IBO
Strategic Information for the Life Science and Analytical Instrument Industry

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# Good News in 2018: New IBO Sales Reviews Track Quarterly Results

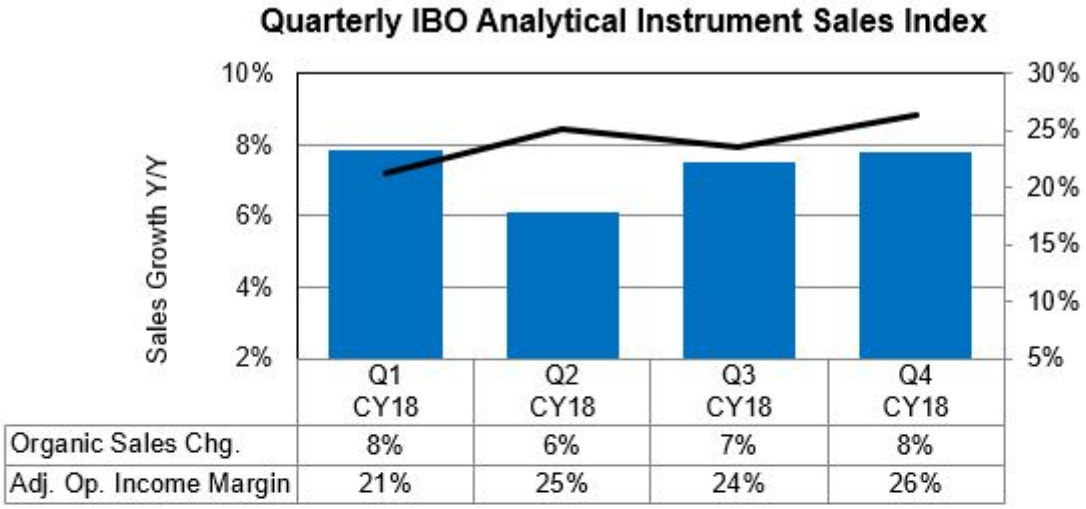
With this issue, ***IBO*** debuts its new Quarterly Review Summary. Designed to provide an overall view of the analytical instrument and life science lab tool industry, the Summary tracks the quarterly and annual revenue growth, as well as operating margins, of 17 of the industry's largest public firms worldwide. These businesses were selected based on how their financial results are segmented and the financial information that each provides. The Review is based on a weighted average of these company's organic sales. Estimates are made for companies that have not yet reported results. The Reviews replace ***IBO***'s previous Analytical Instrument Sales, Life Science Sales and Combined Sales Indexes.

The Analytical Sales Review consists of companies that serve a wide array of end-markets, from life science to industrial to applied, giving a comprehensive view of the industry in general, including life science sales as many of the companies also participate in that market. It includes 6 of the industry's top 10 companies (see ***IBO*** 4/15/18).

In contrast, the Life Science Sales Review consists of businesses whose primary or sole market is the life science market. Two businesses, Merck KGaA Life Science and Thermo Fisher Scientific Life Science Solutions, also include sizable bioprocessing offerings. Although some businesses such as Merck Life Science and Tecan also serve other markets, the bulk of the products sold by the business segments included in the Life Science Sales Review are geared toward life science applications.

## Analytical Sales Review

Organic sales growth for companies in the Analytical Sales Review stayed consistent throughout the year, led by the robust growth of Thermo Fisher's Analytical Instruments business. Oxford Instruments was the only firm to post a decrease in sales. Operating margin increased as the year progressed. For the year in total, organic sales for Review companies rose 8% and operating margin was 24%.




***IBO*** *Indexes'* sales growth is based on organic revenues and on constant exchange rates for

IBO Analytical Instrument Index: Agilent Technologies (Life Sciences and Applied Markets, Agilent Crosslab); Bruker (Scientific Instruments); Oxford Instruments*; PerkinElmer (Discovery and Analytical Solutions); Shimadzu (Analytical and Measuring Instruments); Spectris (Materials Analysis)*; Thermo Fisher Scientific (Analytical Technologies); Waters.

*Based on estimates used for Q4 CY18

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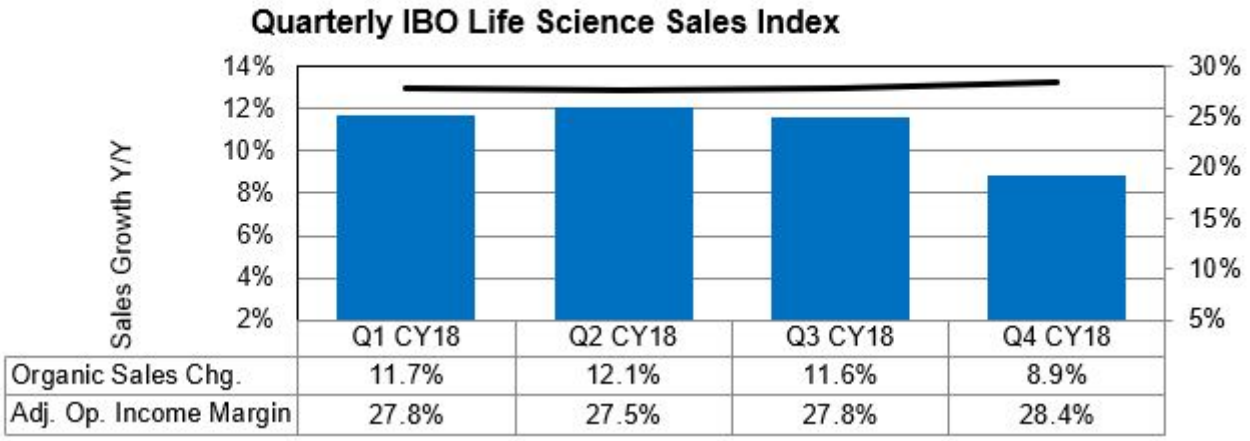
## Life Science Sales Review

Recording faster revenue growth, companies in the Life Science Review grew a combined 15% in 2018. Illumina's sales growth far outpaced the other companies' results, followed by Fluidigm, whose revenue increase steadily increased during the year. Only NanoString Technologies posted a sales decrease. Review companies' sales growth slowed in the year due in part to slower sales growth for Bio-Rad Laboratories Life Science. Illumina's growth rates slowed, though they remained solid for the year in total. Despite slower sales in the latter part of 2018, operating margin remained largely the same each quarter, with an uptick in the fourth quarter.




| | Q1 CY18 | Q2 CY18 | Q3 CY18 | Q4 CY18 |
|---|---|---|---|---|
| Organic Sales Chg. | 11.7% | 12.1% | 11.6% | 8.9% |
| Adj. Op. Income Margin | 27.8% | 27.5% | 27.8% | 28.4% |

*IBO Indexes'* sales growth is based on organic revenues and on constant exchange rates for

IBO Life Science Index: Bio-Rad Laboratories (Life Science)*, Biotage, Bio-Techne (Protein Sciences), Fluidigm, Illumina, Merck KGaA (Life Science)*, NanoString Technologies, Tecan (Life Sciences)*, Thermo Fisher Scientific (Life Science Solutions)

*Based on estimates used for Q4 CY18

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## Biopharmaceutical Market

In fourth quarter 2018, the biopharmaceutical market for companies in both Reviews was the strongest end-market for most businesses. Biotechnology sales and sales in China were high points. Agilent Technologies Life Sciences and Applied Markets and Agilent Crosslab, Bio-Techne Protein Sciences and Thermo Fisher Life Science Solutions each recorded double-digit revenue growth in this end-market for the quarter.

## Applied Market

Sales in applied markets for businesses in the *Reviews* were mixed in the fourth quarter of 2018. Food sales growth showed some slowing; however, environmental sales were strong, bolstered by China. Agilent noted continued delays in sales due to the reorganization of the country's food ministries.

## Academic and Government Market

Fourth quarter 2018 academic and government sales for the Reviews were healthy with strength in the US and Asia Pacific. Bruker Scientific Instruments and PerkinElmer Discovery and Analytical Solutions noted good growth for the end-market due to instrument sales.

## Industrial Market

Industrial markets for Review companies were mixed in the fourth quarter 2018. Growth was affected by year-over-year comparisons, but new products contributed to sales growth. Spectris Materials Analysis reported weakness in the metals sector, while Shimadzu Analytical and Measuring Instruments commented on the overall strength in the sector.

## Geographic Markets

Asia Pacific and China remained the leading regions for sales growth for the Reviews companies in the fourth quarter 2018. Outside of China, businesses noted sales strength in South Korea. Sales in the Americas also grew double digits for several businesses. In contrast, Japanese sales continued to show weakness. Companies that reported double-digit sales increases in China included Bio-Techne Protein Sciences, Thermo Fisher Life Science Solutions and Waters.

| Company | FY19 Revenue Forecast |
|---|---|
| Agilent Technologies (core) | 5.0%–5.5% |
| Bio-Techne (organic) | High single digits |
| Bruker (organic) | 4%–5% |
| Illumina | 13%–14% |
| Merck Life Science (organic) | Slightly above approximately 4% |
| PerkinElmer (organic) | 6% |
| QIAGEN (constant exchange rates) | 7%–8% |
| Tecan (local currencies) | Mid- to high-single digits |
| Thermo Fisher Scientific (organic) | 5% |
| Waters (organic) | 4%–6% |

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# New Labs Announced for Pharma, Academic and Government Research

In the first half of ***IBO***'s biannual coverage of major new labs, we take a look at pharmaceutical, government, chemical and academic laboratory buildings planned for or under construction.

### ASU Builds New Research Center as Part of Expansion Plan

**Organization:** Arizona State University

**Location:** Phoenix, Arizona, US

**Lab Size:** 200,000 $ft^2$ (18,581 $m^2$)

**Lab Cost:** $77 million

**Estimated Opening Date:** 2020

The Phoenix Biomedical Campus in downtown Phoenix, Arizona, will get a new research center in 2020. The sprawling Wexford Science and Technology building is part of Arizona State University's (ASU) expansion efforts, and is also aimed at strengthening the private sector's investment in bioscience and health technology. This marks the 13$^{th}$ project and first public-private development for Wexford, a private research company that partners with universities and research institutions to construct mixed-use facilities. The project is expected to help establish ASU as a leading global research center by 2025.

## Collaborative Research Complex to Accelerate Research at Cal Poly

**Organization:** Cal Poly; California State University; Cal Poly Corporation

**Location:** San Luis Obispo, California, US

**Lab Size:** 100,000 $ft^2$ (9,290 $m^2$)

**Lab Cost:** $125 million

**Estimated Opening Date:** 2021 (first phase)

The new Science and Agriculture Teaching and Research Complex (SATRC) at Cal Poly will be an interdisciplinary facility shared by the College of Liberal Arts, the College of Science and Mathematics, and the College of Agriculture, Food and Environmental Sciences. At four stories, the majority of the building will house faculty offices and labs, while the first floor will contain a lecture hall, classrooms, a computer lab, project areas, a culinary lab, and an assigned section for electrical and mechanical equipment.

The Complex will also feature an agricultural technology center named for Jim Boswell, a Cal Poly graduate who donated $10 million to the project. As the project is a collaboration between multiple faculties, the Center for Expressive Technologies for the College of Liberal Arts will relocate to the SATRC. California State University also donated $10 million for classrooms, as did the Cal Poly Corporation. The first phase of construction is scheduled to be completed by fall 2021.

## Leading Japanese Pharma Company to Build Three New Sites

**Organization:** Astellas Pharma

**Location:** Toyama and Tsukuba, Japan; Massachusetts, US

**Lab Size:** 8,000 $m^2$ (86,111 $ft^2$); 1,800 $m^2$ (19,375 $ft^2$); 24,000 $m^2$ (258,334 $ft^2$)

**Lab Cost:** ¥10.0 billion ($89.9 million); ¥5.0 billion ($44.9 million); ¥14.0 billion ($125.8 million)

**Estimated Opening Date:** 2019; 2020

Japanese pharmaceutical firm Astellas Pharma announced last fall the construction or renovation of new R&D and manufacturing facilities in Japan and in the US. At the Astellas' Technology Center in Toyama, Japan, the company is constructing a Center for Active Ingredient for Biopharmaceuticals (provisional name), which will have antibody manufacturing capabilities for use in products in Europe, Japan and the US. The 8,000 $m^2$ (86,111 $ft^2$) Center will also be a site for manufacturing cell therapeutics, and will cost approximately ¥10.0 billion ($89.9 million).

Another Center, the Center for Multimodality Clinical Trial Materials (provisional name), is planned for construction in Tsukuba, Japan, inside Astellas' Biotechnology Research Center. At 1,800 $m^2$ (19,375 $ft^2$), the Center will be for the manufacture of clinical trial materials to be used in early-stage clinical trials (Phase 1 and 2), with the company investing ¥5.0 billion ($44.9 million) into the building.

Additionally, the company is relocating and renovating its Astellas Institute for Regenerative Medicine, which is a subsidiary of the company and an R&D center for regenerative medicine and cell therapeutics. Located in Massachusetts, the Institute will be moved to another area in the state, and will have an additional 2 ground floors and a total space of 24,000 $m^2$ (258,334 $ft^2$). With a ¥14.0 billion ($125.8 million) investment, Astellas aims to accelerate R&D in the regenerative medicine and cell therapy areas, and facilitate the company's commercial production.

## Merck Expands US Research Hub

**Organization:** Merck KGaA

**Location:** Billerica, Massachusetts, US

**Lab Size:** 145,000 $ft^2$ (13,470 $m^2$)

**Lab Cost:** $70 million

**Estimated Opening Date:** 2021

Merck KGaA announced last month plans to expand its R&D center at its Billerica, Massachusetts, site. The facility will contain new lab and collaborative workspaces, wet labs and office space to house approximately 400 R&D staff concentrating on oncology, immuno-oncology and immunology research. With this latest building, Merck's R&D infrastructure investments since 2011 will total over $150 million for the acceleration of biopharmaceutical R&D in Massachusetts.

Merck also stated that the building will meet requirements for Leadership in Energy and Environmental Design (LEED) and WELL certifications, a program and standard, respectively, for the construction and operation of green buildings.

## New Energy Research Building for PNNL

**Organization:** Pacific Northwest National Laboratory

**Location:** Richland, Washington, US

**Lab Size:** 110,000 –145,000 $ft^2$ (10,219–13,470 $m^2$)

**Lab Cost:** $90 million

**Estimated Opening Date:** 2021

The US government has invested $90 million to fund the construction of a new energy sciences research building at the Pacific Northwest National Laboratory. The building will largely be for research in advanced chemistry, materials science and computing, with goals that include the development of more energy-efficient chemical processes and new materials for energy technologies. The facility will house workstations and labs for around 175 scientists, engineers and staff, and will encourage collaboration within the region, as well as with the University of Washington and Washington State University.

Along with the federal funding, the state of Washington donated $8 million specifically for purchasing or upgrading scientific instrumentation for the building.

## Michigan State Helps Fund New Complex for MTU

**Organization:** Michigan Technological University

**Location:** Houghton, Michigan, US

**Lab Size:** 115,000 $ft^2$ (10,684 $m^2$)

**Lab Cost:** $44.7 million

**Estimated Opening Date:** 2023

Michigan Technological University's Board has approved planning and design for a new H-STEM Engineering and Health Technologies Complex. The Complex will have 68,000 $ft^2$ (6,317 $m^2$) of new space, which will include shared

and flexible lab space, and 47,000 ft$^2$ (4,366 m$^2$) of renovated classrooms within the Chemical Sciences and Engineering building. The H-STEM Complex will also be connected to the Chemical Sciences building. Michigan state will contribute $29.7 million towards the project, while Michigan Tech will contribute $15 million in matching funds.

## Silicones Leader Doubles R&D Workspace

**Organization:** Elkem Silicones

**Location:** Saint-Fons, Auvergne-Rhône-Alpes, France

**Lab Size:** 64,583 ft$^2$ (6,000 m$^2$)

**Lab Cost:** €25 million ($28.3 million)

**Estimated Opening Date:** 2020

Silicon solutions giant Elkem Silicones plans to double the R&D space at its Saint-Fons site in France to foster collaboration between the company's research teams as well as across its the open-innovation network in the Auvergne-Rhône-Alpes. Workspaces from the original site will be grouped at the new research center to streamline work between the R&D teams. The teams will largely be from China, Europe and the US and will collaborate at the R&D center using enhanced lab equipment and on new projects. In total, the site is estimated to house 130 researchers.

## Sound Trailblazer Ray Dolby's Estate Donates to University of Cambridge

**Organization:** Estate of Ray Dolby

**Location:** Cambridge, England

**Lab Size:** 354,000 ft$^2$ (32,888 m$^2$)

**Lab Cost:** £150 million ($98.8 million)

**Estimated Opening Date:** 2022

Thanks to a £75 million ($98.8 million) donation from Ray Dolby's estate, the University of Cambridge will house a research center at its West Cambridge campus. The center will contain a variety of labs, offices, clean rooms, workshops and lecture theaters, as well a basement area with specialist acoustic and vibration treatments to operate equipment that is extremely vibration sensitive. The site will be a key facility for physics research, and much of the research equipment at the center will be available for use by other institutions.

In addition to the Dolby estate's donation, the research center is being constructed through funding from the UK government's Engineering and Physical Sciences Research Council.

## New Center for Biology, Chemistry at TWU

**Organization:** Texas Woman's University

**Location:** Denton, Texas, US

**Lab Size:** 80,000 ft$^2$ (7,432 m$^2$)

**Lab Cost:** $54 million

**Estimated Opening Date:** 2020

At four stories, the new Science & Technology Learning Center at Texas Woman's University will be home to both undergraduate and graduate research lab space for subjects such as biology, chemistry and biochemistry, nutrition and food science, and psychology. The Center will also house collaboration and conference spaces, faculty offices, workspaces for graduate students, and lab support spaces, as well scientific instrument repair services and a microscopy suite. The purpose of the Center is to accelerate innovative research and enhance interdisciplinary collaborations. The Center is expected to be complete in summer 2020.

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# Bruker Enters New Software Markets

*Billerica, MA 3/14/19*—Scientific instrument company Bruker has acquired Arxspan for an undisclosed amount. Arxspan provides cloud-based solutions for managing research data with a focus on the pharmaceutical biopharmaceutical industries, including ELNs. Financial details of the transaction were not disclosed. "The Arxspan acquisition, coupled with our strategic partnership with Mestrelab, positions Bruker firmly in the field of cloud-based, scientific software for our chemistry and pharma customers," said Dr. Falko Busse, Group President for Bruker Biospin.

*Bruker has specified informatics as an area of investment for the company and future growth. Last year, Bruker purchased a 51% interest in Mestrelab (see* ***IBO*** *12/15/18) for a total of $11.3 million, with an option to acquire the remainder after 2022. Based in Massachusetts and founded in 2011, Arxspan's offerings include software for chemical and biological registration, and inventory and assay data management, giving Bruker new capabilities for lab data management and workflows. Previously, Bruker had not participated in the ELN market.*

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# Proteomics Company Acquired

*Stockholm, Sweden 3/13/19*—Swiss firm Olink Proteomics, which provides products for protein analysis, has been purchased by Summa Equity for an undisclosed amount. Olink Proteomics has 110 employees. "The scientific and business opportunities for Olink Proteomics are enormous, as its technology is radically transforming the market for proteomics, thus enabling improved patient treatment," commented Tommi Unkuri, Partner at Summa Equity. "We look forward to supporting the company in its ambition to continue investing in improved customer solutions, and its effort to roll out its technology on a worldwide basis." Olink Proteomics management and its founder, Professor Ulf Landegren, remain shareholders.

*Olink Proteomics' panels are based on its Proximity Extension Assay technology, an immunoassay based on antibodies labeled with oligonucleotides for greater sensitivity. The technology is capable of simultaneous analysis of 92 proteins in 96 samples using 1 mL of sample. Real-time PCR is used for quantification.*

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# Thai Lab Instrument Distributor to be Acquired

*Zurich, Switzerland 3/5/19*—The Business Unit Technology of DKSH, a market expansion services provider, has agreed to purchase SPC. Financial details were not disclosed. SPC provides sales, marketing, application expertise and services for lab instruments and associated lab products in Thailand. The 430-person company generates CHF 50 million ($51 million at CHF 0.98 = $1) in revenues and is highly profitable. "Their business lines are complementary to DKSH's existing activities and perfectly fit into our business model for Technology in Thailand. Our clients and customers will benefit greatly from a bigger portfolio, better market coverage and more value-added services," stated Hanno Elbraechter, head of Business Unit Technology at DKSH. "DKSH will become the market leader in analytical instrumentation in Thailand and accelerate sustainable profitable growth."

*Founded in 1976, SPC works with more than 140 providers and serves both public labs and private labs in a variety of sectors. Mr. Elbraechter told **IBO**, "Up until now, DKSH and SPC were direct competitors in Thailand. The market for scientific instrumentation is still highly fragmented in the country, with many smaller family-owned distributors." He added, "The combination of DKSH and SPC gives international lab suppliers the opportunity to better meet the demand in Southeast Asia's second-largest economy. And for SPC's existing clients, the acquisition gives them the opportunity to expand their products to other countries throughout Asia where DKSH has operations."*

*Describing why Thailand is a particularly attractive market for DKSH Technology's analytical instrument business, Mr. Elbraechter estimated the size of the country's market for scientific instrumentation at $600 million growing at up to 10%. "Especially in the education and healthcare sectors, Thailand has shown steady growth in recent years. Two main drivers are the aging local population and the attractiveness of the country as an international health care destination," he said. "As an indicator, output in physical science journals from Thai researchers has doubled from 2015 to 2018." Other important segments are inspection and verification, according to him, due to inter-Asian trade, local exports and regulations.*

*Mr. Elbraechter emphasized, "With the acquisition of SPC, a key competitor and a top industry player, DKSH Technology has consolidated the market and became the largest player in scientific instrumentation in Thailand. We will ensure a seamless integration and drive further growth through three key areas: the strategy, the process and the people." He continued, "The business lines of DKSH and SPC are complementary one to another." As an example, he cited calibration services. "Also, the Thai market is currently undergoing a fast transformation, moving from a product-centric to a more service-driven focus. The acquisition of SPC means our customers will enjoy a more comprehensive, wider-range of calibration service offerings in the future."*

*Finally, Mr. Elbraechter noted, "In terms of the process, we are the only company in the market expansion services industry with global-scale, world leading platforms in areas such as CRM, IT and finance," he explained. "Through the strategy, the process, and the people, we will ensure a smooth integration, maximum benefits for our clients and customers, as well as a sustainable growth for both SPC and DKSH."*

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# Fourth Quarter 2018 Results: Bio-Rad Laboratories, Bruker, Danaher and Thermo Fisher Scientific

## Bio-Rad Life Science Revenue Soft Due to RainDance and Process Media Products Sales Decline

### Q4

| Bio-Rad Laboratories Life Science Q4 FY18 | | | | | |
|---|---|---|---|---|---|
| Rev. (M) | Chg. | Currency | Acq./Div. | Organic Chg.% | of Co. Rev. |
| $239.6 | 0.7% | 2.0% | — | 8.0% | 39% |

*Click to enlarge*

Sales for Bio-Rad Laboratories' Life Science segment increased 0.7% on an organic basis. The business segment's revenue growth was driven by demand for cell biology, Western blot and digital PCR products, as well as gene expression and antibody products. The growth was offset by the expected decline of the process media product line and the reduction of sales of RainDance products. The combined decline sales of RainDance and process media products was $8 million, with each declining $4 million. Excluding currency, Life Science experienced strong revenue growth in the US and China.

### FYE

| Bio-Rad Laboratories Life Science FY18 | | | | | |
|---|---|---|---|---|---|
| Rev. (M) | Chg. | Currency | Acq./Div. | Organic Chg. | % of Co. Rev. |
| $861.7 | 9.7% | 2.0% | — | 8.0% | 38% |

*Click to enlarge*

Sales for Bio-Rad Laboratories' Life Science segment increased high single digits on an organic basis. The business segment's revenue increase was driven by double-digit revenue growth of Droplet Digital PCR products, cell biology and food safety products. Other highlights included returned demand for Western blot and process media products, notwithstanding the $4 million decline for the fourth quarter 2018.

Geographically, Life Science saw broad-based demand, fueled by double-digit revenue growth in the US and China. For full-year 2019, Bio-Rad anticipates its Life Science revenue to increase 5.0%–6.0%. This outlook is anticipated from the broad-based growth for its product lines and the regions it serves, despite expectations of a $9 million sales decline of RainDance products.

## Bruker's BSI Revenue Slowdown Due to Low Sales in Europe and China

### Q4 and FYE

Fourth quarter 2018 Bruker Scientific Instrument (BSI) sales increased to make up 91% of company revenues (see ***IBO*** 02/15/19). System sales grew 1.7% to account for 73% of total revenues, while Aftermarket sales jumped 8.1%.

| Bruker Q4 FY18 | | | | | |
|---|---|---|---|---|---|
| | Rev. (M) | Chg. | Currency | Acq./Div. | Organic Chg |
| **Total** | $553.6 | 4.4% | -2.2% | 3.2% | 3.4% |
| Bruker Scientific Instruments | $500.5 | 3.4% | -2.2% | 3.5% | 6.5% |

*Click to enlarge*

Full-year 2018 BSI sales increased to make up 84% of company revenues. System sales grew 6.7% to account for 72% of total revenues, while Aftermarket sales jumped 10.6%. Organic revenue growth was led by strong sales for the Nano and CALID groups.

| Bruker FY18 | | | | | |
|---|---|---|---|---|---|
| | Rev. (M) | Chg. | Currency | Acq./Div. | Organic Chg. |
| **Total** | $1,895.6 | 7.3% | 1.4% | 1.6% | 4.3% |
| Bruker Scientific Instruments | $1,583.9 | 6.1% | 1.3% | 1.8% | 4.7% |

*Click to enlarge*

End-market wise, Bruker saw broad-based demand across all markets throughout the entire year. However, there was a significant sales decline of the semiconductor metrology business during the fourth quarter 2018 and latter half of 2018. Semiconductor metrology sales made up 5% of the company's total revenues.

| Bruker Q4 FY18 | | |
|---|---|---|
| | Rev. (M) | % of Rev. |
| BioSpin | $179.9 | 32% |
| CALID | $153.9 | 28% |
| Nano | $166.7 | 30% |
| BEST | $55.6 | 10% |

*Click to enlarge*

For fourth quarter 2018, the BSI segment delivered low-single-digit revenue growth due to the company focusing on de-risking for full-year 2018 financial results. For 2018, the BSI segment delivered mid-to-high single digit organic growth including solid sales in the last quarter. Sales were led by demand for the CALID and Nano Groups, as well as from North America and China.

| Bruker FY18 | | |
|---|---|---|
| | Rev. (M) | % of Rev. |
| BioSpin | $591.1 | 31% |
| CALID | $547.8 | 29% |
| Nano | $568.1 | 30% |
| BEST | $194.8 | 10% |

*Click to enlarge*

BioSpin experienced a revenue increase in the low single digits due to the broad-based sales to the biopharma, clinical and applied markets and aftermarket sales. Strong sales in these markets offset the soft sales in the academic and government markets. In addition, BioSpin's NMR system sold modestly, while sales for applied and clinical phenomics were consistent. Also, the division's NMR and preclinical imaging aftermarket and service revenues rose in the high single digits.

| Bruker Q4 FY18 | |
|---|---|
| | Rev. (M) |
| US | $142.1 |
| Germany | $65.8 |
| Rest of Europe | $153.8 |
| Asia Pacific | $152.4 |
| Other | $39.5 |

*Click to enlarge*

CALID sales increased high single digits, driven by solid demand for MS, molecular spectroscopy, microbiology and diagnostic product lines. Regarding MS, Daltonics product sales increased significantly thanks to strong demand for its microbiology and life science MS portfolios. Life science MS portfolio sales were led by the solid performance of the QTOF MS portfolio. The microbiology and diagnostics portfolio were led by broad-based sales of its instruments, consumables and services, while molecular spectroscopy business sales were driven by solid demand within its end-markets. Due to the continuing sluggish sales of CALID's detection product line, Bruker began a restructuring program that will consolidate it within CALID's optic business. CALID's detection product line delivered approximately $30 million in revenue in 2018.

| Bruker FY18 | | | |
|---|---|---|---|
| | Rev. (M) | Chg. | % of Rev. |
| US | $489.4 | 12.6% | 26% |
| Germany | $201.1 | 0.4% | 11% |
| Rest of Europe | $500.2 | 7.6% | 26% |
| Asia Pacific | $549.2 | 6.7% | 29% |
| Other | $155.7 | 3.0% | 8% |

*Click to enlarge*

Nano sales were fueled by solid sales of the division's ADVANCE x-ray products in industrial, materials research and academic and government markets. Other highlights include the increased sales of Nano Surfaces and Nano-analysis tools. These product lines' strong sales offset the sales declines of the Nano-semiconductor metrology product line due to the overall slow demand for the company's semiconductor metrology product line.

| Bruker Q4 FY18 | | | |
|---|---|---|---|
| Adj. Op. Profit | Chg. | Adj. Op. Margin | Chg. (bps) |
| $106.4 | 11.6% | 19.2% | -375 |

*Click to enlarge*

By region, European BSI sales rose modestly with low-single-digit growth, while North American BSI sales rose low double digits. Asia Pacific sales rose in the mid-single digits, with flat Chinese sales only delivering low-single-digit growth. However, BSI orders in China remained robust throughout fourth quarter and full-year 2018.

| Bruker FY18 | | | |
|---|---|---|---|
| Adj. Op. Profit | Chg. | Adj. Op. Margin | Chg. (bps) |
| $262.4 | 19.5% | 13.8% | -3906 |

*Click to enlarge*

For full-year 2019, Bruker forecasts its revenue to grow 6%–7%, including 4%–5% organic revenue growth and 8%–9% grown on a constant currency basis. This includes a 4% acquisition contribution. Geographically, the company expects double-digit growth in China as well as a solid performance in the US, while having lower expectations for Europe due to the region's long pattern of annual low-single digits revenue growth. End-market wise, Bruker anticipates biopharma's sales to be led by NMR and MS sales while expecting the applied market to have strong product sales for NMR, optics, microbiology, infectious disease diagnostics and the aftermarket business. However, Bruker does anticipate a slight decline in sales for the applied end-market as well as industrial. Product-wise, the company expects revenue tailwinds from proteomics and timsTOF Pro sales, and is also expecting sales for fluorescence microscopy portfolio for neuroscience and cell biology.

Bruker did not provide first quarter company or BSI revenue guidance, but the company stated that it anticipated a 5% currency headwind for the first quarter.

# Danaher's Beckman Life Science Sales Led by Automation

## Q4 & FYE

| Selected Danaher Segments Q4 FY18 | | |
|---|---|---|
| | Rev. (M) | Chg. |
| Life Sciences | $1,793.5 | 10.4% |
| Environmental & Applied Solutions | $1,126.5 | 4.5% |

*Click to enlarge*

| Selected Danaher Segments FY18 | | | | | |
|---|---|---|---|---|---|
| | Rev. (M) | Chg. | Currency | Acq./Div. | Organic Chg. |
| Life Sciences | $6,471.4 | 13.3% | -1.0% | -5.0% | 7.5% |
| Environmental & Applied Solutions | $4,319.5 | 8.8% | -1.0% | -2.0% | 6.0% |

*Click to enlarge*

Danaher's 5.5% revenue growth with core growth of 5.5% for the fourth quarter 2018, was led in part by 10.5% revenue growth with core growth of 7.5% for the Life Sciences business (see ***IBO*** 01/31/19). Life Sciences' operating profit margin declined 19.7% due to foreign exchange headwinds and investments including in R&D spending and sales and marketing. Danaher's 8.5% revenue growth with core growth of 6.0% for the full-year 2018 was led in part by 13.3% revenue growth for the Life Sciences business.

| Selected Danaher Segments Q4 FY18 | | | | |
|---|---|---|---|---|
| | Life Science | | Environmental & Applied Solutions | |
| | Rev. (M) | % of Seg. Rev. | Rev. (M) | % of Seg. Rev. |
| North America | $653.2 | 37% | $462.0 | 41% |
| Western Europe | $500.2 | 28% | $273.6 | 24% |
| Other | $152.1 | 8% | $30.8 | 3% |
| High Growth Markets | $488.0 | 27% | $360.1 | 32% |

*Click to enlarge*

| Selected Danaher Segments FY18 | | | | |
|---|---|---|---|---|
| | Life Science | | Environmental & Applied Solutions | |
| | Rev. (M) | % of Seg. Rev. | Rev. (M) | % of Seg. Rev. |
| North America | $2,295.6 | 37% | $1,770.7 | 41% |
| Western Europe | $1,846.7 | 28% | $1,059.1 | 24% |
| Other | $570.0 | 8% | $125.7 | 3% |
| High Growth Markets | $1,759.1 | 27% | $1,364.0 | 32% |

*Click to enlarge*

Within the Life Sciences segment, Beckman Life Sciences' revenue rose high single digits due to 20% revenue growth in automation. Specifically, automation revenue growth was led by demand for new products such as the Biomek i-Series, a liquid handling system. SCIEX revenue grew high single digits, with solid sales in North America and China. Marketwise, demand was high in the clinical, food testing and forensics markets.

Also, within the Life Sciences segment, Leica Microsystems' revenue was up mid-single digits due to broad-based growth across all markets and regions, led by life science research in North America. Phenomenex's revenue rose high single digits, while biotech sales were up double digits. Pall's revenue rose high single digits, driven by demand across the life sciences and industrial markets, with demand led by single-use technologies. IDT experienced broad-based growth across all major regions and product lines which resulted in a mid-teens revenue increase.

| Selected Danaher Segments Q4 FY18 | | | |
|---|---|---|---|
| | Op. Margin | Chg. (bps) | Core Chg. (bps) |
| Life Sciences | 19.7% | 190 | 230 |
| Environmental & Applied Solutions | 22.7% | 130 | 160 |

*Click to enlarge*

| Selected Danaher Segments FY18 | | | |
|---|---|---|---|
| | Op. Margin | Chg. (bps) | Core Chg. (bps) |
| Life Sciences | 19.0% | 190 | 230 |
| Environmental & Applied Solutions | 22.9% | 130 | 160 |

*Click to enlarge*

Within the Environmental and Applied Solutions segment, water quality sales were up mid-single digits, including high single-digit revenue growth for Hach. The business' revenue growth was attributed to demand in the municipal and industrial markets, led regionally by China. For the full-year 2018, Hach's revenue grew 10%. Danaher forecasts both its first quarter revenue and full-year 2019 revenue to increase approximately 4%.

## Thermo Fisher Scientific's Life Science Solutions Sales Led By

# Bioproduction, BioScience and Clinical NGS

## Q4

Reported high single-digit fourth quarter 2018 revenue growth for Thermo Fisher Scientific included 1% growth from acquisitions and a 2% decrease from currency (see ***IBO*** 01/31/19). The company credited the revenue growth to strong market conditions and improved operational execution.

| Thermo Fisher Scientific Q4 FY18 | | | | |
|---|---|---|---|---|
| | Rev. (M) | Chg. | % Organic Chg. | % of Total Rev. |
| **Total Company** | $6,507.0 | 7.6% | 8% | |
| Life Sciences Solutions | $1,697.0 | 7.5% | 8% | 25% |
| Analytical Instruments | $1,568.0 | 10.9% | 12% | 23% |
| Specialty Diagnostics | $951.0 | 4.0% | 5% | 14% |
| Laboratory Products & Services | $2,602.0 | 8.4% | 9% | 38% |

*Click to enlarge*

Revenue growth in the Life Sciences Solutions segment was led by bioproduction, bioscience and clinical NGS. The Analytical Instruments segment had broad-based growth across all businesses in the segment. The Specialty Diagnostics segment's revenue growth was led by the transplant diagnostics, neuro diagnostics and clinical diagnostics businesses, while the Laboratory Products and Services saw broad-based growth across all businesses, especially the pharma services business.

| Thermo Fisher Scientific Q4 FY18 | | | | |
|---|---|---|---|---|
| | Adj. Op. Profit (M) | Chg. | Adj. Op. Margin | Chg. (bps) |
| **Total Company** | $1,615 | 11.5% | 24.8% | 86 |
| Life Sciences Solutions | $624 | 11.2% | 36.8% | 122 |
| Analytical Instruments | $416 | 20.2% | 26.5% | 206 |
| Specialty Diagnostics | $233 | -3.7% | 24.5% | -198 |
| Laboratory Products & Services | $342 | 14.0% | 13.1% | 65 |

*Click to enlarge*

Sales to the biotech and pharmaceutical end-market increased in the low teens, while sales to the academic and government end-market delivered mid-single digit growth due to strong sales for the Life Science Solutions and Analytical Instruments businesses. Sales to the diagnostics and healthcare end-markets also grew in mid-single digits led by strong demand in the transplant diagnostics, amino diagnostics and clinical diagnostics businesses. Industrial and applied end-markets' revenue was up 10%, led by strong demand in the analytical instrument's businesses.

| Thermo Fisher Scientific Q4 FY18 | | |
|---|---|---|
| | Rev (M) | % of Total Rev. |
| Consumables | $3,231 | 35% |
| Instruments | $1,830 | 20% |
| Services | $4,141 | 45% |

*Click to enlarge*

North America and Europe's revenue growth rose in the high single digits, while Asia-Pacific sales increased in the low teens. Rest of the World sales grew in the mid-single digits. Within Asia-Pacific sales, Chinese sales rose more than 17% to $696 million. Within North America, US sales grew 8% to $3.0 billion.

| Thermo Fisher Scientific Q4 FY18 | | |
|---|---|---|
| | Rev (M) | % of Total Rev. |
| North America | $3,168 | 49% |
| Europe | $1,694 | 26% |
| Asia-Pacific | $1,441 | 22% |
| Other | $204 | 3% |

*Click to enlarge*

The company did not provide a first quarter revenue guidance.

## FYE

Reported double-digit full-year 2018 revenue growth for Thermo Fisher included 7% growth from acquisitions and a 1% decrease from currency. The company also responded to the impact of tariffs by implementing pricing and sourcing actions and adjusting supply chain operations.

| Thermo Fisher Scientific FY18 | | | | |
|---|---|---|---|---|
| | Rev. (M) | Chg. | % Organic Chg. | % of Total Rev. |
| **Total Company** | $24,358 | 16.4% | 8% | |
| Life Sciences Solutions | $6,269 | 9.4% | 8% | 25% |
| Analytical Instruments | $5,469 | 13.4% | 12% | 21% |
| Specialty Diagnostics | $3,724 | 6.8% | 5% | 15% |
| Laboratory Products & Services | $10,035 | 28.2% | 9% | 39% |

*Click to enlarge*

Sales to the biotech and pharmaceutical end-market increased in the mid-teens, while sales to the industrial and applied end-market delivered high single-digit revenue growth. Both the diagnostics and healthcare, and academic and government end-markets grew in the mid-single digits. Patheon sales increased 10%.

| Thermo Fisher Scientific FY18 | | | | |
|---|---|---|---|---|
| | Adj. Op. Profit (M) | Chg. | Adj. Op. Margin | Chg. (bps) |
| **Total Company** | $5,615 | 15.7% | 23.1% | -14 |
| Life Sciences Solutions | $2,158 | 13.9% | 34.4% | 136 |
| Analytical Instruments | $1,247 | 21.4% | 22.8% | 150 |
| Specialty Diagnostics | $952 | 2.7% | 25.6% | -103 |
| Laboratory Products & Services | $1,258 | 25.3% | 12.5% | -29 |

*Click to enlarge*

North America sales grew in the mid-single digits, while Europe and the Rest of World revenues increased in the high-single digits. Asia-Pacific sales rose in the mid-teens. Within Asia-Pacific, Chinese sales rose 22% to $2.5 billion while India delivered double-digit sales growth. Sales in high-growth emerging markets accounted for 21% of total revenues totaling approximately $5 billion.

| Thermo Fisher Scientific FY18 | | |
|---|---|---|
| | Rev (M) | % of Total Rev. |
| Consumables | $12,576 | 52% |
| Instruments | $6,292 | 26% |
| Services | $5,490 | 23% |

*Click to enlarge*

The company anticipates its full-year 2019 revenues to grow 2%–4% to $24.88 billion–$25.28 billion, including 5% organic growth and a 1.6% ($400 million) currency headwind. Thermo Fisher took the anticipated slower 2019 GDP performance into consideration for 2019 revenue guidance. Other forecasts include the Advanced Bioprocessing acquisition which the company expects to add $85 million to 2019 total revenues (see ***IBO*** 09/15/18). End-marketwise, Thermo Fisher expects high-single-digit revenue growth for the biotech and pharmaceutical end-market, while for academic and government end-market, the company expects low-single to mid-single-digit revenue growth. For the industrial and applied end-market, the company expects a slight decline revenue-wise due to a difficult year-over-year comparison, particularly in the second half of the year. Geographically, Europe is forecast to have low single-digit to mid-single-digit revenue growth.

| Thermo Fisher Scientific FY18 | | |
|---|---|---|
| | Rev (M) | % of Total Rev. |
| North America | $12,143 | 51% |
| Europe | $1,454 | 25% |
| Asia-Pacific | $1,251 | 21% |
| Other | $185 | 3% |

*Click to enlarge*

# Single-cell RNA Sequencing

Single-cell RNA sequencing (scRNA-seq), or single-cell transcriptomics, is a method for measuring the expression levels of genes in individual cells within a population of input cells. Traditional bulk transcriptomic analysis methods require input material from thousands of cells and generate only an average of the genetic expression levels of the input cells. However, gene expression has proved to be heterogeneous, even among cells from a common tissue source, making traditional methods ill adapted for the identification and analysis of rare cell types or comparative transcriptomics between similar cell types. By investigating transcriptomes at the single-cell level, scRNA-seq can provide deeper insight into tissue heterogeneity, cancer and disease, cellular response, immunobiology, and many other areas of interest. The method has rapidly gained acceptance in life science and applied research, and is gaining momentum in clinical settings, particularly for liquid biopsy applications. In the pharmaceutical and biotechnology sector, scRNA-seq has found applications in the development of biologics-based therapeutics.

As scRNA-seq and microfluidics technologies have matured, the ability to perform transcription analysis at a single-cell level has become much more accessible and practical. scRNA-seq methods have evolved from a set of very labor intensive, multistage workflows to kits, and now to automated instruments. Today, high-throughput instruments capable of analyzing tens of thousands of single cells in parallel are available, as a handful of companies have brought dedicated scRNA-seq instruments to the market. While each company has taken a different approach to the technique, general workflow steps include droplet encapsulation of single cells, lysis, reverse transcription of mRNA, amplification of cDNA and library generation. From there, sequencing is performed separately using high-throughput sequencing instruments, followed by computational analysis. The approaches differ in which strategies are used for reverse transcription and cDNA synthesis, amplification and the inclusion or exclusion of sequence-specific barcoding.

In addition to dedicated scRNA-seq platforms, the technique can also be adapted by single-cell analysis systems, which are capable of performing several types of single-cell analysis, including genomic, epigenomic and proteomic. However, it should be noted that single-cell analysis systems cannot yet perform multimodal single-cell analysis; that is, performing one type of analysis consumes the input cell, so that no further types of analysis can be performed on that cell.

Despite many advances in method development, challenges remain in performing scRNA-seq. As with other experimental methods that involves amplification, there is a risk that lower-abundance RNA transcripts can fail to be detected. Computational analysis challenges also remain, as many labs do not possess the expertise to perform the analysis. Bioinformatics software tools for scRNA-seq analysis are still in their early stages.

## scRNA-seq at a Glance:

### Leading vendors

- Becton, Dickinson
- 1CellBio
- Dolomite Bio

### Largest Markets

- Academia
- Pharmaceutical and biotechnology
- Hospital and clinical

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# Reported Financial Results

| $ in Millions USD | Period | Ended | Sales | Chg. | Op. Prof. | Chg. | Net Prof. | Chg. |
|---|---|---|---|---|---|---|---|---|
| HTG Diagnostics | FYE | 31-Dec | $9.1 | 34.2% | -$16.2 | 8.8% | -$16.5 | 13.2% |
| NanoString Technologies | Q4 | 31-Dec | $30.0 | -14.8% | -$17.6 | -138.6% | -$21.11 | -141.2% |
| NanoString Technologies | FYE | 31-Dec | $106.7 | -7.1% | -$69.4 | -81.7% | -$77.2 | -77.9% |
| Quanterix | Q4 | 31-Dec | $10.9 | 65.1% | $14.2 | 42.3% | -$8.8 | -19.8% |
| Quanterix | FYE | 31-Dec | $37.6 | 64.5% | $49.1 | 36.3% | -$31.0 | -14.9% |
| **Other Currencies (in Millions)** | | | | | | | | |
| Abcam* | 6 mo. | 31-Dec | £124.70 | 10.8% | £40.80 | 22.2% | £33.60 | 21.3% |
| Merck KGaA | Q4 | 31-Dec | € 3,887.60 | 6.6% | € 340.90 | 42.0% | € 2,445.70 | 141.6% |
| Merck KGaA | FYE | 31-Dec | € 14,836.30 | 2.2% | € 1,726.50 | -28.7% | € 3,373.70 | 29.5% |
| Merck KGaA (Life Sciences) | Q4 | 31-Dec | € 1,627.70 | 8.8% | € 231.80 | 48.2% | NA | NA |
| Merck KGaA (Life Sciences) | FYE | 31-Dec | € 6,185.20 | 5.2% | € 1,035.60 | 24.2% | NA | NA |
| Microsaic | FYE | 31-Dec | £0.58 | 69.0% | -£2.99 | -3.8% | NA | NA |
| Tecan | FYE | 31-Dec | CHF 593.80 | 8.2% | CHF 88.55 | 11.0% | CHF 70.70 | 7.2% |
| Tecan (Life Sciences) | FYE | 31-Dec | CHF 347.26 | 9.0% | CHF 51.26 | 1.5% | NA | NA |
| Tecan (Partnering) | FYE | 31-Dec | CHF 267.59 | 9.9% | CHF 48.62 | 15.9% | NA | NA |
| XRF Scientific* | 6 mo. | 31-Dec | AUD 15.00 | 24.0% | AUD 2.10 | 75.0% | AUD 1.10 | 107.5% |

**For fiscal year ending June 30, 2019*

NA = not available, NM = not material

# Government

The Trump administration has released a $4.7 trillion budget proposal for FY20 that includes many cuts for government science agencies. However, certain scientific endeavors are prioritized in the budget proposal, such as AI, quantum information science, wireless 5G communications and advanced manufacturing. For example, the proposal allocates $850 million for AI and $430 million for quantum science within multiple federal agencies. However, according to observers, the importance of research in general is not viewed as a priority, as the proposal allocates $134 billion in total federal R&D investments, an 11% decrease.

The budget request would lower the NIH's budget by 13% to $34.4 billion. Within the NIH, a new pediatric cancer project at the National Cancer Institute (NCI) would receive $50 million in funding for drug discovery, researching the biology of such cancers and creating shared resources from existing datasets. For this project, $500 million would be allocated over a 10-year period. However, experts worry about the heavy focus on data sharing in the project, believing that the initiative will be at the expense of other research for pediatric cancers, as the overall budget for the NCI would fall to $5.2 billion, a 15% decline.

The Trump administration has also requested to close the Agency for Healthcare Research and Quality, revamping it as a new Institute of the NIH called the National Institute for Research on Safety and Quality, with $256 million in funding. This request had been made in the past by the Trump administration as well, only to be rejected by Congress, as has the request to end the Advanced Research Projects Agency–Energy.

The NSF would receive a 12% drop in funding to $7.1 billion, while the DoE's Office of Science funding would fall 17% to $5.5 billion. Also in the DoE, the budget for the Office of Energy Efficiency and Renewable Energy would plummet 86% to $343 million. The proposal also calls for an almost 33% decline in the EPA's budget to $6.1 billion, with only $440 million allocated to the Agency's science programs, a 40% fall. Climate change science, part of the EPA's air and energy research, would decline 66% to $32 million. Additionally, the NIST would also face a 30% decrease in its budget.

Although the proposal calls for a 15% decline for the USDA budget, including an 8% drop in funding for the Agricultural Research Service to $1.2 billion, the Agriculture and Food Research Initiative, which is the main competitive grants program at the USDA, would get a 20% increase to $500 million.

Most experts believe the science cuts in the proposal will not be approved by Congress.

**Source**: *Science*

# Pharmaceuticals

A spike in counterfeit and low-quality medications has clinicians around the world requesting an international initiative to fight against these drugs, which are estimated to kill hundreds of thousands of patients annually. A projected 250,000 children alone die each year as a result of fraudulent medicines for malaria and pneumonia, likely due to poor vaccines and antibiotics. Many of the deaths related to counterfeit drugs are in countries with a high demand for therapies and a low enforcement of quality control and oversight, leaving the space open for criminal organizations to enter the market. If caught, the penalties are light, with offenders having to pay fines or serve short jail sentences.

A large array of drugs that have been tested have been proven to be ineffective or downright fake, including antibiotics, antimalarials, and cardiovascular and cancer medicines. Some counterfeit medicines that were tested were found to contain components such as printer ink, paint and arsenic. The predominant drugs on the counterfeit market are largely lifestyle drugs, such as Viagra. These fake medicines either do not contain the effective ingredients, do not dissolve properly when taken, have been sold past their expiration date or have degraded due to improper storage conditions. Experts estimate that up to 10% of drugs in low- and middle-class countries are either poor quality or completely fraudulent, and have cost the local economies anywhere between $10–$200 billion each year.

Because of the rise in fake medicines, doctors have labeled this a public health emergency affecting people internationally. For example, through its testing efforts, Pfizer found 95 counterfeit products in 113 countries last year, up from 29 fake drugs in 75 countries in 2008, an over 200% increase. Doctors have made recommendations to address the issue, including enhancing support to the World Health Organization's drug surveillance program, and establishing a global treaty on drug quality that would allow for monitoring of fraudulent drug manufacturing and the extradition of suspects for trial in countries they are targeting.

**Source**: *The Guardian*

# Biopharmaceuticals

In 2018, the Nasdaq Biotechnology Index spiked 15%, only to lose its gains in the fourth quarter of the year, resulting in a year-end decline of 9%, while the Dow Jones Pharma and Biotech index remained flat. In contrast, the S&P Pharmaceuticals Index grew 5%.

The Japan Index had grown 17% by the end of September 2018, but fell 18% in the fourth quarter. This is largely due to Takeda and its unpopular takeover of Shire for $64 billion, which led to a year-end share price decline of 42%. The acquisition led to a $6 billion gain for Shire. Takeda lost $20 billion in value, an overall poor performance that was nominally worse than that of Bayer, which has also faced losses over its likewise unpopular acquisition of Monsanto.

Thanks to large funding rounds, drug developers fundraised approximately $17 billion globally in 2018, an increase of 29%, even with the number of financings dropping to record low numbers over the past 10 years. However, experts do not expect the massive gains of 2018 to be repeated, leaving the extent of the slowdown in 2019 unknown. Companies with the highest venture rounds in 2018 included Moderna Therapeutics at $500 million, Samumed with $438 million and Relay Therapeutics with $400 million. The biotech IPO market hit a record high in 2018, reaching $7.23 billion, with the average amount raised surpassing $100 million for the first time.

Also in 2018, the US FDA approved 62 novel drugs, a new record for the Administration, with the medicines estimated to generate $24 billion in sales by 2023. The newly approved drugs include a completely new class of

migraine drugs with Aimovig, Emgality and Ajovy, as well as 17 cancer drugs, including 6 for hematological cancers, and the very first RNAi therapeutic with Alnylam's Onpattro. There was also a nominal reduction in average approval times to 10.6 months, largely due to faster standard review cycles and slightly slowed priority reviews.

**Source**: *Evaluate*

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# Liquid Chromatography

## Company Announcements

Separations technology provider **Biotage** announced in December 2018 that it will not exercise its current call option to acquire **Chreto**, which is developing membrane cartridge-based affinity purification technology. Biotage currently owns 22% of Chreto (see ***IBO 8/31/16***). At the time of its initial investment, Biotage gained the option to acquire the remainder of the company for SEK 141.2 million ($17.0 million). Biotage now plans to renegotiate with other Chreto shareholders for a different price.

In February, agarose product supplier **Bio-Works** announced that it increased its customer base by 125% last year to 236. The highest number of customers, 40, are working with scale-up.

**Prometic Life Sciences**, which provides bioseparation technology, engaged **Lazard** in February to review and execute key strategic transactions focused on maximizing shareholder value. These transactions could include, among other things, the out-licensing of drug candidates and monetization of non-core assets.

**Repligen**'s 2018 revenues grew 37.4% to $194.0 million (see ***IBO*** 2/28/19), including organic revenue growth of 17%. Direct product sales grew 72%. Chromatography, filtration, protein and other products accounted for 23%, 47%, 28% and 2%, with sales rising 24.8%, 84.7%, 1% and 104.7%, respectively. The company forecasts 2019 revenues to increase 12%–16% to $218–$225 million, with organic growth of 13%–17%.

In March, **Sartorius Stedim Biotech (SSB)** and **Novasep**, which has expertise in resin-based batch and continuous chromatography systems, entered into a collaboration agreement in the area of membrane chromatography and single-use bioprocessing. Novasep's established BioSC platform and SSB single-use technology will form the basis for the codevelopment of innovative chromatography systems.

## Product Introductions

In January, **Shimadzu** introduced the Nexera Prep Series Preparative Purification LC. The Nexera Prep Series reduces the time spent on examining conditions by using the software's simulation function. Systems can be configured using related products such as the LH–40 Liquid Handler, FRC–40 Fraction Collector, Shim-pack Scepter LC Column for Analysis and Preparative Work, and Column Hub.

In January, **Shimadzu Scientific Instruments** released its new Hemp Analyzer. The HPLC system is a complete turnkey analyzer for quantitative determination of cannabidiol (CBD) and cannabinoid content. The high-throughput method is designed for analysis of CBD and 9 other commonly requested cannabinoids in under 8 minutes.

In February, **Shimadzu Scientific Instruments** released the new PPSQ–51A single reactor and PPSQ–53A triple reactor gradient system protein sequencers for the analysis of N–terminal amino acid sequences through automated Edman degradation.

In February, **Shimadzu Scientific Instruments** released the new Shimpack Arata LC columns for high pH compounds. They are currently available in 2.2 µm particles with 5 µm particle columns to be released in the future.

**Waters** launched in January the BioResolve SCX mAb columns and Vanguard FIT Cartridge technology, together with a suite of complementary consumables, enabling mAb charge variant analyses. The base material consists of 2 µm nonporous particles. The Vanguard Fully Integrated Technology (FIT) Cartridge prevents particulates and other contaminants from being carried onto the column.

**PharmaFluidics** introduced in February a µPAC trapping column, compatible with their line of analytical micro-chip columns.

**BUCHI Labortechnik** launched in February the new Pure flash and prep chromatography systems. The closed fraction collector bay enables use of the system outside of a fume hood. It features integrated UV and ELS detection, and flash and prep HPLC capabilities in one system.

In February, **Tosoh Bioscience** released the TSKgel FcR-IIIA-NPR column, calling it the first FcγR affinity chromatography analysis column. TSKgel FcR-IIIA-NPR uses the human Fcy receptor IIIa as a ligand.

**Axcend** announced in February that its Axcend shoe box-sized LC is now shipping. It features 150 µm internal diameter fused silica capillary columns and single or dual on-column UV-absorption detectors, with pressure up to 6,000 psi. The price begins at $35,000 and includes 1 standard AFLC cartridge.

### Sales and Orders of Note

In February, **Novasep** announced **Enzene Biosciences** (India) chose its BioSC Pilot for purification of biopharmaceuticals at its Pune plant.

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# Sequencing

### Company Announcements

In January, **MGI**, a subsidiary of **BGI**, announced its expansion in the Middle East with a new office in Dubai.

In February, **Miami Cancer Institute**, part of **Baptist Health South Florida**, implemented **Philips'** cloud-based comprehensive genomics platform under a multi-year agreement to inform cancer treatment options through advanced NGS diagnostics. This new initiative with Philips and Miami Cancer Institute also helped accelerate the lab's launch of the TruSight Tumor 170 (TST170) NGS testing service, in collaboration with **Illumina** and **N-of-One**.

**HTG Molecular Diagnostics** announced in February a fourth amendment of the second statement of work (SOW) with **QIAGEN** under their Master Assay Development, Commercialization and Manufacturing Agreement. The Fourth SOW Two amendment contemplates the use of the investigational use-only assays developed in the previous phases of SOW Two in multiple pharma clinical trials and additional development activities, which potentially could be included in a future companion diagnostic regulatory submission.

**HTG Molecular Diagnostics'** 2018 revenues grew 45.7% to $21.5 million (see Bottom Line). Product and Product-related Services, and Collaborative Development Services represented 34% and 56% of revenues, growing 34.2% and 55.5%, respectively. Instrument revenue declined 8.6%, while Consumables sales grew 27.1%.

In February, **QIAGEN** entered into a broad agreement with **Ares Genetics**, a subsidiary of **Curetis**, to develop bioinformatics and assay solutions to accelerate research targeting antibiotic-resistant bacteria. QIAGEN acquired an exclusive license to leverage Ares Genetics' antimicrobial resistance database, ARESdb, as well as bioinformatics tools and workflows from the ARES Technology Platform, ARESstools. QIAGEN also obtained a non-exclusive worldwide license to develop and commercialize molecular research assays using ARESdb content with its NGS and PCR solutions.

Rare disease diagnostics AI software provider **Diploid** entered into a partnership in February with **Genomenon**, integrating their respective Mastermind Genomic Search Engine and Moon diagnostic software.

In February, the **Illumina Corporate Foundation** and **Discovery Education**, a provider of digital curriculum resources, digital content and professional development for K-12 classrooms, launched DNA Decoded, a program designed to equip middle and high school teachers with lessons and activities for teaching genomics.

In March, **Illumina** announced an agreement with **Boai NKY Medical** to jointly develop an integrated NGS system

that provides IVD assays for genetic kidney disease testing based on Illumina's MiniSeq System and related sequencing consumables. The solution will integrate NKY's proprietary testing component that includes library preparation kits and analysis software. Illumina stated that the collaboration is a significant step toward achieving **National Medical Products Administration** approval in China.

In February, the **Medical Genome Initiative**, a consortium that will work to expand access to high-quality clinical whole genome sequencing (cWGS) for the diagnosis of genetic diseases, launched. The Initiative will focus on the publication of common laboratory and clinical best practices for the application of cWGS. Founding member institutions include **Baylor Genetics**, **Broad Institute of MIT and Harvard**, **HudsonAlpha Institute for Biotechnology**, **Illumina**, **Mayo Clinic**, **Rady Children's Institute for Genomic Medicine**, **The Hospital for Sick Children** (**SickKids Toronto**) and **Stanford Medicine**.

**Murrieta Genomics**, the genomic sequencing business incubator, and **SeqOnce**, maker of RhinoSeq library construction kits, announced a partnership in February.

In February, **seqWell**, which provides multiplex barcoding library preparation technology, announced distribution partnerships covering 15 countries in the Asia-Pacific Rim, Europe and the Middle East.

**Thermo Fisher Scientific** announced in February that **Japan's Ministry of Health, Labor and Welfare** granted expanded approval to its NGS-based multiplex Oncomine Dx Target Test CDx System, adding 3 additional biomarkers to the 8 already approved for targeted therapies for non-small cell lung cancer.

In March, genomics services company **TATAA Biocenter** announced a collaboration to offer exploratory microRNA profiling services and distribution of **SomaGenics**' RealSeq NGS products in Scandinavia, and the Czech and Slovak Republics.

## Product Introductions

In February, **Oxford Nanopore** released the '109' cDNA Kit, which provides high throughput while generating complete sequences of full-length cDNA strands, with a low input option of 1 ng PolyA+ RNA. The new cDNA sequencing method enables users to sequence whole transcriptomes to high coverage on a single MinION flow cell (10–15 million reads x full-length transcript).

**Illumina** announced in February the availability of the NovaSeq 6000 S Prime (SP) Reagent Kit. The new NovaSeq S-Prime Reagent Kits are available in 100- and 300-cycle configurations, as well as a 500-cycle configuration that will support read lengths up to 2 x 250bp.

In February, **Dolomite Bio** debuted the scRNASeq Reagent Kit to enable robust and reliable generation of PCR-amplified cDNA libraries on its Nadia Instrument, allowing high-throughput gene expression profiling of heterogenous cell populations.

**Partek** released in February Partek Flow 8.0, designed for single-cell omics. The t-SNE plot feature can now be used for visualization of multimodal single-cell experiments, such as the simultaneous analysis of protein and mRNA expression.

In February, **Circulomics** launched the Short Read Eliminator Kit to perform size selection purification of high molecular weight DNA for long-read sequencing library preparation. The kit enhances long-read sequencing read lengths by using size selective precipitation to remove short DNA. Short DNA up to 25 kb in length are progressively depleted, while DNA less than 10 kb in length is nearly completely removed.

In February, **New England Biolabs** preannounced the release of the NEBNext Enzymatic Methyl-seq (EM-seq) products, which provide an enzymatic alternative to bisulfite sequencing, combined with high-efficiency, streamlined library preparation. The company will also introduce NEBNext Companion Module for **Oxford Nanopore Technologies**' ligation sequencing, as well as NEBNext DNA repair, End prep and Ligation reagents for use alongside Oxford Nanopore's SQK-LSK109. NEB also previewed new options for depletion of abundant RNAs.

**Agilent Technologies** launched in February the turnkey, fully automated Magnis NGS Prep System. The solutions includes reagents and protocols that make it easy to assay multiple genes and complex genetic aberrations from

genomic DNA with a one-day turnaround for results.

In February, **Lexogen** introduced the CORALL Total RNA-Seq Library Prep Kit, an all-in-one library preparation kit for whole transcriptome analysis applications. CORALL is a fragmentation-free protocol and works with 1 ng to 1 µg of total RNA.

**Twist Bioscience** debuted the Twist Human Core Exome Kit and Twist Custom Panels NGS target enrichment workflows, available to early access customers, in February. New products include Twist Fast Hybridization and Wash Kit; Twist Universal Blockers to allow flexible blocking and improved on-target capture; the Twist Universal Adapter System, to maximize performance for library preparation; and the Twist Mechanical Fragmentation Library Prep Kit for highly degraded samples.

In March, **MGI**, a subsidiary of **BGI**, introduced CoolNGS chemistry, a new sequencing approach for its DNBseq sequencing technology that enhances the throughput, accuracy, read length and cost effectiveness of DNA sequencing.

**Loop Genomics**, the single-molecule counting long-read sequencing company with a hardware free solution, introduced in March what it calls the first solution that provides both transcript counting and phasing for mRNA using long reads on **Illumina** sequencers in one kit.

In March, **Integrated DNA Technologies** (**IDT**) debuted the rhAmpSeq targeted sequencing system for amplicon sequencing on **Illumina** NGS platforms. The technology employs a unique RNase H2/DNA polymerase two-enzyme system coupled with RNA-DNA hybrid primers that increase the specificity of PCR amplification while minimizing primer dimer formation.

### Sales and Orders of Note

In February, **Genomics England** selected **QIAGEN**'s QCI (QIAGEN Clinical Insights) portfolio offering on behalf of the **National Health Service** to support the UK's program to sequence, analyze and interpret 5 million genomes over the next 5 years. QIAGEN will support a national network of UK laboratories.

**BC Platforms** announced in February that it is providing a customizable end-to-end SAAS genomics platform to **Bumrungrad International**, a multi-specialty hospital located in Bangkok, Thailand.

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# Molecular Spectroscopy

### Company Announcements

In January, color measurement system provider **X-Rite**, a **Danaher** company, named **Odak Kimya** as its sole distributor for Turkey.

**Princeton Instruments**, a manufacturer of scientific cameras and spectroscopy equipment, appointed in January **Te Lintelo Systems** as a distributor for the Benelux Union (Belgium, the Netherlands and Luxembourg).

In February, **WITec** established an office in France, located in Lyon.

In March, **Bruker** announced a collaboration with **MilliporeSigma** resulting in the development of a certified reference material tailored to qNMR that is the basis of Bruker's new Quantitative Performance Qualification (qPQ) test.

### Product Introductions

In January, **Anton Paar** introduced the 5000 Wine system, calling it the company's first FTIR analyzer. The system

determines more than 13 characteristic values of wines or must.

**Anton Paar** debuted in February the handheld, 1.5 lb (0.68 kg) Cora 100 Raman spectrometer, designed to be compatible with all major decontamination techniques.

**PG Instruments** released in January the new Micro UV/Vis spectrophotometer for use with 0.5–2 µl of sample. A new function is bacterium cell concentration measurement in a cuvette.

In January, **Modern Water** launched the Microtox LX for the biological monitoring of water using bioluminescent bacteria, replacing the Microtox M500 analyzer. New features include actively cooled reagents, read and sample wells and a touchscreen tablet.

In February, **Pendar Technologies** released the handheld PendarX10 Raman system for chemical detection, allowing for a standoff distance of up to 3 feet with no laser eye-safety protection.

**Magritek** launched in February a new Spinsolve Autosampler for its desktop NMR system, which enables the measurement of up to 20 samples in any order.

In March, **Bruker** released new NMR qualification solutions and GxP readiness kit, including software, for use with NMR and EPR in regulated markets. The new qPQ test is now incorporated within the Bruker AssureSST. The company also introduced AutoCalibrate, an imbedded tool in the IconNMR automation software that determines the optimal settings for key NMR parameters, logs results and monitors changes.

**AMETEK Spectro Scientific** launched in March an expanded cloud-based TruVu 360 Enterprise Fluid Intelligence Platform for oil analysis consisting of two standalone versions, theTruVu 360 Basic and TruVu 360 Pro. The system is for use with a Spectro Scientific MiniLab on-site oil analysis system for a single user.

In March, **WITec** debuted the ParticleScout particle analysis tool for its alpha300 Raman microscope series. The company stated that the integration of a particle analysis tool with a Raman database is unique.

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# Sample Preparation

## Company Announcements

**Yunnan Energy International** (formerly **Techcomp**) announced in December 2018 an exclusive distribution agreement with **Eprep** for China, Hong Kong and Macau SAR.

In December 2018, **PreOmics**, which is developing sample preparation products for MS, raised €3.3 million ($3.8 million) in a Series A funding round led by **Think.Health Ventures**.

In January, **Covaris**, a developer of ultrasonicators, signed an exclusive distribution agreement with **Alliance Global** for the Middle East, Africa and parts of Central Asia.

**Chromatrap** entered into a partnership with **Covaris** in January to offer a highly scalable and simple ChIP (Chromatin ImmunoPrecipitation) workflow enabling researchers to easily isolate protein DNA complexes for downstream applications, such as ChIPSeq, ChIPqPCR, NGS and MS.

**Pressure BioSciences** announced in January a collaboration with **NutraFuels** to advance the development of a new generation of health and wellness nutraceutical products based on processing using its Ultra Shear Technology platform.

In March, **Pressure BioSciences** announced a collaboration with Germany's **Steinbeis Center for Biopolymer Analysis & Biomedical Mass Spectrometry**, combining the capabilities of its pressure cycling technology with the Steinbeis Center's PROTEXMS instrument for elucidating structural details of antibody interactions.

In February, **Macherey-Nagel** and **Andrew Alliance** signed an agreement to develop an automated solution for the preparation of transfection-grade plasmid DNA. Under the co-marketing agreement, Macherey-Nagel will combine

its existing NucleoBond Xtra Midi kits with Andrew Alliance's OneLab software platform and Andrew+ robot.

**Gilson** announced in February a new partnership to distribute **AFFINISEP**'s line of sample preparation and extraction products. The products and services complement Gilson's ASPEC line of SPE instruments and bring application-specific kits and pre-developed methods.

In February, **Porvair Sciences** announced its involvement in a new £2.6 million ($3.8 million) project led by **Swansea University** that aims to improve the diagnosis and treatment of ovarian cancer. This project will involve collaboration with five key industrial partners: **Porvair Sciences**, **Bruker UK**, **GE Healthcare UK**, **Axis Bio** and **GlaxoSmithKline**. A new antibody drug conjugates company will join the project in its second year. The Cluster for Epigenomic and Antibody Drug Conjugate (ADC) Therapeutics project aims to utilize novel epigenetic drugs and ADCs to manipulate chemical compounds thus creating a new route for the treatment of ovarian cancer. Porvair will supply its ChIP technology.

### Product Introductions

**QIAGEN** launched in November 2018 the new DNeasy Plant Pro Kit, a system for extraction of high-quality DNA from varied plant samples. The new kit includes the innovative bead beating technology for significantly higher sample disruption efficiency.

In January, **Pressure BioSciences** announced the commercial launch of its Biopharmaceuticals Contract Services Business. This follows the company's acquisition of the assets of **BaroFold,** which supplies technology for the disaggregation and controlled refolding of proteins, in December 2017.

Gene synthesis provider **GenScript** released the AmMag SA semi-automatic purification instrument that simplifies protein and antibody purification. The AmMag SA, developed under an exclusive license agreement with **Amgen**, features high throughput for larger sample volumes, enabling researchers to purify up to 50 mL samples while maintaining a low endotoxin environment.

In February, **BUCHI Labortechnik** introduced the Universal Extractor E-800, a new extraction line that includes a fully automated extraction unit for residue and contaminant analysis, natural products research, and analysis of polymers and materials. The company also debuted the FatExtractor E-500, a specialized instrument for fat extraction.

In March, **Diagenode** debuted its third generation long-fragment DNA shearing innovation, the Megaruptor 3. The new instrument is designed to provide automated and consistent fragmentation of DNA from 5 kb to 100 kb.

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# EU

The European Commission (EC) released this month a strategy addressing the stages of pharmaceutical development, production and disposal, and how the process can be optimized. The EC outlined the environmental damage some pharmaceuticals cause, as residues of products may get into the environment during their production, use and disposal. These residues have been located in water bodies, both surface and ground, soils and animal tissues across the EU, with most of the residues being from painkillers, antimicrobials, antidepressants, contraceptives and antiparasitics. Some residues have also been found in drinking water.

As pharmaceuticals are effective in low concentrations so they can be processed and tolerated by the patient's body, once in the environment, the drugs cause lasting damage. This is because the low concentrations are still toxic or have other physiological effects and, in some cases, constant releases result in a steady concentration of chemicals being emitted into the natural surroundings.

Currently, over 3,000 APIs are on the market, with the number of human medicinal products rising dramatically since 1990 due to increases in product prices driving innovation as well as growing consumption. The EC projects that the pharmaceutical concentrations in the environment and, therefore, environmental damage will continue to

increase as EU populations age.

As there is limited information and studies being conducted on the links between pharmaceuticals in the environment and the effects they have on human health, the EC is proposing a new strategy. The "Strategic Approach to Pharmaceuticals in the Environment" will help further investigate risks, accelerate innovation to address those risks, identify any knowledge gaps and find solutions for them, and ensure that the solutions to address risks do not negatively affect access to safe and effective pharmaceuticals.

**Source**: *European Commission*

# Luxembourg

During the period between 2018 and 2021, Luxembourg plans to spend €1.5 billion ($1.7 billion) on R&D, with the FNR, the country's National Research Fund, receiving €340 million ($381.8 billion). Currently, Luxembourg's public R&D spending is close to the EU average of 0.7% of GDP.

Support for research spending is both public and bipartisan in Luxembourg. While the country previously revamped its economy by investing in banking and finance in the 1990s, the government is aiming for another economic overhaul by focusing on science and innovation investments to reduce the nation's dependence on finance. To achieve this, establishing a high-technology sector is key.

The nation is prioritizing programs that will help boost the growing economy, including space and satellite businesses, and information and communications technology. The FNR is also highlighting biomedicine, with the goal of uniting life science and data science. An example of this is the FNR's support of a national study cohort for Parkinson's disease, in which patient samples are analyzed for biomarkers and assigned differing diagnoses and recommendations for each treatment, resulting in extremely high-quality data.

In addition, the linchpin of science in Luxembourg, the Belval Innovation Campus, is the site of one of the largest urban regeneration projects in Europe, totaling €1 billion ($1.1 billion). Belval is home to the namesake university, as well as research centers and business incubators.

**Source**: *Financial Times*

# China

In 2018, GDP in China grew 6.6% to CNY 90,030.0 billion ($13,392.5 billion). Science and technology R&D expenditures jumped 11.6% to CNY 1,965.7 billion ($292.4 billion), representing 2.18% of the nation's GDP. Of the total figure, CNY 111.8 billion ($16.6 billion) was allocated to basic research programs, with 1,052 projects being conducted under China's key R&D program. Additionally, 563 research projects were organized under the national R&D program in 2018, and 44,504 projects were financed by the National Natural Science Foundation.

By year-end 2018, 501 state labs, 132 national engineering research centers, 217 national engineering labs and 1,480 national enterprise technical centers were fully operational. Twenty-one subfunds were established by the National Fund for Technology Transfer and Commercialization, totaling CNY 31.3 billion ($4.7 billion). Last year, 412,000 technology transfer contracts were signed, which reflected a value of CNY 1,769.7 billion ($263.3 billion), a 31.8% increase.

Also at the end of 2018, 791 national quality inspection centers had been established. A total of 484 product quality and management system and service certification agencies were created, and 2,668 national standards were either developed or revised.

Total Chinese energy consumption in 2018 reached 4.64 billion tons of standard coal equivalent, a rise of 3.3%. Coal consumption in general rose 1.0%, accounting for 59% of total energy consumption, while crude oil and natural gas

grew 6.5% and 17.7%, respectively. Electric power usage increased 8.5%.

**Source**: *National Bureau of Statistics of China*


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