to receive US FDA approval. The \$475,000 drug was approved for use to treat B-cell acute lymphoblastic leukemia in individuals under 25 years old who have not responded to other therapies. This is about 600 people per year. The CAR T-cell therapy removes T-cells from the body and inserts a gene designed to attack leukemia cells into them. The T-cells are then introduced back into the patient. Because of the possibility of serious side effects, Novartis is limiting distribution to hospitals and personnel that have been appropriately trained. Other types of cancer have also been shown to respond to such a treatment, and Novartis will seek approval this year of a similar drug to treat non-Hodgkin lymphoma in adults.

Source: [Washington Post](#)

Energy

Large oil companies, such as Shell, Exxon Mobil and Chevron, are beginning to invest in energy-technology startups, signaling a change in business strategies for key players in the industry. Investments have been made in areas from wind and solar power to biofuels and electricity grid improvements. As of now, the investments are small compared to the \$7.5 billion investment into the clean energy sector by VC and private equity firms in 2016; however, the move signals the possibility of new revenue streams that may grow into a major source of profit for oil companies, as governments around the world tackle climate change by limiting the production and usage of fossil fuels.

Many key oil companies have changed their strategies to include investments in clean energy. Royal Dutch Shell spends 50% of its budget on clean energy, with the figure forecast to jump to 60% in the coming years, and has invested in companies such as Kite Power Systems and Glasspoint Solar. Total Energy Ventures International has invested \$160 million to date in clean energy, with 75% of the investments in North America, and has invested in clean energy firms such as AutoGrid and Off Grid Electric. BP Ventures similarly has invested \$325 million to date, focusing most of its investments on the chemicals and fuels sectors, and backing companies such as Tricoya Technologies, Fulcrum and Solidia.

Exxon has taken a different approach, leaning towards internal and collaborative clean energy R&D as opposed to buying minority stakes in startup firms, like other companies. The oil giant is working with Synthetic Genomics and FuelCell Energy, and focusing on biofuels, carbon capture and storage, and energy-efficiency and -savings. Chevron has invested in alternative energy through its backing of companies such as Acumentrics and Ensyn, and Statoil Energy Ventures has invested \$20 million since February in renewable energy startups like ChargePoint and Oxford Photovoltaics.

Source: [Bloomberg](#)

Pharmaceutical

As innovation within gene therapy technologies continues to advance, drugmakers are looking to create commercial gene therapy medicines for specialized diseases, such as hemophilia. Although the medicines are extremely expensive, drugmakers claim that gene therapy will save health insurance providers money in the long run, since it provides a "one-off" cure for rare diseases, as opposed to conventional medications that patients usually need to take for many years.

Over the past 5 years, 2 gene therapies have been approved in Europe, though only 3 patients have been given commercial medications. Complicated reimbursement processes, inconsistent clinical trial records and a lack of presence are thought to be contributing factors in why gene therapies have not sold well, according to Spark chief

executive Jeffrey Marrazzo. However, the commercialization of gene therapies is still a complex question, as health care systems usually pay for drugs on a monthly basis as opposed to paying an enormous bill upfront. A “one-off” cure is thought to ultimately decrease the need for expensive treatment and care, but gene therapy companies are looking to create a new business model in order to be rewarded for the time and R&D costs spent in developing the gene therapy medication. One option is a “pay-for-performance” model, in which insurers or the government would pay companies and stop payments if the medication became ineffective.

Currently, hemophilia is forecast as being the first significant commercial opportunity for gene therapy companies.

Source: [Reuters](#)

UK

In a new [report](#) for the UK government, Oxford professor Sir John Bell suggests major changes to grow the country’s life science industry (pharmaceuticals, biotech and medical devices), which is valued at an estimated £64 billion (\$86 billion). Among his recommendations is the establishment of the Health Advanced Research Programme (HARP) to bring together public and private entities to “undertake large research infrastructure projects and high-risk ‘moon shoot’ programs that will help create entire new industries in health care.” Proposed areas of investment include genomics, prognosis of chronic disease, the use of artificial intelligence for pathology and imaging, and the biology of healthy aging.

Other recommendations are greater research funding, efforts to encourage UK-based manufacturing, plans to address skill shortages, and increased partnerships between industry and the National Health Service (NHS). Specific goals include 50 projects involving industry and the NHS within five years, and the addition of two thousand scientists to the country’s research workforce. The report also encourages a close partnership between the UK and the EU regulatory system after Brexit. Sir John expects most of the recommendations to be adopted.

Source: *Financial Times*

India

The largest refinery companies in India (Indian Oil, Bharat Petroleum and Hindustan Petroleum) are preparing to invest \$35 billion in petrochemicals to meet high demands for goods such as plastics, paints and adhesives. According to executives at the Chemical and Petrochemical Manufacturing Association, India’s petrochemical usage is 25% of the world’s average and half of the country’s petrochemical consumption is imported. However, they forecast demand to rise an extra 10 million tons to 40 million tons within the next 3 years, which will result in a \$65-\$70 billion petrochemical market in India.

In July, Petroleum minister Dharmendra Pradhan indicated the government’s plans to set up petrochemical companies around refineries in the Eastern, Western and Southern regions of the country. Bharat Petroleum and Hindustan Petroleum plan to spend \$15 billion over a five-year period to raise the Indian petroleum industry’s share of total revenue to 10%. Indian Oil will invest INR 300 billion (\$4.7 billion) over the next 5-7 years to increase petrochemical revenue to 33% of revenue. Cumulatively, the three companies are preparing to invest a total of INR 2.7 trillion (\$42.3 billion) to create the world’s largest crude refinery in Western India, linked to a petrochemical plant, with an output capacity of 1.2 million barrels/day. The petrochemical plants serve as alternate revenue for the petroleum companies and add to their “gross refining margins,” making it a good “de-risking model,” according to a chairman of Hindustan Petroleum.

Source: [Reuters](#)

Japan

The Japan Society for the Promotion of Science, part of the Ministry of Education, Culture, Sports, Science and Technology, has announced plans to make changes to its Grants-in-Aid for Scientific Research program, the largest competitive grant program in the country. The Grants-in-Aid program is dedicated to innovations and progress in science research, and the last time changes were made to the program was 50 years ago. The changes are expected to be implemented in the next round of grants this September, and were made to salvage Japan from its falling position as one of the global leaders in science.

Between 2005 and 2015, Japan's share of published articles dropped 38.1% to 5%, as has its global share of research papers, which dropped 1% to 6% in 2016. The decreases in contributions are largely related to the government's flat budget for R&D, which has remained at approximately ¥3.5 trillion (\$30 billion) for the past 16 years.

Changes to the program include creating new scientific field categories to limit competition between fields; reforming the overly specialized grant categories so researchers have more control over their projects; reducing panel numbers from 500 to about 375 to ensure focus on proposals instead of the fields of study; and the merging of a medium-sized grant category for researchers at the start of their careers with other categories. Additionally, a special grant category created for grants up to ¥500 million (\$4.4 million) will be capped at one grant per applicant in order to be accessible to more researchers.

Source: [Nature Index](#)

MS & LC/MS

Company Announcements

In July, **Thermo Fisher Scientific** announced that its collaboration with **SRI International** resulted in the direct linking of the Thermo Scientific Compound Discoverer 2.1 platform for small molecule research with SRI's BioCyc database, a collection of 9,300 databases that provide electronic reference sources on the metabolic pathways and genomes of many organisms. This enables researchers to combine the results of high-resolution Orbitrap LC/MS experiments with highly curated and organism-specific metabolic pathway and genome data.

Biognosys, which provides services and products for highly multiplexed protein quantification, announced in July that it secured \$5 million in an extended series C round.

In July, **Agena Bioscience** and **Intermountain Healthcare** entered into a strategic collaboration to expand the use of Agena's MassARRAY System in oncology applications, with the goal of focused panels for liquid and tissue biopsies. Intermountain currently offers the ICG100 Onco Focus Panel, which was developed on the MassARRAY System.

Agena Bioscience and **HeartGenetics** announced in July a comarketing alliance for Agena's CE-IVD-marked MassARRAY DX system and HeartGenetics' CE-IVD-marked HEARTDECODE services and assays for cardiovascular testing.

In July, **Waters** obtained a license to certain **SISCAPA Assay Technologies'** technology for the standardization of LC/MS assays. The technology uses multiple stable isotope-labeled versions of an analyte molecule, each with a distinct mass increment, added to a sample at different known concentrations as a way to establish a within-sample internal standard curve.

Proteome Sciences reported that first-half sales for its TMT (Tandem Mass Tag) protein labeling reagents, available exclusively through **Thermo Fisher Scientific**, grew 40% to £0.96 million (\$1.2 million). Due to limited resources for new higher plexing reagents, commercial availability of the reagents is not expected until the second half of 2018.

SCIEX announced in July the availability of its SCIEX MS systems through a wide range of flexible financing packages via financing company **EVOSCIENCES**. The agreement allows access by a broader range of customers, and limited or short-term MS use via the calculation of actual use. The financing packages are currently available in France, Italy, Spain, Germany, the UK, Benelux, Austria and Switzerland.

In July, **Bruker** received **FDA** clearance for its third, further expanded claim for its MALDI Biotyper-CA for microbial identification. The new claim adds 144 new species to the reference library, bringing it to 424 microbial species in 333 different groups. The latest claim also includes the new disposable MBT Biotargets 96 US IVD. Additional workflows tools now available for the MALDI Biotyper-CA are MBT Pilot for optically guided target-preparation assistance and the MBT Galaxy for automated reagent addition.

German firm **BIOTECON Diagnostics**, a developer of real-time PCR products for the food industry, was named in August as an OEM partner for the distribution of **Bruker's** MALDI-TOF systems in the DACH area (Germany, Austria, Switzerland) and Eastern Europe. In connection with the agreement, BIOTECON plans to release a reference library focused on the dairy and milk industry.

bioMérieux announced in July the receipt by its VITEK MS MALDI-TOF MS system of **FDA** 510(k) clearance for the expanded identification of mycobacteria, Nocardia and molds. For the first time, it enables identification of the Mycobacterium TB group, the most frequent non-tuberculous mycobacteria, including species from both solid and liquid growth media.

In August, **Protea Biosciences** announced a collaboration research agreement with **the Vaccine Immunotherapy Center division of the Massachusetts General Hospital and Harvard Medical School**. The goal is to codevelop a new diagnostic method that will provide cancer cell molecular profiles using advanced molecular imaging technology.

Product Introductions

In July, **Hitachi High-Technologies** unveiled the HM1000 thermal desorption chemical ionization MS for testing of four types of phthalates. Each sample can be screened in less than 10 minutes, according to the company. Using an autosampler, up to 50 samples, including reference specimens, can be analyzed in approximately 8 hours. The system is priced starting at ¥14 million (\$128,000). The company expects to sell 100 units annually.

IONICON Analytik introduced in July the AMC-Monitor T-1000 PRT-TOFMS for FOUP (Front Opening Unified Pod) for fab and clean room environmental airborne molecular-contamination monitoring in the semiconductor industry. It features new AME (Automated Measurement and Evaluation) analysis software.

Prosolia announced in July that its new DESI (Desorption Electrospray Ionization) model is compatible with **Agilent Technologies'** TOF, Q-TOF and IM-Q-TOF LC/MS systems

In August, **Shimadzu Scientific Instruments** released the nSMOL (nano-Surface and Molecular Orientation Limited proteolysis) Antibody Bio-Analysis Kit for selective proteolysis of the Fab region of monoclonal antibodies. The simplified workflow eliminates the need for denaturing, reduction and alkylation.

Advion launched in August Peak its Express software for its expression compact MS. It features a new Delta Spectrum mass spectrum display, which automatically detects the smallest peaks without the user needing to know the product ion mass in advance.

Sales/Orders of Note

In July, **EPL Bio Analytical Services**, an agriculture-focused analytical contract lab, selected the **SCIEX** QTRAP 6500+ LC-MS/MS with SelexION for complex environmental analysis and agricultural markets testing.

Sequencing

Company Announcements

In July, **LabCorp** and **Cancer Genetics** joined **Thermo Fisher Scientific's** Next Generation Sequencing Companion Dx Center of Excellence Program. Each partner will participate in oncology-focused clinical trials in collaboration with pharmaceutical companies and Thermo Fisher. The companies may also qualify for early access to Thermo Fisher's pipeline of novel platforms and assays to assist with development of Oncomine-branded solutions.

NuGEN Technologies and **Cambridge Epigenetix** (CEGX) announced in August a co-exclusive license covering the manufacturing and integration of CEGX's TrueMethyl technology for oxidative bisulfite sequencing with NuGEN's library preparation kits.

In August, **10x Genomics** named Eric Whitaker as principal legal officer (see [Executive Briefing](#)). Most recently, he served as chief legal officer at cloud computing software company **Nutanix**.

10x Genomics named Mathai Mammen, MD, PhD, to its Board in August. He currently serves as global head, science and development, at the **Janssen Pharmaceutical Companies of Johnson & Johnson**.

Fluidigm entered into a licensing agreement with **Baylor Genetics** in August to offer an NGS library prep assay that enables efficient sequencing of the CFTR (Cystic Fibrosis Transmembrane Conductance Regulator) gene. Fluidigm obtained the rights to commercialize the assay for research use with its Juno automated microfluidic system.

In August, the [Abuquerque Business Post](#) reported that the state of New Mexico's **Catalyst Business Fund** invested \$1.5 million in **Armonica Technologies**, which is developing a long-read sequencing technology.

DNAexus announced in August a collaboration with **Saphetor** to build a sample-in, report-out genomic analysis solution. Saphetor's technology for the annotation and classification of genetic variants is now available on DNAexus's cloud-based platform.

Edico Genome announced the availability of its DRAGEN end-to-end platform solutions for NGS data analysis on **DNAexus'** genome informatics and data management platform.

Product Introduction

Sophia Genetics launched in May its Whole Exome and Clinical Exome Solution, accessible through the company's DDM analytical platform for clinical diagnostics. The offering also includes DNA sample preparation kits. The pattern-recognition technology enables a database search that identifies and retrieves matching variants regardless of the variants' representations.

In August, **Bioline** released the JetSeq Clean Kit, a paramagnetic bead-based clean-up system for purification of nucleic acid fragments for NGS.

Swift Biosciences introduced in August the Accel-NGS 2S Indexed Adapters for multiplexed sequencing on **Illumina** platforms. The set of indices provides the largest set of commercially available single indices for high-throughput genomic sequencing applications, according to the company. The indices enable the multiplexing of up to 96 single-indexed samples and 768 dual-indexed samples per run.

In August, **PerkinElmer Genetics** launched affordable Whole Exome Sequencing (WES) and Whole Genome Sequencing (WGS) services, which are offered in combination with biochemical profiling targeted for rapid WES and WGS for genetic disease diagnostics.

Geneformics Data Systems released in August the Geneformics D, a distributed cloud compression solution for genomics data that increases the efficiency and speed of upload, download, storage and archiving.

Lexogen unveiled in August a Small RNA-Seq Library Prep Kit. The protocol can be completed in 5 hours, with just 1 hour hands-on time. Up to 96 barcodes are included.

In August, **Illumina** launched the BaseSpace Variant Interpreter, which supports results from targeted enrichment panels, whole exome and genome data, and fully supports review of germline VCFs (Variant Call Formats) and family-based analysis. The product will be free until the end of year.

Sales/Orders of Note

In June, **Qlucore** announced that diagnostic firm **Immunovia** is using the Qlucore Omics Explorer for data analysis.

New England Biolabs announced in August that the **Wellcome Sanger Trust Institute** chose to implement its NEBNext Ultra II Directional RNA Library Prep Kit, which requires a minimum input of 100 ng total RNA for a standard pipeline.

In August, **Edico Genome** announced a contract with the **National Human Genome Research Institute** (NHGRI) and the **National Cancer Institute** for the use of its DRAGEN (Dynamic Read Analysis for Genomics) Bio-IT platform. The organizations purchased the DRAGEN Somatic pipeline and Genome pipeline. The NHGRI signed a four-year contract.

Pacific Biosciences announced in August an agreement to sell 10 Sequel Systems to genomic services provider **Novogene**, giving Novogene the capacity to run up to 20 Sequel Systems at a time.

In August, **Seven Bridges** was selected to build a new data center in partnership with the **Center for Data Driven Discovery in Biomedicine at the Children's Hospital of Philadelphia** and a consortium of academic research institutes. The Center will establish the **Kids First Data Resource Center**, which will bring together harmonized, large-scale, pediatric cancer and structural birth defects data.

Informatics

Company Announcements

Pine Biotech announced in June that it raised over \$1 million in seed funding for its development of a platform for the comprehensive analysis of large genomic, transcriptomic, proteomic, structural and phenotypic data using an intuitive interface. The platform is being commercialized in partnership with **Tauber Bioinformatics Research Center** and the **University of Haifa**.

Geneious Biologics announced in July the opening of an office in Denmark.

In July, **Schrödinger** announced a multiyear, multitarget research collaboration with **Takeda**. The company will use its in silico platform-driven drug discovery capabilities, supported by Takeda's protein crystal structures, to guide the development of new chemical entities. Schrödinger will be responsible for the discovery costs, with Takeda having the exclusive option to license the programs later in discovery.

Schrödinger also announced in July a research collaboration with Professor Jeffrey Wiggins of the **University of Southern Mississippi** to advance the development and design of polymer and high-performance materials using its Materials Science Suite.

In August, **DNASTAR** appointed newly formed **SHIPS Bioscience** as a distributor for Japan.

Bioinformatics provider **SoftGenetics** acquired **Mitotyping Technologies** in August from **Health Network Laboratories** for an undisclosed amount. Mitotyping Technologies provides services for the forensic and anthropological analysis of mtDNA. SoftGenetics CFO Nina Fosnacht will also serve as the new COO of Mitotyping Technologies. SoftGenetics provides software for STR and mtDNA analysis, including NGS data.

ELN provider **Iabfolder** announced in August the establishment of an office in Cambridge, Massachusetts.

Product Introductions

IDBS released in June the E-WorkBook Request, a work requesting and orchestration tool, available as a module for its E-Workbook Cloud. It can be deployed and set up within one week and works with pre-existing LIMS.

In June, **DNAnexus** launched the MOSAIC Microbiome Platform in collaboration with **Janssen Research & Development and its Janssen Human Microbiome Institute**. The cloud-based platform enables collaboration and data sharing, as well as customized workflows.

DILIsym Services, a **Simulations Plus** company, introduced in August the DILIsym 6A for liver safety modeling. New features include additional simulated population capabilities focused on biomarker variability, and new validation compounds.

In August, **Simulations Plus** released the MembranePlus 2 in vitro data analysis program. Enhancements include new mechanistic models for in vitro hepatocyte assays.

In August, **Certara** debuted D360 Partner, which adds externalization technology to its D360 scientific informatics platform to facilitate collaboration with external partners.

PerkinElmer unveiled in August its ChemDraw 17 chemical drawing software. New features include the **Pistoia Alliance's** Hierarchical Editing Language for Macromolecules (HELM) and enhanced hotkeys.

In August, **Sunquest Information Systems** launched the cloud-based Sunquest Mitogen LIMS and genetic analysis software suite for molecular diagnostics and precision medicine. It supports a wide range of molecular testing requirements.

Sales/Orders of Note

In July, **Genedata** announced an expanded partnership with enzyme manufacturer **AB Enzymes** to include its Genedata Selector platform for decision support on production strain optimization and strain compliance assessment processes. The companies have worked together since 2013.

Genedata announced in July that **Merck** has implemented Genedata Biologics to scale-up its biospecific antibody discovery programs. Merck is expanding the use of the software beyond its central biologics workflow.

Cheminformatics firm **Optibrium** signed a two-year license agreement with **Bugworks Research** in July for its StarDrop software.

In August, **OpenEye** announced an agreement with **Pfizer's** Medicinal Services division to provide its Orion cloud platform for computational chemistry.

Process Analysis

Company Announcements

Battery Ventures announced in March that its Process Sensing Technologies platform has acquired **Analytical Industries (AII)**, a manufacturer of electrochemical oxygen sensors and gas analysis products. AII complements the platform's **Mitchell Instruments** business.

In March, **HORIBA Instruments' Process & Environmental** business opened a 9,600 ft² (2,926 m²) office in Houston, Texas. It is the new hub of the business's US operations, housing design, production, sales and service.

In July, **AppliTek** announced sales growth of more than 100% from the first to second quarters.

Novatech, a Canadian supplier of analytical instrumentation and solutions, acquired the assets of Canada-based **G.A.S. Analytical Systems**, which provides process analytical solutions.

Product Introductions

In May, **Keit** increased the spectral range of its IRmadillor FTIR spectrometer, which now provides analysis of liquids throughout the majority of the mid-IR region from 800 cm⁻¹ to 4000 cm⁻¹.

Metrohm Process Analytics launched in June a dedicated solution for online monitoring of free chlorine or total chlorine in wastewater streams using photometric determination. It is performed on the ICON Analyzer.

In June, **Pharma Test** released the in-line TIDAS P Milk Inspector, based on VIS/short-wave NIR analysis, for real-time determination of fat, protein and dry weight during production.

In July, **Emerson** introduced the Rosemount CT5800 continuous gas analyzer, calling it the first Quantum Cascade Laser (QCL) analyzer designed for industrial process applications requiring Class I, Division 2 hazardous area certification built within a flameproof enclosure. It can measure up to 12 components simultaneously.

ABB Measurement & Analytics released in July the PGC5000 GC oven with an integrated controller, reducing the shelter space required and cost.

In August, **Thermo Fisher Scientific** debuted the photometer-based Thermo Scientific iQ Series gas analyzers for air quality, developed on the new iQ Series environmental monitoring platform. Designed to be more reliable and accessible, they feature a mobile application, wireless connectivity.

Sales/Orders of Note

In May, **Yokogawa Electric** received an order from **Chicago Bridge & Iron** and **CTCI** for an analyzer package solution, including 75 GC8000 process GCs. The systems are for the Liwa Plastics Industries Complex in Oman.

DNA Microarrays

In the late 1990s and 2000s, DNA array technology progressed rapidly from long DNA sequences to oligo arrays, thanks to the increasing quantity of publicly available DNA sequence information. The use of oligos increased in specificity. Nowadays, microarrays are widely used to measure the relative concentration of DNA or RNA in solution as they allow the analysis of many—tens of thousands—different sequences on a small surface (often referred to as “chips”). The main applications include gene expression analysis, transcription factor binding analysis and genotyping.

To prepare a microarray assay, unknown nucleic acid molecules are cut into fragments and fluorescent markers are attached to those fragments. Then, the nucleic acid fragments bind to their complementary sequence of the pre-loaded sequences on a chip. The remaining fragments are washed away. The target nucleic acid pieces can be identified by their fluorescence emission after illumination with an appropriate laser light source. With a computer, the fluorescent emission pattern is recorded and then sequences can be identified.

While this technology is extremely useful, microarrays have a number of limitations. First, arrays provide an indirect measure of relative concentration. At high concentrations, the array may become saturated, and at low concentrations the equilibrium favors no binding. Second, it is difficult to design probes that will not bind to different related sequences, particularly problematic in gene families. Finally, an array can only detect sequences that it was design to detect. This can be a problem when working with variable bacterial genomes, for example, where probes are designed using the reference genome.

The largest markets for microarrays are hospital and clinics, academia and CROs. The technology is transitioning from research-use only in the past to a more active role in the diagnostic space, informing physicians about patients' conditions. Some of the main applications of this technology include agrigenomics, cytogenetics and biobank genotyping studies.

Illumina, the leading vendor of the market, manufactures the HiScan, iScan and HiScan HQ scanners and a range of microarray chips including the Infinium Global Screening Array for human genotyping. The company benefits from the strong synergy of NGS sequencing and microarray technology, which are both part of its portfolio. Affymetrix, which pioneered the high-density microarray market and accounts for a quarter of the market, was acquired by Thermo Fisher Scientific in 2016 (see [IBO 1/15/16](#)) Thermo Fisher offers the flagship Affymetrix GeneChip instrument system and the GeneAtlas microarray system, as well as microarrays such as the CytoScan HD Array. Agilent Technologies also participates in the market, offering two systems, the SureScan microarray scanner and the SurePrint G3 for gene expression, as well as microarray chips, including the Agilent Human Genome CGH Microarray.

In 2016, the total microarray market was about \$870 million. Although threatened by NGS and PCR technologies, microarrays will continue to grow at low single digits for the next five years due mostly to their relative ease of use.

Microarrays at a Glance:

Leading Suppliers:

- Illumina
- Thermo Fisher Scientific
- Agilent Technologies

Largest Markets:

- Hospital and Clinical
- Academia
- CROs

Scanner Cost:

- \$75,000-\$150,000

Reported Financial Results

\$US	Period	Ended	Sales	Chg.	Op. Prof.	Chg.	Net Prof.	Chg.
Bioanalytical Systems (Products)	Q3	30-Jun	\$0.9	-31.1%	(\$0.2)	NM	NA	NA
Brooks Automation (Life Science)	Q3	30-Jun	\$36.8	26.5%	\$1.1	NM	NA	NA
HTG Molecular Diagnostics	Q2	30-Jun	\$1.8	-7.1%	(\$5.5)	13.4%	(\$5.8)	14.8%
Kewaunee Scientific	Q1	30-Jun	\$33.9	-9.1%	\$1.7	-18.1%	\$1.2	-10.4%
MKS Instruments	Q2	30-Jun	\$480.8	47.5%	\$92.9	384.1%	\$120.4	1207.7%
Repligen	Q2	30-Jun	\$32.4	11.2%	\$5.5	-6.6%	\$8.4	117.9%
Techcomp	H1	30-Jun	\$79.5	2.2%	(\$0.9)	NM	(\$0.9)	NM
Techcomp (Distribution)	H1	30-Jun	\$47.8	3.7%	\$0.0	-92.1%	NA	NA
Techcomp (Manufacturing)	H1	30-Jun	\$31.8	0.1%	(\$0.9)	-133.5%	NA	NA
Other Currencies								
Photon Control	Q2	30-Jun	CAD 8.9	22.7%	CAD 0.3	-82.3%	(CAD 0.3)	NM
Renishaw	FYE	30-Jun	£536.8	25.7%	£120.4	42.2%	£88.8	86.2%
Renishaw (Metrology)	FYE	30-Jun	£503.4	26.2%	£126.8	44.6%	NA	NA
Renishaw (Healthcare)	FYE	30-Jun	£33.4	17.8%	-£6.5	-108.8%	NA	NA
Tecan	H1	30-Jun	CHF 253.3	7.7%	CHF 29.6	6.6%	CHF 25.7	9.6%
Tecan (Life Science)	H1	30-Jun	CHF 143.4	16.4%	CHF 17.8	46.5%	NA	NA
Tecan (Partnering)	H1	30-Jun	CHF 115.9	-2.1%	CHF 19.0	-9.2%	NA	NA

NA = Not Available, NM = Not Meaningful

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