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Pittcon 2021 Exhibits New Products But Number of Exhibitors Declines

Pittcon, now in its 72nd year as an annual conference, stepped into a new era in 2021, going virtual. The virtual show was held March 6–10. Next year's conference is already planned to be an in-person affair and is scheduled for March 5–9 in Atlanta, Georgia, with 10 program tracks.

The virtual version of Pittcon offered the usual lineup of invited symposia, award symposia, and contributed presentations with Q&A, networking and chat. Recorded presentations are available online until June 12.

This schedule included seven company press conferences. Metrohm USA and Shimadzu Scientific Instruments held their annual press conferences, introducing a host of products released over the last year. Shimadzu highlighted the new capabilities found in the software for its Advanced iSeries HPLC series (see "Pittcon 2021 New Products") software, including remote options for operating software and the proprietary iPDeA II deconvolution algorithm for analysis. Metrohm detailed new products within 4 of its technology platforms (titration, IC, spectroscopy, electrochemistry and process analytics).

Like last year, JEOL USA hosted a press conference, and announced new GC-TOF and cryo-EM systems. The company has already sold its first of the new GC-TOF system to Caltech. JEOL's annual sales, which include analytical instruments, semiconductor analysis tools, clinical analyzers and other technologies, total more than \$1 billion. At its press conference, the company discussed how it worked remotely with customers during the pandemic, including running instruments for university classes. The company also emphasized that it is the only company with its own helium-capable cryo-TEM.

Another company that debuted a GC at the show was Lucidity, which is owned by CEM. At its press conference, Lucidity announced how its compact GC and LCs promise new levels of accessibility. The company also discussed a model for shopping, evaluation, financing, setup, operation and support based on consumer product companies, such as clear pricing on the website, a 30-day return offer, short training videos and rent-to-buy agreements.

Malvern Panalytical, a Spectris company, used its press conference to focus on the recently introduced Aeris powder diffraction XRD system with an in-depth look at new features and unique capabilities. At the show, the company announced two new applications: grazing incidence XRD, with applications such as thin film analysis, and transmission diffraction for foils and capillaries.

At its press conference Lab Vantage, the LIMS company used the opportunity to launch three new products and highlight its "culture of cybersecurity." It also provided an overview of the company's business, citing more than 200,000 users and 1,600 installations with an end-market made up of pharmaceutical/biotech (54% of revenues), the chemical sector (12%), food labs (9%), and consumer

packaged goods (9%), with the rest being “other.” They showed a slide of some of their major customers. Cybersecurity measures include using third parties for penetration testing, and trying to identify issues before they occur.

Exhibitor attendance plummeted this year. Only 173 exhibitors participated versus 529 in 2020. Among the staples of past Pittcons missing from this year’s exhibition hall were Anton Paar, Hamilton and Waters. Major companies that did participate with virtual booths included Beckman Coulter Life Science, Bruker and Mettler-Toledo. Vendors exhibiting this year but not last year included PerkinElmer and Digital Surf, its first time at the show.

Although Pittcon is more known for its analytical chemistry presentations, the conference included a number of life science talks. Addressing an issue very much relevant to CoVID-19 vaccines, Annette Bak, PhD, of Astra Zeneca spoke about “mRNA Therapeutics: Analytical and Bioanalytical Characterization,” discussing lipid nanoparticles (LNPs), which encapsulate the mRNA for delivery into a cell. LNPs are typically 60–80 nm in size and there are 6–8 mRNA per particle. Key analytical steps are analysis of early mRNA batches, and formulation characterization and testing.

Presenting a case study focused on the discovery stage, Dr. Bak discussed the use of a high-throughput solution for LNP testing and formulation, a process usually done with a manual solution involving microfluidic mixing. The automated 5-day design, testing and analysis cycle employed liquid handling and continuous imaging (over 24 hours) with fluorescence microscopy used to determine the best formulation for each cationic lipid. Analysis included measurements of encapsulation efficiency, size and polydispersity. Using an automated solution, the researchers were able to produce a 55x increase on average in efficacy compared to standard formulations.

Touching on COVID-19 more directly was a presentation by David S. Bell from Restek, a chromatography and analytical consumables company. He described how the company has adjusted its work environment and processes since the shutdown began last spring, recounting both the positive and negative outcomes.

Early company responses included the formation of a rapid response team. Key issues were reprioritization of business objectives, establishing new communication processes, and developing policies for each department. In the R&D department, remote working replaced onsite work whenever possible, and Mr. Bell discovered that much of the team’s work could be done offsite. Onsite visits were reserved for instrument operation, and use of remote instrument operation tools increased. Learning such tools became necessary. Overall, he noted how teamwork and communication enabled the department to meet demands for onsite visits.

When onsite in labs, employees practiced social distancing, and labs’ and offices’ occupancy was kept to a minimum. With more space in labs, employees had more access to instruments, helping move priority projects forward faster. Although employees adapted well to working independently, Mr. Bell noted the loss of quality in team interactions. As he put it about the post-COVID situation, “Things like transferring technology between departments tend to me more of a handoff than a Hail Mary.” Also lost, he noted, were the little “epiphanies” that occur when you are in the lab and able to do side experiments. But the most impacted were training and cross-training of the team.

On the positive side, he observed that it led to the work being just as effective. It also forced greater focus on priority projects and better teamwork. In the case of onsite work, the planning necessary

now to visit the lab engendered more efficiency. In many ways, he said the changes underscored the flexibility required for R&D work. As he commented, “I’ve always felt that R&D is not a 9–5 job.”

New Products at Pittcon 2021

Atomic Spectroscopy

Last November, **LECO** introduced the CHN828 member of its 828 series, providing carbon, hydrogen and nitrogen analysis of macro samples of coal, biomass and other organic samples. The combustion instrument adds hydrogen analysis (via IR detection) to LECO's existing CN828 product. The price tag is roughly \$60,000, and there is also an option to add sulfur analysis.

Malvern Panalytical showed off the new version of its compact Aeris XRD instrument, which adds significant new capabilities more typical of larger floor standing instruments. While the previous Aeris could provide standard reflection powder diffraction, the new version can also perform grazing angle measurements (useful for analyzing thin films on substrates) and transmission measurements through sample foils or capillaries. The uncoupled source and detector arms allow for the sample to remain horizontal throughout the measurement. An integrated six-position sample changer allows for efficient operation, and simple touchscreen and pushbutton operation enables fast routine testing for standard operators. Qualified operators have more access to make changes to the system geometry and x-ray optics options. The system fully launched last month. Although pricing was not disclosed, the company emphasized the similar performance to floor standing models and the comparatively low cost of ownership, as the system does not require a separate power supply or water cooling.

Shimadzu expanded its line of total organic carbon instrumentation with a system addressing a new part of the market. While Shimadzu has ultrapure TOC instruments for the lab and an online combustion TOC system, the new TOC 1000e is the first Shimadzu system that is both online and for ultrapure water, reaching detection limits as low as 0.1 ppb, suitable for demanding applications in semiconductors and pharmaceuticals. The system has an innovative mercury-free excimer lamp operating in the UV at 172 nm to oxidize organics in the sample. The flow channel actually passes through the hollow cylindrical lamp, making it very efficient. Differences in conductivity between the oxidized and unoxidized sample provide the TOC measurement. The system can operate for a year before the pump head and filter require maintenance and standard replacement of the lamp. The system was introduced last October at a price of about \$25,000.

Thermo Fisher Scientific unveiled a new isotope mass ratio ICP-MS, the Thermo Scientific Neoma Multicollector ICP-MS. The system has an array of 11 Faraday cup detectors, which can be aligned to capture ions from lithium to uranium. The company also expects to produce a future upgrade to include a collision/reaction cell for even greater capabilities. Applications include geochemistry and the regulation of nuclear weapons material.

Chromatography

Lucidity, a division of CEM corporation, introduced the MiniGC, a compact GC that weighs around 35 lbs (16 kg) with the size of a shoebox. Even though it is much smaller than a conventional GC, the

MiniGC boasts the same functionality and analysis power that matches traditional GC instruments, according to the company. The instrument supports temperature programming and since the oven is smaller in size, it can heat and cool faster than a regular GC. The MiniGC is built so that anyone can readily operate the system. With simple software design, easy column installation and the magnetically attached autosampler, the MiniGC can be installed and ready to use in under 30 minutes. The MiniGC is ready for shipment at the low price of \$15,000 and an extra \$5,000 for the autosampler.

Lucidity is also entering the LC market with its MiniLC. With the same concept as the MiniGC, the MiniLC is a compact and easy-to-use instrument with analysis power comparable to traditional LC. The system uses standard HPLC/UHPLC columns and can operate up to 10,000 psi with 0.1–10 mL/min flowrates. It is also equipped with built-in software and multiwavelength UV detector that covers 185–475 nm spectrum. Lucidity already launched the beta phase for MiniLC and it will be ready for shipment in a couple of months with a price tag of \$25,000.

PerkinElmer showcased its new LC product line at Pittcon 2021. The LC 300 series is designed to provide ultraprecise gradient flows and low levels of dispersion. The system promotes high throughput and user friendly operation for various industries such as food, cannabis, pharmaceuticals and chemicals. PerkinElmer offers both HPLC and UHPLC versions of the LC 300 model. The HPLC system can operate up to 10,000 psi, while the UHPLC system has a higher pressure setting of 18,000 psi. The high operating pressure in the LC 300 allows for applications using superficially porous particle and <2 µm columns to achieve UHPLC and UHPLC-like separations with reduced runtimes, lower solvent consumption and greater sensitivity. Both systems are equipped with a high-visibility color display for immediate assessment of system status without having to log into the CDS software. To accompany the new LC 300 series, PerkinElmer also provides a next generation SimplicityChrom CDS software. The CDS software supports data integrity to ensure 21 CFR Part 11 compliance, and proactive alerts for consumable usage and required maintenance to minimize downtime. With this new LC system, PerkinElmer is expanding its long-established presence in the LC market, accompanying its previous Flexar LC product line. The LC 300 systems are ready for shipment globally, with a price range between \$45,000 to \$65,000 depending on configuration.

Shimadzu featured its latest HPLC product line, the Advanced i-Series HPLC. The new i-Series LC-2050 and LC-2060 are based on the previous i-Series HPLC technology introduced in 2014. The upgrades include Analytical Intelligence functions, which enable full automation and remote monitoring. The Analytical Intelligence feature supports auto start-up with flow pilot and automatic shutdown to save electrical cost. The remote monitoring system includes sensor detection that prevents mobile phase depletion and ensures continuous analysis with minimum downtime. The system also has enhanced pressure tolerance compared to the previous model, up to 50 MPa for the LC-2050 and 70 MPa for the LC-2060. It also boasts low carryover (<0.0025%), high speed (14-second injection cycle) and high sample capacity (over 1,500 samples). The system is equipped with the Intelligent i-PDeA I Deconvolution software to support spectral separation of complex compounds, especially remote data processing. The i-Series LC-2050 and LC-2060 is already shipping globally with a price range of \$40,000–\$65,000.

Shimadzu also introduced the AOC-30 Autoinjector/Autosampler for GC, designed to support automatic and remote operation. The AOC-30 automatic sample injection system automates analysis, reduces operators' workloads and enables continuous analysis with a high degree of accuracy, according to the firm. The system is also equipped with Shimadzu's Xtra Life Inlet Septa that promotes injection durability and enables continuous analysis with up to 1,000 injections before replacement. Featuring an advanced sample washing functionality, it supports continuous analysis without the worry of running out of solvent. Four 4-mL vials can be used in a single tower, and twelve 4-mL vials (up to 33.6 mL) can be used with the full tower and sampler system. The AOC-30 Autoinjector/Autosampler will begin shipping in April with the price point between \$8,000 and \$15,000 depending on whether it is a single tower/sampler or dual tower/sampler.

Aside from the brand-new AOC-30, Shimadzu also showcased its AOC-600 Plus Multifunctional Autosampler. This instrument enables multiple GC/MS sample injection methods in one device: liquid sample, headspace and SPME injection. The tool switching function enables users to automatically swap all syringe tools for various injection methods. Each syringe and fiber-usage log is recorded on a chip to promote data policy compliance and reliability. This autosampler is suitable for high-throughput GC/MS analysis in various industries such as environmental testing, food, cannabis and forensics.

Thermo Fisher Scientific featured its latest IC product. The Dionex Easion system is designed for small environmental and academic teaching laboratories specializing in water analysis. This compact instrument expands Thermo Fisher's presence in the basic IC market as it promotes simpler analysis with an affordable cost. The Dionex Easion system is user friendly and equipped to run out of the box, and includes columns, a suppressor and consumable items required to perform IC separations. This setup encourages traditional wet chemistry users to switch to a simpler IC method, which is specifically designed to streamline the drinking water analysis process. The Dionex Easion IC uses only a single-flow path to simplify both operation and maintenance, so that users of all skill levels can easily run a routine IC analysis.

Informatics

Autoscribe Informatics announced an updated version of its Regulated Manufacturing LIMS, designed for highly regulated industries such as pharmaceuticals, biotechnology and foods. Using Matrix Gemini LIMS software, the update provides full batch traceability, access for authorized personnel only, and an instrument calibration and maintenance system. It became available in January.

LabVantage announced the immediate availability of LabVantage LIMS 8.6. The update emphasizes robust cybersecurity capabilities through enhancements that can scan source code for vulnerabilities, perform ongoing software penetration testing and more. LabVantage is also now offering a SaaS LIMS that is validated for highly regulated industries, most notably pharmaceuticals and biotechnology. This software solution is based on GAMP5 guidelines that prescribe a risk-based approach to validation. It allows LabVantage to accept the responsibility of managing their customers' LIMS, and in the process to ensure data compliance with the FDA and other regulatory bodies. LabVantage Validated SaaS LIMS is available in either entry-level or enterprise-level formats.

The company also announced this month the release of LabVantage Analytics, an accessible interface from within LabVantage LIMS that turns data from laboratory and enterprise operations into business insights. The interface offers interactive visualizations and allows LIMS users to build and create custom self-service dashboards without the need to code or consult IT. LabVantage Analytics also utilizes the security and compliance features from LabVantage LIMS 8.6.

LabVantage also highlighted the Customer Self Service Portal, a configurable portal for service-based labs that need to submit testing requests, order sampling kits, label and ship samples, track status and view results. It will be released with LabVantage LIMS 8.7 in June.

Laboratory Products

ELGA Veolia showed off the PURELAB Quest and PURELAB Quest UV, both of which were unveiled last spring, at its virtual booth. These water purification systems are unique for their ability to produce all three types of laboratory water ranging from Type I ultrapure water to Type III water, allowing end-users to save time and space with a single system. The PURELAB Quest systems also feature remote connectivity with the AQUAVISTA remote monitoring software, allowing users to monitor and support their water purification system from anywhere in the world.

Mettler-Toledo showed its newest upcoming balances at their virtual booth this year. Designed for the highest degree of accurate and reproducible weighing, the XPR Automatic Balance is set to be released in the next month. These new balances are made to reduce human error with low minimum sample weights and an easy-to-use dosing head. The XPR balances can also be combined with Mettler-Toledo's automated sample changer to further increase the level of automation. The balances also include Mettler-Toledo's LabX software featuring FDA 21 CFR Part 11 compliance and easy connectivity to a lab network.

MilliporeSigma highlighted the company's newest water purification system, the Milli-Q IX. This system is designed to be smaller and features a more ergonomic design than older systems. It also includes a digital touchscreen and intuitive user interface for easy operation. The software includes an integrated data management system for easy audit trails. The Milli-Q IX is a Type 2 water purification system and can be used for a variety of applications ranging from cell culture media to preparing buffers to supplying instruments. It was released in May 2020.

Skalar featured its newest continuous flow analyzer (CFA) released last fall, the San Compact. The San Compact includes all the features and capabilities of the San++ series of CFAs but in a small and compact size. The analyzer features 21 pump tube positions and can fit up to 3 chemistry modules. The San Compact can also be fitted with a range of autosamplers to further extend the automated capabilities of the instrument. The instrument is designed for a number of applications including environmental and pharmaceutical testing.

Mass Spectrometry

JEOL introduced the JMS-T2000GC “AccuTOF” GC-Alpha, which is the sixth generation of its AccuTOF GC series. The signature difference in this new version comes from a redesign of the TOF tube itself, whose flight path was increased from 2 m to 4 m, extending well above the instrument. This upgrade also changed the resolving power from 10,000 to more than 30,000, while maintaining the sensitivity of the previous model, the JMS-T200GC. The new GC-Alpha also allows hard ionization and soft ionization methods, allowing the user to switch between the two automatically. The new GC-Alpha system also includes new variance component analysis capabilities in the msFineAnalysis software, allowing users to perform differential analysis quickly and qualitatively between two samples. This can be done visually using a Volcano plot, which uses different colors to highlight peak differences. These improvements allow the new system to better handle the analysis of complex samples. The GC-Alpha system is available for immediate order and will begin shipping in May–June.

Thermo Fisher Scientific introduced two new GC/MS platforms that extend its Orbitrap Exploris series of high-resolution accurate mass systems. With resolving power of up to 240,000, the Orbitrap Exploris GC 240 MS is designed for research applications, such as in metabolomics or compound identification in complex sample matrices. Its high resolving power enables users to better differentiate ions of interest from background ions. Thermo Fisher also introduced the Orbitrap Exploris GC/MS, with resolving power of up to 60,000. It is designed for high-throughput applications, such as in contract labs that perform food and environmental testing, as well as forensic toxicology. Both units are integrated with Chromeleon CDS software and may also be used with Thermo Scientific Compound Discoverer software for profiling and discovery, or Thermo Scientific TraceFinder software for streamlining data analysis.

Materials Characterization

Beckman Coulter Life Sciences showcased its latest particle counter product. The MET ONE 3400+ portable airborne particle counter is the fifth generation of the MET ONE product line, which is specifically design for cleanroom application. The new instrument is lighter and has a smaller footprint compared with the previous model. It also features an interactive sampling map that the user can upload into the system, along with SOP customization to accommodate different protocols. A specialized touch screen promotes ease of use and is easy to clean. Supervisors can review results remotely through the web browser to make sure that the operator covered all required areas in the map regularly. Microsoft Active Directory tracks user logins and provides electronic signatures that support 21 CFR Part 11 compliance. The MET ONE 3400+ is already shipping globally with a starting price of \$14,000.

CANNON Instrument introduced the CAV 4.1 single-bath kinematic viscometer, a sister model to its existing CAV 4.2 product. The CAV 4.1 shares the same basic architecture and footprint with the CAV 4.2 and is designed to be a direct replacement for CAV 2100 instruments. A fully automated system, the CAV 4.1 conforms to ASTM D445/446 testing parameters through its two 14-position sample handlers. Each of the sample handlers covers a 100-fold viscosity range at values between 0.5 mm²/s and 10,000 mm²/s from 40°C to 150°C. The system is intended for use in numerous

industries such as petroleum, basic chemicals, pharmaceutical, and paints and coatings. The CAV 4.1 is ready for shipment with the basic price range starting around \$55,000.

CANNON Instrument also showcased its TESC-5133, which was launched in October 2020. This low-temperature viscometer is specifically designed for testing engine lubricants such as gear oils, transmission fluid and other industrial lubricants. The TESC-5133 is a compact system that automates the ASTM D5133 process of conditioning and testing low-temperature viscosities. Its software records sample temperature and viscosity, and computes the temperature at which there is a rapid change in viscosity, thus providing the Gel Index. The TESC-5133 is shipping with an MSRP of \$23,000.

Hitachi High-Tech displayed its latest NEXTA DSC product. The NEXTA DSC features an advanced heat-flow design in the sensor and a furnace built with three-layered insulation design, which provides high baseline stability and repeatability. The system also promotes a high sensitivity of 0.1 μ W or lower through its thermopile-type DSC sensor. It has a wide temperature range with the Real View Sample Observation Unit, which has a built-in two-megapixel high-resolution camera. A heating mechanism extends the measurement range from room temperature and above down to the low temperature of -50°C . The NEXTA DSC is ready for shipment with a price point of around \$70,000.

Malvern Panalytical showcased its latest particle analysis product line. The Zetasizer Advance Range is comprised of the Lab, Pro and Ultra models. Each model is available in two variants: a Blue Label version for routine sample investigation, and a Red Label version for use with more challenging samples. The Zetasizer Lab is an entry-level system that employs classic 90° DLS, while the Pro version utilizes non-invasive back scatter DLS (NIBS). The Zetasizer Ultra incorporates both NIBS and multi-angle DLS (MADLS) technology for the measurement of particle and molecular size. NIBS provides the versatility and sensitivity to measure over a wide concentration range, while MADLS permits a higher-resolution view into the sample's size distribution for critical measurements. The Zetasizer Advance Range is already shipping globally at various prices.

Renishaw featured its newest software module for the inVia Raman microscope. The Particle Analysis module is designed to locate, identify and analyze multiple particles at once, while providing detailed optical and Raman measurements simultaneously. The module is designed for several different applications including environmental, pharmaceutical and forensic end-markets. The Particle Analysis module was released last fall.

Molecular Spectroscopy

Biochrom showed off their newest life science spectrophotometer, the Biowave 3+ Colour Touch. Designed for a variety of life science applications including nucleic acid quantification and protein assays, the Biowave 3+ CT is a small form-factor spectrophotometer featuring a wide range of built-in life science methods and a color touchscreen for quick data visualization. The Biowave 3+ CT also comes with optional Bluetooth connectivity for easy access to the end-user's laboratory network.

The Fluorolog-QM is a fourth-generation **HORIBA** fluorescence instrument. Some updates to the instrument line include industry leading S:N sensitivity and monochromator focal length. The

instrument also features the FelixFL fluorescence software, a comprehensive solution designed for analysis of samples in the pharmaceutical, chemical and applied end-markets. Similar to other HORIBA fluorescence instruments, the Fluorolog-QM features a modular design allowing for adaptability to any type of analysis. The instrument was launched last spring.

PerkinElmer featured its newest FT-IR spectroscopy instrument, the Spectrum 3 spectrometer. The Spectrum 3 is designed to measure across the near-, mid- and far-IR regions in a single instrument. The systems can switch between mid- and near-IR spectral regions in seconds with fully automatic optical performance. The instrument also features CFR 21 Part 11 compliance and PerkinElmer's Spectrum 10 and NetPlus software packages, allowing for fast data acquisition and cloud connectivity. The Spectrum 3 is designed for a wide range of applications including pharmaceuticals, polymers and academia. The Spectrum 3 launched last spring.

Sample Preparation

SCP Science featured its new MultiVIEW with AutoLOADER microwave digestion system. The digestion racks are easy to load, and with automation, the system can process as many as 300 samples per run. The system is also flexible enough to use up to 12 different specific methods per rack, with 12 individually controlled magnetrons. This fully independent control is a new feature, compared to the previous NovaWAVE product line. A 15-inch color touchscreen provides easy operation, and the user can monitor the 12 sample digestions in real time. The MultiVIEW debuted in February at a price of around \$30,000 for a basic ready-to-run system.

Surface Science

Among the products featured at its press conference, **JEOL** discussed the JEM-CRYO ARM300 II, an atomic resolution cryo-TEM. JEOL's first cryo system was launched in 1986, and several generations of improvements have followed, including this most recent entry, an updated version of the CRYO ARM300 introduced in 2017. Among the new additions are an improved cold field emission source, an improved in-column energy filter and high reproducibility of stage positioning. The system provides high throughput, capable of as many as 20,000 images per day, twice that of its predecessor. Even with 500 images of a target molecule, the system can generate a 3D structure with resolution under 2 angstroms. An automated specimen exchanger has a capacity of up to 12 samples. The system was introduced in January.

ZEISS exhibited its ZEISS Primostar 3 upright microscope series, composed of compact systems suitable for digital teaching, remote education and routine lab work. The system has an integrated eight-megapixel camera, and the software makes it easy to share microscope images to monitors. For educational users, the Labscope Teacher software module helps to manage and organize classes. The durable and portable system debuted during the International Day of Education in January and replaces the Primo Star line. Eight specific product packages offer combinations of illumination, objectives, condensers and cameras for a variety of needs with magnification up to 100x. Depending on the configuration, prices range from about \$1,250 to \$5,000.

ABRF 2021 Virtual Meeting: Companies Launch New Spatial Omics Products

Overview

The 25th annual meeting of the Association of Biomolecular Resource Facilities (ABRF) was held virtually March 7–11. The meeting is the largest conference of shared and core laboratories enabling multidisciplinary research and providing researchers at academic institutions and other organizations with access to services, shared advanced instrumentations and technical expertise.

Like nearly all scientific conferences held over the past year, the meeting was conducted virtually. This was a challenge for an organization that has traditionally had a strong emphasis on networking and collaboration. But meeting organizers, attendees and exhibitors adapted through the use of interactive chat features, which were implemented throughout the conference interface. Each virtual booth in the exhibition hall featured live or scheduled chat requests to speak with a representative. Presenters were mindful of reserving enough time at the end of their talks to answer questions submitted through the chat feature. And the networking events that have been a highlight of past ABRF meetings were still held, even if drinks with colleagues could only be shared over a computer screen.

The emphasis of this year's meeting was Supporting Interdisciplinary Science, promoting "the collaborative energy of technology, scientific research and core facilities leadership." To this end, a diverse program of presentations by core lab directors, researchers and exhibitors covered topics across technologies, including genomics, imaging, flow cytometry, MS, bioinformatics and core administration.

Presentations

Among the topics discussed for core lab administration were the many challenges faced during the pandemic, as facility closures and limitations on occupancy affected the ability of core labs to function. In a presentation titled "Innovative Strategies and Technologies for Digital Learning in Cores," core lab directors discussed how they adapted to be able to continue to allow users access to instruments and services. Speakers described how social distancing and restricted occupancy created challenges in training new users and providing instrument access. While newer instruments can be accessed remotely, older instruments and computers that are not networked can only be used on-site. Even if networked, older graphics cards do not necessarily display properly when accessed remotely.

To compensate, Christopher Gilpin, Director of Electron Microscopy at Purdue University, described IT solutions that were implemented. Instruments that normally must be controlled by keyboard and

mouse were set up for VPN access, allowing off-campus remote access to users. This provided the additional benefit of being able to specify levels of accessibility for a given user, allowing the lab to grant control or view-only access. Older computers without networkability were tethered to newer computers to provide remote accessibility.

The meeting provided a venue for suppliers in the lab instrumentation and consumables space to showcase new and existing products, highlight research conducted with their products and present workflow solutions for emerging applications, through extended Technology Showcase sessions and short Innovation Theater presentations.

In its technology showcase presentation, 10x Genomics presented a spatial gene expression workflow using its Visium instrument. The workflows were presented in the context of the company's recent acquisitions of Readcore and Cartana (see IBO 10/14/21) and its partnership with Thermo Fisher Scientific. The Visium Spatial Gene Expression system facilitates targeted and whole transcriptome analysis, and analysis of both protein and mRNA from the same tissue section for multiomic studies.

Because the Visium was designed to fit into a workflow that is platform-agnostic using existing instrumentation, there is room for end-users to get lost in finding the right solutions. To that end, 10x Genomics has partnered with Thermo Fisher to highlight Thermo Fisher's EVOS M7000 Imaging System as a compatible product to support the Visium workflow. Compared to other types of microscopes, the EVOS line of instruments is simpler to use, according to the companies, making it more accessible to the common user while delivering high signal-to-noise and data quality. For the Visium workflow, the image acquisition speed provided by the EVOS M7000 enables quick and efficient imaging of Visium slides, while also simplifying multi-site collaboration and communication.

10x Genomics went on to make several announcements about the Visium system. Currently, the platform is compatible with human tissue and tissues from several common model organisms, including mouse, rat, dog, primate and zebrafish. Support for plant tissues is in development and expected to be introduced within the next few months. Also coming within the next two months is compatibility with FFPE tissues, a common method for preserving biopsied tissue samples. The company also expects to launch compatibility for CAR-T cell analysis early next year.

The acquisitions of Readcore and Cartana have provided chemistries for the expansion of products for the Visium platform. Several panels for the system are also due to launch soon, broadening applications for the Visium platform. These include new targeted expression panels for neurodegenerative disease, oncology and cell signaling. Later this year, a highly multiplexed protein solution will be launched to enable analysis of dozens, and eventually hundreds, of proteins at a time. As for the Visium platform itself, improvements providing higher resolution are expected to launch in the first half of 2022, as well as an updated version of the Celeste image analysis software.

Exhibition

Dropworks presented its inaugural instrument, the Dropworks Continuum digital PCR platform. Unlike other dPCR systems, the Continuum requires just one user touch point; users simply load their 96-well plate into the sample-input tray and use the system's on-board software to set up the

analysis. Sample preparation is performed by the system, removing a common source of analytical artifacts typical in real-time PCR. The Continuum system features four-channel multiplexing, enabling complex gene expression and biomarker assays while increasing throughput. The system will launch commercially in the near future.

Rebus Biosystems debuted its Rebus Esper platform. The Rebus Esper is an integrated, automated spatial omics platform that provides high-throughput single-cell data with spatial context at sub-cellular resolution. Only one hour of hands-on time is required of users, otherwise the system is fully automated with automation provided by Hamilton. The instrument leverages the company's Synthetic Aperture Optics technology, which illuminates samples with a series of high-resolution light patterns created by the interference of excitation laser beams. A series of low-resolution images are captured by a 20x air objective lens, which are combined by a proprietary algorithm to reconstruct a high-resolution image equivalent to a 100x oil immersion lens, providing sub-cellular detail. The purpose-built microfluidics and flow cells are temperature controlled to optimize reaction speeds. The Esper Spatial Studio software suite processes images for data visualization and spatial mapping. The initially available assay for RNA can analyze up to 30 custom genes using single-molecule FISH. At launch, the system is currently validated for fresh-frozen tissue samples. Later this year, a FFPE assay will become available. Assays for additional analytes, beginning with DNA, will be introduced next year. While Rebus Biosystems declined to publicly disclose pricing for the Rebus Esper platform, it did share that the cost is in line with competing spatial omics platforms.

Adaptive Biotechnologies displayed its immunoSEQ Technology and showcased its Human hTCRB Kit. immunoSEQ technology utilizes a multiplex PCR-based assay to sequence directly from genomic DNA to significantly reduce amplification bias. The human T-cell receptor beta (hTCRB) kit is used to sequence T- and B-cell receptors, specifically the CDR3 region, where the majority of antigen specificity is conferred. The assay can be used in numerous applications, including repertoire property analysis to explore the diversity of antigen recognition, COVID mapping, and T-cell fraction which measures the magnitude of immune response. Aside from COVID-19 applications, the assay is also applicable to oncology, where it can be used to calculate what proportion of a tumor tissue sample T-cells represent to monitor T-cell infiltration. The hTCRB assay is available as either a service or a kit, and is currently offered for human and mouse. Sample type requirements are flexible, with compatibility with FFPE tissue, whole blood, bone marrow and others. While the hTCRB kit has been available on the market for a couple of years, the COVID-19 pandemic has greatly increased the relevance of the assay.

ABRF 2022 will be held March 27–30 in Palm Springs California.

2021 SDi Global Assessment Report Charts Out the Future of the Nearly \$70 Billion Lab Instrument and Product Industry

Strategic Directions International (SDi) (publisher of *IBO*) has just released the “2021 SDi Global Assessment Report: The Laboratory Analytical & Life Science Instrumentation Industry.” This is the company’s flagship report, providing its most universal and in-depth coverage of the laboratory market for analytical and life science instruments.

This marks the 18th complete and all-new edition of the report, although a few interim update editions have occurred over the years for special situations. This happened most recently in 2020, when the effects of the COVID-19 pandemic were taken into account in a June 2020 update. “The disease had just received its official designation of COVID-19 when our original 2020 edition was published,” noted Mike Tice, SVP Business Intelligence at SDi. “Obviously, the world changed rapidly in so many ways, including for the life science and analytical instrumentation industry. Consequently, we updated our models mid-year to provide our clients with a more realistic picture of the market.” Since then, the SDi team has continued to monitor the situation, collect information and revise estimates, culminating in the present report which uses 2020 as the base year, with annual forecasts of market demand through 2025.

Due to the pandemic, total global market demand fell 0.8% in 2020 compared to 2019, totaling nearly \$66 billion in revenues. Looking forward, many technologies will recover strongly in 2021, but there are interesting exceptions. Some products, like nucleic acid (NA) prep kits, saw a meteoric rise in demand to handle the surge in COVID-19 testing. New manufacturing capacity had to be brought to bear to serve the need. However, as testing volumes drop, this demand will dissipate, so that markets like NA prep and PCR will see short-term declines in sales.

Other highlights of the report include forecasts of demand by region and by end-market. In this respect, the report states that China and the rest of the developing nations of Asia are strong regional growth areas, and that pharma is a strong application area for instrument markets.

The scope of the report includes dozens of different product categories organized into 10 major technology sections: chromatography, life science instrumentation, mass spectrometry, molecular spectroscopy, atomic spectroscopy, surface science, materials characterization, lab automation & software, sample preparation techniques, and lab equipment. For each of the 83 specific categories, information is provided on market size, growth, vendor share, and segmentation by region and end-market. New in 2021, the report provides forecasts by laboratory function and an improved presentation on specific applications for each technology in terms of size, growth, and innovation potential.

Executive Briefing

IDT Adds to Library Prep Portfolio

Coralville, IO 3/11/21—Genomics solutions company Integrated DNA Technologies (IDT) has purchased Swift Biosciences for an undisclosed amount. Swift Biosciences provides NGS library preparation kits for the academic, translational and clinical research markets. “Swift’s research tools are being used for cancer, inherited disease and other health applications, as well as research in agrigenomics, metagenomics and the biotech/pharmaceutical industry,” commented IDT President Trey Martin. “Their broad portfolio of library preparation and enrichment products are highly complementary to IDT’s existing NGS product line, giving us an increased ability to provide gold standard offerings to researchers and to be well positioned for future growth.” Swift will continue to operate from its facilities in Ann Arbor, Michigan.

According to an IDT spokesperson, Swift Biosciences has approximately 50 employees and IDT has more than 1,700 associates globally. The purchase considerably expands IDT’s portfolio of library kits. Major competitors in the library prep market include Illumina and Thermo Fisher Scientific. IDT was acquired by Danaher in 2018 (see IBO 3/15/18).

Agilent Buys Liquid Biopsy Firm

Santa Clara, CA 3/2/21; Kirkland, Washington 3/2/21—Agilent Technologies has acquired Resolution Bioscience for \$550 million cash and \$145 million in future milestone payments. Resolution Bioscience is a developer of an NGS-based oncology liquid biopsy assay for the biopharma services market and clinical oncology diagnostic testing. In 2020, the company recorded revenues of \$35 million, and revenues this year are expected to be \$50–\$55 million. Products are available both as test services and kits. “By adding Resolution Bioscience’s liquid biopsy-based diagnostic technologies to our portfolio, we are strengthening Agilent’s offering to our biopharma customers and boosting the growth of our diagnostics and genomics business. This also accelerates our strategy to broaden access to precision oncology testing for patients worldwide through distributed NGS-based diagnostic kits,” stated Agilent President and CEO Mike McMullen. The US FDA has awarded Resolution Bioscience’s homologous recombination deficiency assay with Breakthrough Device Designation. The company has a partnership in place with LabCorp for detection of actionable mutations in genes associated with non-small cell lung cancer. The deal is scheduled to close in April.

Regarding Agilent’s current liquid biopsy offerings Sam Raha, Senior Vice President, Agilent and President of the Diagnostics and Genomics Group, told IBO, “While Agilent does not directly offer any liquid biopsy-based Dx kits today, Agilent’s SureSelect NGS technology powers many of our customers’ liquid biopsy research and diagnostic assays that are currently available in the market.” He continued, “Agilent is committed to continue innovating its market leading SureSelect technology

and associated workflow, and to supplying and supporting customer that leverage these products for both liquid biopsy and tissue-based research and diagnostic work.”

Regarding what differentiated Resolution Bioscience from other liquid biopsy developers, Mr. Raha commented, “Being able to identify and leverage complex genomics-based biomarkers is increasingly important in cancer diagnostics, and NGS is an ideal tool for this. Resolution Bioscience’s NGS technology has been optimized for liquid biopsy and is able to analyze the four important types of mutations—single nucleotide variations, insertions/deletions, copy number variation and fusions.” He added, “Along with this, Resolution Bioscience’s technology has been designed for kitting which makes it an ideal fit for our strategy to develop NGS-based CDx tests for cancer indications in partnership with pharma partners and then to distribute the CDx tests as IVD kits to diagnostic testing labs around the world.”

The acquisition marks the entry of Agilent’s diagnostic business into the liquid biopsy market, expanding its portfolio of tissue-based cancer diagnostics. Agilent’s Diagnostics and Genomics Group currently offers IHC assays and instrumentation. Its pDx kits measure patient response to cancer treatments. Resolution Bioscience’s cell-free ctDx assay received Breakthrough Device Designation from the US FDA in 2019.

PerkinElmer Buys LC Columns Supplier

Waltham, MA 3/8/21—PerkinElmer has added proprietary HPLC and SFC columns to its portfolio with the purchase of ES Industries (ESI). Financial details were not available. “We know that labs are looking to streamline and simplify their LC analyses and maximize productivity while also meeting ever increasing quality and regulatory demands. By augmenting our portfolio with HPLC columns technology, expertise and manufacturing capabilities, we can now innovate faster and provide complete end-to-end workflow solutions,” stated Suneet Chadha, VP and GM of Applied Markets for PerkinElmer.

Mr. Chadha told IBO, “Customers working with LC today are looking for innovative approaches, technologies and expertise to help them streamline processes while they tackle complex chemistries and separations necessary to meet ever increasing regulatory and market demands. With the addition of ESI’s columns to our portfolio, PerkinElmer now offers full expertise, technologies and tools across the entire LC workflow—from analytical instruments, software and advanced columns/chemistries...to world class OneSource services and also spanning pharma, food, applied and other application areas.”

Mr. Chadha continued, “If a customer wishes to centralize with one supplier across the LC workflow, they now have the added choice of doing that with us, and if they want to more easily and effectively manage a multivendor LC lab, we can help with that as well. Cross-workflow LC rigor, flexibility and innovation excellence is what we are focusing on and delivering to customers across multiple industries for LC.” In summary, he observed, “We are excited to welcome ES Industries and their columns and chemistries know how, technologies and manufacturing expertise into the larger PerkinElmer infrastructure to help up-level and accelerate LC value innovation for our customers.”

PerkinElmer currently offers three LC models (see “New Products at Pittcon 2021”) as well as GC/MS and LC/MS systems. As part of a complete solution approach, PerkinElmer also recently introduced a new CDS system.

Bio-Techne to Expand Diagnostics Business

Minneapolis, MN and Austin, TX 3/3/21—Bio-Techne has agreed to purchase Asuragen for \$215 million in cash plus a potential \$105 million in future milestone payments. With \$30 million in annual revenues, Asuragen provides kits for genetic carrier screening and oncology testing that can be used with multiple detection platforms, including qPCR and NGS. US FDA–cleared kits include the AmplideX Fragile X Diagnostic and Carrier Screening kit. Asuragen’s operations include a 50,000 ft² (4,645 m²) GMP facility and a CLIA-certified lab. Asuragen CEO Matt McManus will join Bio-Techne and continue to lead the business. “We are not only acquiring a financially strong and scalable business, building our diagnostic portfolio and expanding our bandwidth with an additional CLIA-certified and GMP compliant laboratory, but are also adding a team with deep expertise in the intricacies of the global regulatory environment and a proven track record of opening new market channels,” said Bio-Techne President and CEO Chuck Kummeth. The acquisition is expected to close by June.

The acquisition is Bio-Techne’s latest addition to its growing clinical testing and diagnostics business, which also includes early-stage developers Advanced Cell Diagnostics (ACD) and Exosome Diagnostics, as well as its established R&D Systems Clinical Controls and BiosPacific businesses. The company’s Diagnostics and Genomics unit, consisting of the four brands, grew sales 19% on an organic basis for the quarter ending December 31, 2020 (see IBO 2/16/21).

Protein Assay Firm Olink Files for IPO

Washington, DC 3/3/21—Swedish firm Olink has filed with the US SEC for an IPO which is expected to raise \$100 million. In 2020, the firm’s proforma revenues grew 16.7% to \$54.1 million (see Bottom Line), and Olink had 630 customers. Total debt stands at \$66.1 million. Olink’s Proximity Extension Assay (PEA) enables protein measurements in circulating blood with higher sensitivity and resolution than competing technologies as well as high multiplexing and scalability, according to the firm, and requires as little as 1 µL of sample. The company’s major shareholder is Sweden-based Summa Equity. The firm will be listed on the Nasdaq under the symbol “OLK.”

The company currently offers the mid-plex Target 96 kits, the Focus kit for clinical applications, and introduced last year, the low- and mid-plex Target 48 kit. Each is run on Fluidigm’s Biomark HD qPCR platform. Also, last year, the company launched Explore, a 384-plex kit that runs on Illumina NGS systems, as a service. This year, the Explore kit was launched, offering up to 1,472 assays per run.

Next year, Olink plans to introduce a qPCR workflow built around Fluidigm’s Biomark HD platform, as well as the Olink Signature Q100 qPCR system for PEA. Also, next year, the company anticipates an LDT lab will launch the first diagnostics product using PEA technology based on circulating protein

measurements. The company boasts a library of 1,500 validated protein biomarker targets that it expects to rise to 3,000 in 2021. Olink was founded in 2016.

Diagnostic Maker Targets Epigenetics Firm

Marlborough, MA 3/1/21—Medical technology firm Hologic has purchased Diagenode for approximately \$159 million. Diagenode provides molecular diagnostic and life science research products, including CE-marked PCR tests for applications such as sexually transmitted infections, respiratory diseases, meningitis and gastroenteritis. The company recorded \$30 million in revenues over the last year. “The acquisition is consistent with our tuck-in M&A strategy, leverages our automation capabilities and provides attractive growth potential. And combined with our recent purchase of Biotheranostics, it enables us to continue strengthening our base diagnostics business to accelerate growth post-COVID,” commented Steve MacMillan, Hologic’s Chairman, President and CEO. The purchase should be break-even to Hologic’s non-GAAP EPS until fiscal 2023 and subsequently accretive.

Based in Belgium, Diagenode consists of both a diagnostics business and a research products business. On the research side, Diagenode specializes in sample preparation equipment and consumables for epigenetics research. Diagenode Diagnostics’ offerings include over 30 CE-marked PCR tests. Its first US FDA-approved kit, the Panther Fusion GBS Assay, was approved in 2018 and is sold by Hologic.

Renishaw for Sale

London, UK 3/2/21—Renishaw, a metrology and healthcare technology provider, has announced that its two major shareholders, who together hold 53% of issued share capital, plan to sell their stakes. As a result, Renishaw is investigating a formal sale process. No discussions are currently underway. The two shareholders, Executive Chairman Sir David McMurtry and Non-executive Chairman John Deer, stated: “Now finding ourselves in our 80s, our thoughts have increasingly turned to considering the future of our shareholdings in the Company and how we can actively contribute to securing the future success of the business.”

Renishaw’s non-diagnostic laboratory tool offering encompasses Raman spectrometers and Raman spectroscopy microscopes. This business is part of its £35.0 million (\$44.3 million at £0.79 = \$1) Healthcare unit, which makes up 7% of Renishaw’s total revenues. Sir McMurtry and Mr. Deer founded the company in 1973.

Antibody Developer Sold

Boston, MA 3/5/21—Research and diagnostics lab tool provider ABclonal Biotechnology has purchased Yurogen Biosystems. Financial details were not disclosed. A CRO, Yurogen Biosystems provides monoclonal antibody discovery services using its single-B-cell-based SmaB platform, including production of recombinant rabbit monoclonal antibodies. ABclonal Biotechnology stated that the purchase broadens its exposure to the IVD and pharmaceutical end-markets. ABclonal

Technology, an ABclonal Biotechnology subsidiary, has collaborated with Yurogen Biosystems since 2017. "In the medical research community, there is an increasing need for reagents with little to no batch-to-batch variation because of the rising demand for experiment replicability. Traditional antibodies such as polyclonal antibodies and hybridoma-based monoclonal antibodies simply cannot meet the requirements in the market," noted ABclonal CEO Zack Wu. "Because of that, the industry is experiencing an important transformation—a shift from traditional rabbit polyclonal antibodies and mouse hybridoma toward recombinant monoclonal antibodies." ABclonal intends to invest \$30 million over three years to introduce 10,000 new recombinant rabbit monoclonal antibody products for both research and IVDs.

The acquisition gives ABclonal Biotechnology new production expertise and access to new markets. ABclonal Biotechnology, based in Wuhan, China, and its US subsidiary offer a range of research products in addition to antibodies, including proteins, ELISA kits, NGS library preparation kits and molecular enzymes as well as services. ABclonal Biotechnology recently raised \$92.9 million Series C financing, part of which funded the acquisition.

Calibre Scientific Makes More Investments

Los Angeles, CA 3/8/21—Calibre Scientific, a provider of life science tools, has purchased Switzerland-based laboratory product distributor HUBERLAB for an undisclosed amount. HUBERLAB serves academic, pharmaceutical, chemical, healthcare and industrial labs. It is the company's first acquisition of a Swiss firm. "We're looking forward to combining their one-stop shop catalogue with our niche offerings and expanding our customer relationships across the DACH region," said Calibre Scientific CEO Dr. Ben Travis.

*This is Calibre Scientific's second acquisition this year, following its January purchase of French firm AIT France (see **IBO** 1/31/21). Also in the region, Calibre Scientific owns German diagnostics product distributor BIOZOL Diagnostica, which serves Germany, Austria and Switzerland. In addition to BIOZOL and now HUBERLAB, Calibre Scientific's portfolio of dedicated lab product distributors includes Canadian Life Science. In total, Calibre Scientific owns 17 firms.*

CELLINK to Buy Tissue Model Provider

Ashland, MA 3/10/21; Gothenburg, Sweden 3/10/21—Cell analysis technology firm CELLINK has agreed to acquire MatTek, which produces lab-grown human tissue models, for \$68 million (cash and debt free) in cash, with 20% funded by an offering of newly issued shares. According to CELLINK, MatTek has the largest portfolio of proprietary 3D human tissue and disease models. "By combining CELLINK and MatTek's revolutionary technologies, we can offer market leading in vitro methods and finally replace controversial animal tests that are limited by their physiological relevance to predict human results," commented CELLINK CEO Erik Gatenholm. "We see several strong synergies in combining CELLINK's cutting edge, bioprinting technology and modular large-scale industrial robotic flows with MatTek's 3D reconstructed, human-derived tissue models creating a world leading tissue model offering, based on decades of research, creating the largest proprietary library of 3D human

tissue and disease models in the world.” The transaction is scheduled to close this month, with MatTek management continuing in their roles.

The purchase will add to CELLINK’s consumables offerings, as well as expand the company’s role in toxicology testing. The company’s primary product lines currently consist of bioprinters and cell analysis automation systems. According to a CELLINK presentation, MatTek’s 2020 revenues totaled \$16.6 million and EBITDA margin was 21.9%.

Listed on the Nasdaq Switzerland, CELLINK’s 16-month sales ending December 31, 2020 (its latest reporting period) grew 167.3% to SEK 416.0 million (\$45.5 million at SEK 9.15 = \$1) (see Bottom Line), including 73% organic growth. Sales from September 2020 to December 2020 grew 118% organically. Last month, in the diagnostics space, the company

Fourth Quarter Results: Agilent Technologies, Danaher, PerkinElmer, Thermo Fisher Scientific and Waters

Agilent Starts Fiscal 2021 Strongly Thanks to China

Agilent Technologies' fiscal first quarter revenues exceeded company expectations posting double-digit growth (see *IBO* 3/2/21). The company's performance included a two-and-a-half-percentage point contribution stemming from the COVID-19 marketplace, 2.8% growth from currency and a negligible impact from acquisitions. Product wise, Agilent's overall instrument portfolio finished the fiscal first quarter flat.

Agilent Technologies by Division Q1 FY21

	Rev. (M)	Chg.	Organic Chg.	% of Rev.
Total	\$1,548	14.1%	11.3%	
Life Sciences & Applied Markets	\$722	13.2%	11.0%	47%
Agilent CrossLab	\$532	13.2%	10.0%	34%
Diagnostics & Genomics	\$294	18.1%	15.0%	19%

Source: Science and Medicine Group

For the first fiscal quarter, the Life Sciences and Applied Markets Group (LSAG) saw broad-based gains across end-markets and regions. The segment's cell analysis franchise posted high-teens percentage growth thanks in part to the BioTek business. BioTek finished the quarter with an approximate 26% increase in sales. Like the cell analysis business, the segment's LC and MS portfolios also reported high-teens percentage growth. End-market wise, the food and pharmaceutical sectors were the primary drivers for the LSAG business.

Similarly, Agilent CrossLab Group's (ACG) saw strength in the quarter thanks to broad-based gains across end-markets and geographies. ACG sales performed well thanks to laboratory customers resuming activity. Due to a large instrument installed base and in-country capital investment, ACG posted double-digit sales growth in China.

Diagnostics and Genomics Group's (DGG) sales were broad-based as well because of strong sales for its Nucleic Acid Solutions Division (NASD) business. Additionally, end-user demand for COVID-19-related PCR products and DGG's genomics line helped boost revenues to increase in the double digits. Lastly, DGG also experienced substantial demand for its NGS sample preparation business.

Agilent Technologies Operating Margin Q1 FY21

	Op. Margin	Chg. (bps)
Total	25.6%	266
Life Sciences & Applied Markets	27.6%	280
Agilent CrossLab	26.7%	130
Diagnostics & Genomics	18.6%	510

Source: Science and Medicine Group

For the company as a whole, sales to the food, and pharmaceutical and biotech markets led Agilent's total revenue growth, with sales in both rising double digits. The pharmaceutical and biotech end-market posted 20% revenue growth to make up 34% of Agilent sales thanks to the NASD business, which helped with a three-percentage point contribution. Excluding NASD, biopharmaceutical sector sales delivered 20% revenue growth because of strong demand for Agilent's LC and MS instrument lines. Geographically, the biopharmaceutical sales saw broad-based gains across all regions, especially in China. Agilent's small molecule sector reported double-digit growth, which also included substantial demand in China

Environmental and forensics, and chemical and energy market sales grew about 10% and 2%, respectively. Growth in the environment and forensics market segment, which represents 11% of the company's total revenues was thanks to the contract labs sector. Chemical and energy end-market revenues improved sequentially, rising to 21% of total sales, because of increased end-user activity in the specialty chemical industry.

In contrast, academic sales declined 1% because of university laboratories operating at limited capacity. Academic and government sales accounted for 9% of company revenues.

Accounting for 11% of Agilent's quarterly revenue, food market sales rose about 22%. Regional demand from China's commercial and government customer bases drove overall food sales.

As a result of meeting demand in both the Americans and European's COVID-19-related marketplaces, Agilent's diagnostics and clinical end-market sales grew about 9% for the fiscal first quarter to make up 14% of total revenues. The company generated significant revenue growth from end-users' non-COVID-19 activities, such as Agilent's pathology business, which saw a slight sales increase. Despite having a relatively small presence in China's diagnostic and clinical industry, the company saw sector-related sales improve as demand for non-COVID-19 testing solutions increased. Agilent's LC/MS product sales also performed well because of the diagnostics and clinical end-market needs.

Agilent Technologies by Region Q1 FY21

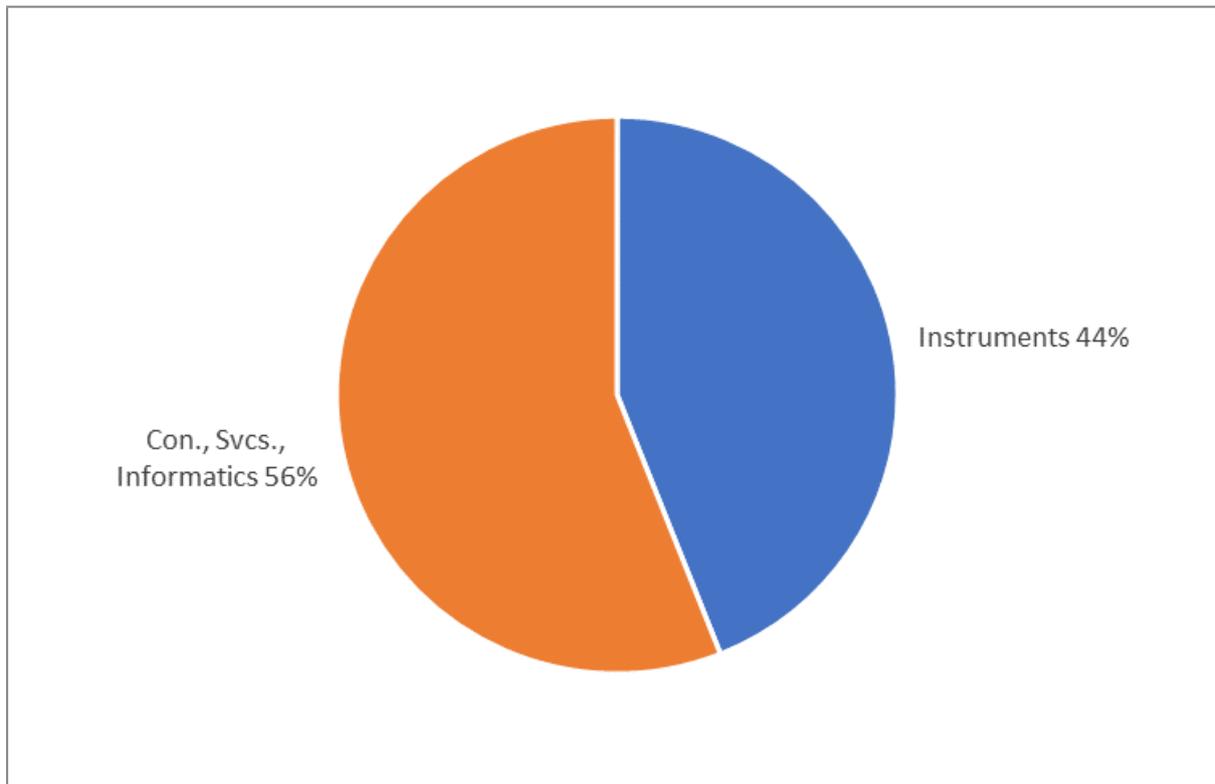
	Chg.	% of Rev.
Americas	12.3%	36%
Europe	11.5%	28%

Asia Pacific	18.0%	36%
China and Hong Kong	28.2%	21%

Source: Science and Medicine Group

China was the best performing region for Agilent in the fiscal first quarter. By meeting demand from China's food, and pharmaceutical and biotech end-markets, the company posted about 25% sales growth in the country. Like China, sales in Americas and European's food, and pharmaceutical and biotech end-markets were the primary drivers for those regions' sales growth.

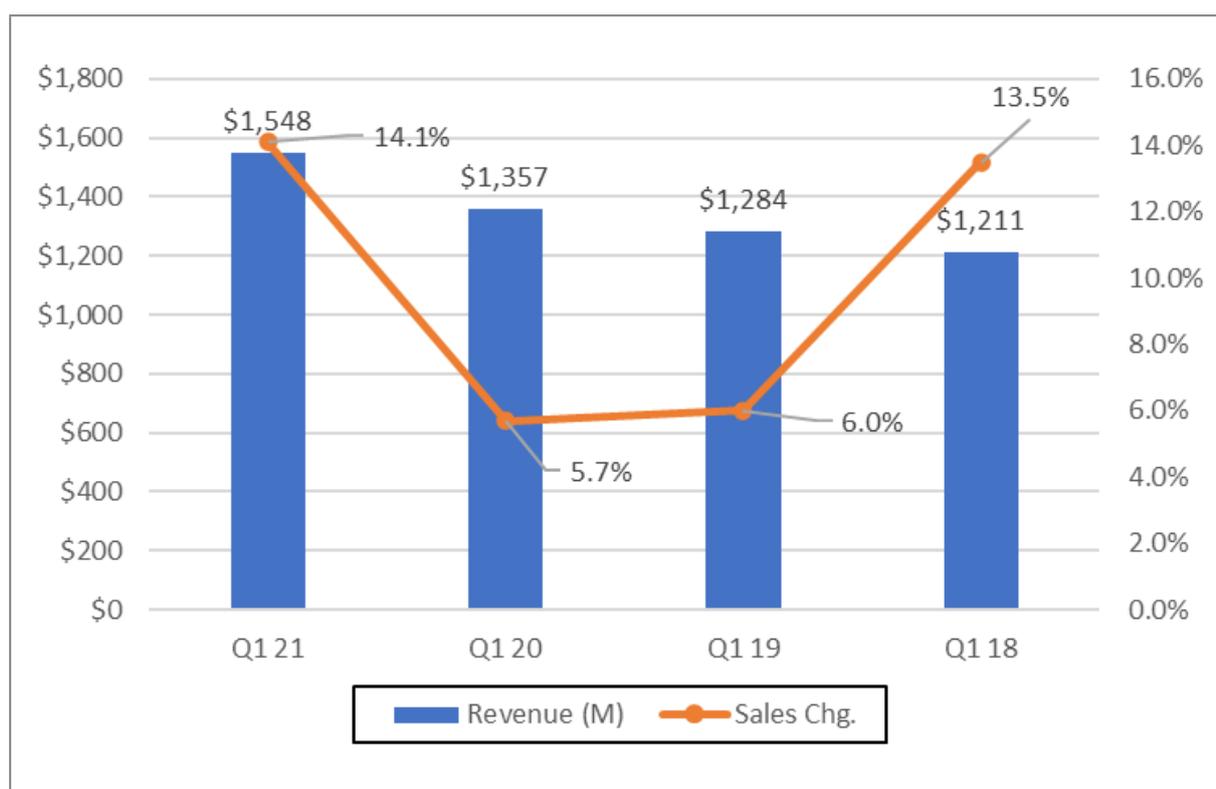
Agilent Technologies Q1 FY21 Sales by Product Line



Source: Science and Medicine Group

The company forecasts fiscal second quarter revenues to total \$1.37–\$1.39 billion, which would result in 11%–12% growth and organic revenue growth of 7%–9%. For fiscal 2021, the company increased its previous annual guidance from \$5.6–\$5.7 billion (see *IBO* 12/1/20) to \$5.8–\$5.9 billion, resulting in approximately 9%–11% revenue growth and organic growth of 6.5%–8.0%. On a geographical basis, Agilent forecast fiscal 2021 sales in China to rise double digits driven by both pharmaceutical and food market demand.

Agilent Technologies Q1 FY21 Sales Comparison



Source: Science and Medicine Group

Danaher Finishes 2020 Strong Thanks to its Life Sciences Business

Q4 & FYE

Danaher by Division Q4 FY20

	Rev. (M)	Chg.	Currency	Acq./Div.	Organic Chg.
Life Sciences	\$3,361.0	75.4%	0.0%	0.0%	18.5%
Environmental & Applied Solutions	\$1,172.0	2.1%	0.5%	0.5%	1.0%

Source: Science and Medicine Group

Danaher by Division FYE 20

	Rev. (M)	Chg.	Currency	Acq./Div.	Organic Chg.
Life Sciences	\$10,576.0	52.2%	0.0%	-46.5%	5.5%
Environmental & Applied Solutions	\$4,305.0	-2.1%	0.5%	0.0%	-1.5%

Source: Science and Medicine Group

For the fourth quarter of 2020, Danaher finished with 36.3% reported revenue growth and core growth of 15.5%, including negligible impact from currency and acquisitions. For 2020, revenue increased 24.4%, with core growth of 6.5%, which included little impact from currency and an 18.0% decrease in growth due to acquisitions (see *IBO* 2/1/21). Full-year 2020 highlights included 52.2% sales growth for the Life Sciences business, with recurring revenue representing 70% of the division's sales. In contrast, Environmental and Applied Solutions reported annual sales decreased 2.1%, with recurring revenue representing 57%. Also, unless noted, all mentions of sales growth or declines below are on a core basis.

Selected Danaher Divisions Operating Margin Q4 FY20

	Op. Margin	Chg. (bps)	Core Chg. (bps)
Life Sciences	24.1%	299	330
Environmental & Applied Solutions	23.2%	-214	-180

Source: Science and Medicine Group

Selected Danaher Divisions Operating Margin FYE 20

	Op. Margin	Chg. (bps)	Core Chg. (bps)
Life Sciences	19.4%	-73	200
Environmental & Applied Solutions	22.7%	-117	65

Source: Science and Medicine Group

Within the Life Sciences segment, sales in the fourth quarter 2020 were driven by a combined 30% uptick in growth from the division's Cytiva acquisition (see *IBO* 4/1/20) and additional sales contribution from the Pall Biotech, Beckman Life Sciences, and IDT businesses, with Cytiva as the primary driver. For full-year 2020, Cytiva concluded the year with \$4 billion in annual sales, resulting in more than 25% growth. End-market wise, the Life Sciences segment experienced strong demand from the biopharmaceutical market thanks to both COVID-19 and non-COVID-19-related activities. Non-COVID-19-related quarterly sales grew in the double digits.

For the COVID-19 marketplace, the Life Sciences segment benefitted from Cytiva and Pall Biotech's presence in the bioprocessing market, especially their involvement in more than 400 vaccine and therapeutics projects globally. The combined quarterly performance of Cytiva and Pall Biotech saw order growth increase about 50% and sales rising approximately 35% in the latter half of 2020.

Selected Danaher Divisions by Region Q4 FY20

	Life Sciences			Environmental & Applied Solutions		
	Rev. (M)	Chg.	% of Seg. Rev.	Rev. (M)	Chg.	% of Seg. Rev.
North America	\$1,197.9	66.9%	36%	\$479.9	-0.4%	41%

Fourth Quarter Results: Agilent Technologies, Danaher, PerkinElmer, Thermo Fisher Scientific and

Western Europe	\$976.1	90.5%	29%	\$288.6	5.0%	25%
Other	\$229.6	54.2%	7%	\$33.6	4.0%	3%
High Growth Markets	\$957.1	78.2%	28%	\$370.8	3.2%	32%

Source: Science and Medicine Group

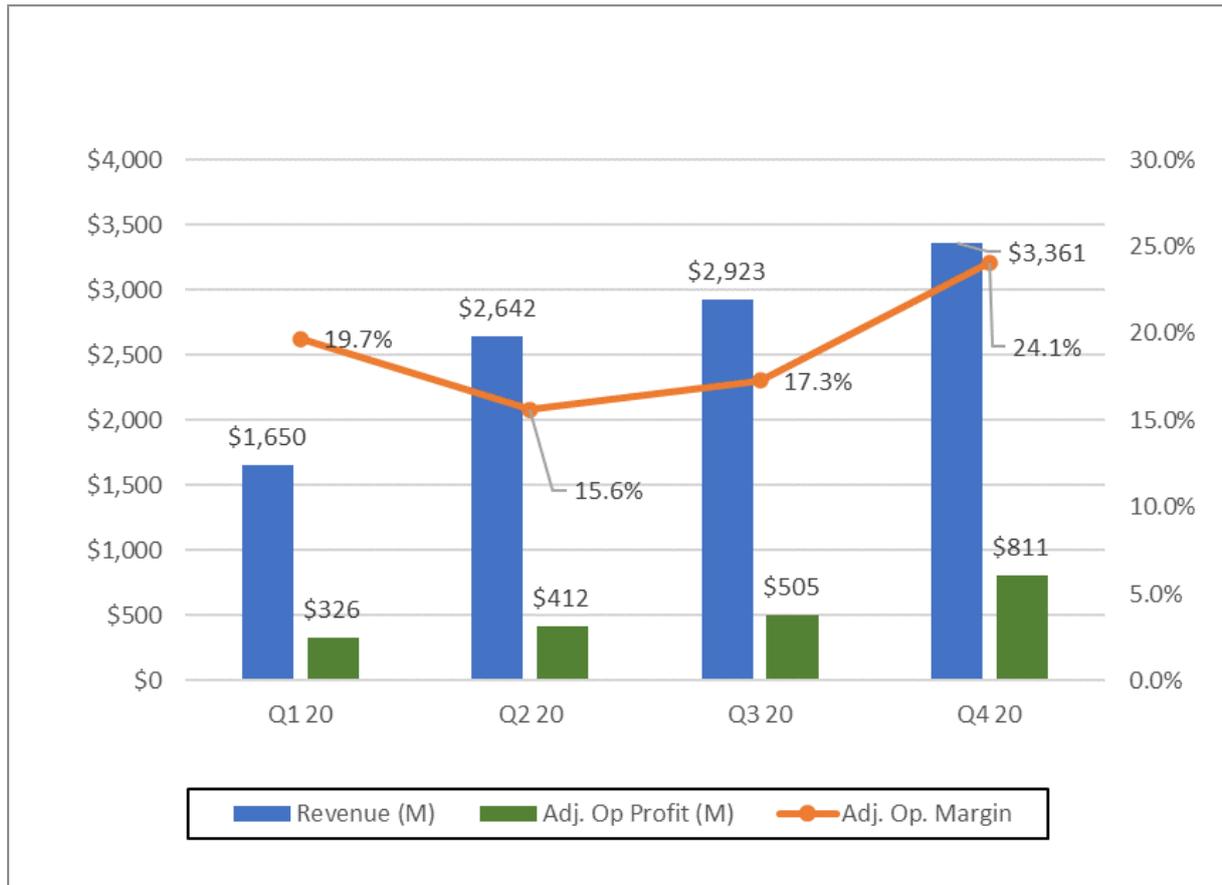
Selected Danaher Divisions by Region FYE 20

	Life Sciences			Environmental & Applied Solutions		
	Rev. (M)	Chg.	% of Seg. Rev.	Rev. (M)	Chg.	% of Seg. Rev.
North America	\$3,919.0	51.0%	37%	\$1,910.0	1.3%	44%
Western Europe	\$2,939.0	56.7%	28%	\$1,009.0	-3.8%	23%
Other	\$754.0	28.9%	7%	\$122.0	-2.4%	3%
High Growth Markets	\$2,964.0	56.5%	28%	\$1,264.0	-5.7%	29%

Source: Science and Medicine Group

During the fourth quarter 2020, Life Sciences posted mid-single-digit growth in the academic and research laboratory sector as end-users began to reopen their worksites. Product wise, system sales in the academic and research laboratory sector improved sequentially, with some portfolios experiencing high single-digit growth on a year-over-year basis. The uptick in activity in the academic and research laboratory sector also boosted SCIEX quarterly sales to mid-single-digit growth. The business saw high demand for its 7500 Triple Quad and Echo MS systems.

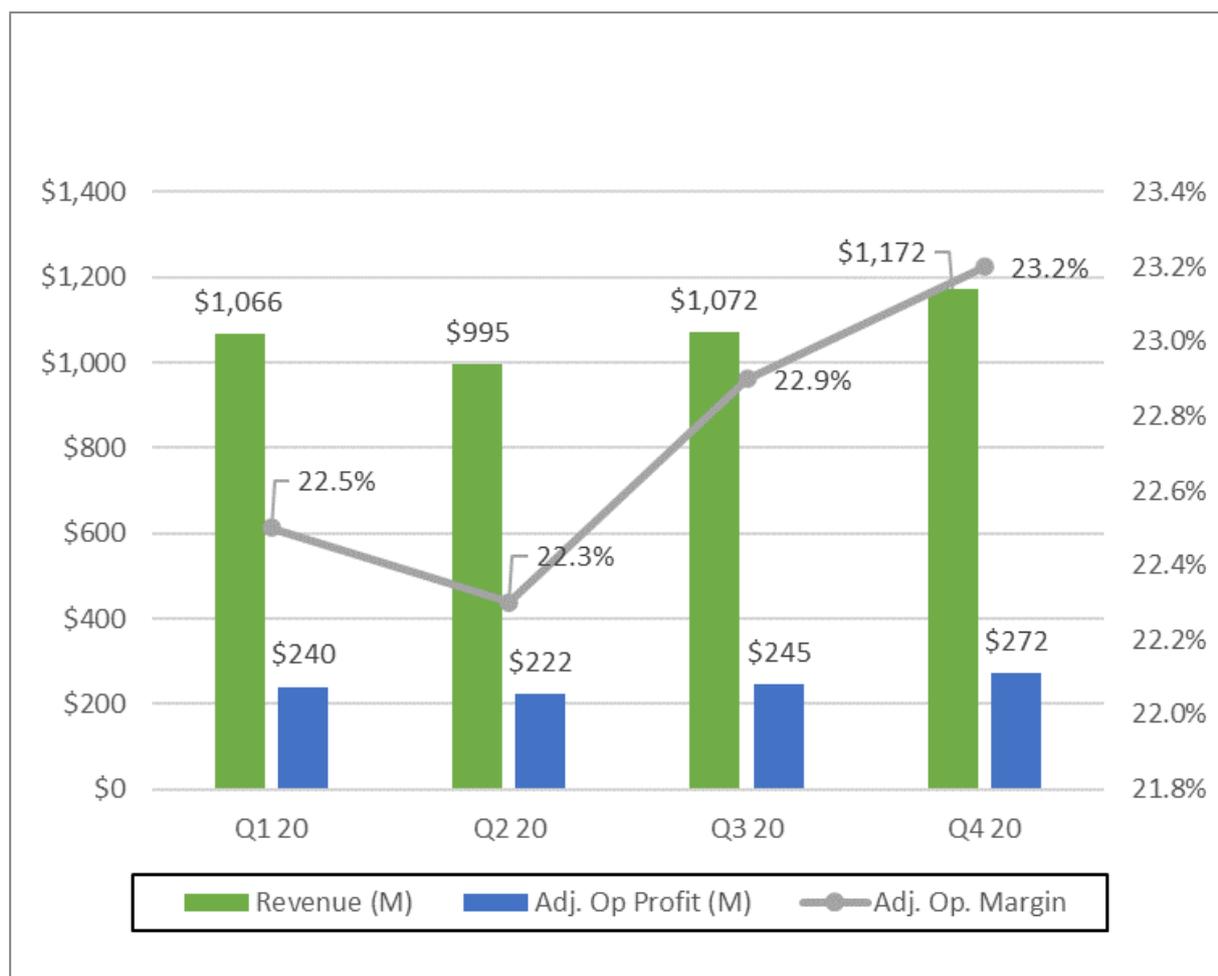
Danaher's Life Sciences 2020 Quarterly Sales Comparison



Source: Science and Medicine Group

Danaher's water quality franchise saw a low single-digit sales uptick, driving the Environmental and Applied Solutions' fourth quarter 2020 sales. The water quality business posted strong sales for its consumables and chemistries product. sales recovered for systems as end-user activity in the government and industrial end-markets improved.

Danaher’s Environmental and Applied Solutions 2020 Quarterly Sales Comparison



Source: Science and Medicine Group

Geographically, for 2020, Danaher reported a low double-digit revenue increase in China thanks to broad-based gains across all businesses. Demand was strong from the country's healthcare and applied end-markets.

Danaher forecasts its revenues for the first quarter to be up double digits. Additionally, Danaher predicts COVID-19-related revenue will experience a 13% uptick, while its non-COVID-19-related sales are expected to post mid-single-digit core revenue growth. Lastly, Danaher forecasts its first quarter sales for the Cytiva business to grow more than 50%.

For 2021, Danaher forecasts revenues will not reach pre-pandemic levels. As a result, the company anticipates posting low double-digit core revenue growth while facing a tough comparison in the latter half of the year. Danaher expects Life Science instrument sales to stabilize and to finish the year with double-digit growth for Life Sciences.

The company also expects an approximate 5% sales tailwind from its COVID-19-related business, with Cytiva and Pall Biotech contributing a combined \$1.3 billion due to pandemic-related vaccine and therapeutics projects. Additionally, Cytiva and Pall Biotech's combined non-COVID-19-related core sales are anticipated to rise in the mid-to-high single digits due to a strong market presence in

the bioprocessing end-market. Both businesses entered the first quarter with a combined order backlog of \$1 billion.

Within Environmental and Applied Solutions, Danaher forecasts the water quality business will see recovery in instrument sales and placements, concluding the year in the mid-single-digit range.

PerkinElmer Concludes 2020 on a Strong Note

Q4

PerkinElmer by Division Q4 FY20

	Rev. (M)	Chg.	Currency	Acq./ Div.	Org. Growth	% of Rev.
Total	\$1,355.1	68.2%	3%	0%	65%	
Discovery & Analytical Solutions	\$503.1	1.3%	3%	0%	-2%	37%
Diagnostics	\$852.0	175.5%	3%	0%	172%	63%

Source: Science and Medicine Group

For the fourth quarter of 2020, PerkinElmer achieved its best quarterly performance since 1999 (see *IBO* 3/2/21). A \$549 million sales contribution from COVID-19-related products was the primary driver. Specifically, PerkinElmer met demand in the COVID-19 marketplace through its offerings of PCR tests, RNA extraction solutions and Lab-In-A-Lab testing solutions in California and the UK. Excluding the business disruptions related to lab closures, the PCR and RNA extraction portfolios' combined sales contributed \$300 million of COVID-19-related revenues. However, instrument-related sales only accounted for 10% of PCR and RNA extraction sales. Lastly, COVID-19-related sales engendered about 68% growth for the fourth quarter of 2020.

Non-COVID product revenues fell 3% organically. By revenue type, recurring revenue accounted for 78% of total company sales and non-recurring revenue made up the remaining 22%. The company's operating margin expanded 1,830 basis points to 42.2% due to productivity, volume and product mix.

PerkinElmer Operating Margin by Division Q4 FY20

	Adj. Op. Profit (M)	Chg.	Adj. Op. Margin	Chg. (bps)
Total	\$571.2	197.0%	42.2%	1879
Discovery & Analytical Solutions	\$92.4	-20.3%	18.4%	-1093
Diagnostics	\$501.8	453.9%	58.9%	3503

Source: Science and Medicine Group

Diagnostics fourth quarter 2020 organic and reported revenues each posted triple-digit surges due to strong immunodiagnostics and applied genomics sales. In contrast, the division posted a slight sales decline for its reproductive health business. Revenues included a 3% contribution from currency and a negligible impact from acquisitions. On a geographical basis, the Americas and Europe drove overall Diagnostic sales, with both regions posting double-digit growth.

The unit's applied genomics business posted over 420% growth because of broad-based gains and strong sales for its nucleic acid extraction, liquid handling and sample preparation product lines. Immunodiagnostics line sales grew more than 250%, thanks to over 20% growth from the EUROIMMUN business, strong global demand for the RT-PCR assay line, and strength in Europe and the US. The division's serology portfolio experienced sequential revenue growth.

The Diagnostic segment's reproductive health franchise posted a low single-digit sales decline due to lower newborn and prenatal testing activity in the Asia Pacific and Europe regions. Asia Pacific and European sales in the reproductive health business tumbled double digits and high single digits, respectively. However, the newborn testing sector in the Americas generated mid-single-digit growth.

PerkinElmer by End-Market Q4 FY20

End-market	Discovery & Analytical Solutions	Diagnostics	Chg.
Diagnostics	—	\$851.8	175.6%
Life Sciences	\$297.4	—	8.2%
Applied Markets	\$205.4	—	-7.4%

Source: Science and Medicine Group

The Discovery and Analytical Solutions (DAS) segment reported a low single-digit organic revenue decline due to mixed reception across end-markets. Like the Diagnostic division, currency provided a three percentage point contribution to DAS total revenues while acquisition impact was minimal. Life science market organic sales were up in the mid-single digits thanks to the pharmaceutical and biotech, and academic and government sectors posting mid-single-digit and double-digit growth, respectively. Leading pharmaceutical and biotech were the enterprise and discovery franchises, which posted double-digit and high single-digit growth, respectively. The academic and government sector saw 20% sales growth thanks to DAS's discovery franchise.

A 10% revenue decline in the applied end-market caused DAS's fourth quarter 2020 sales to finish negatively. The DAS faced a tough comparison for its cannabis products and experienced a 20% sales decline in the Americas. Excluding cannabis, applied market sales declined mid-single digits. Likewise, as part of the food sector within applied markets, DAS' cannabis quarterly performance caused food sector sales to drop about 20%. However, excluding cannabis, food sales declined approximately 12%. Additionally, within the applied end-market, DAS saw low demand from the industrial and environmental safety industries, which engendered a mid-single-digit tumble despite sequential growth.

PerkinElmer by Region Q4 FY20

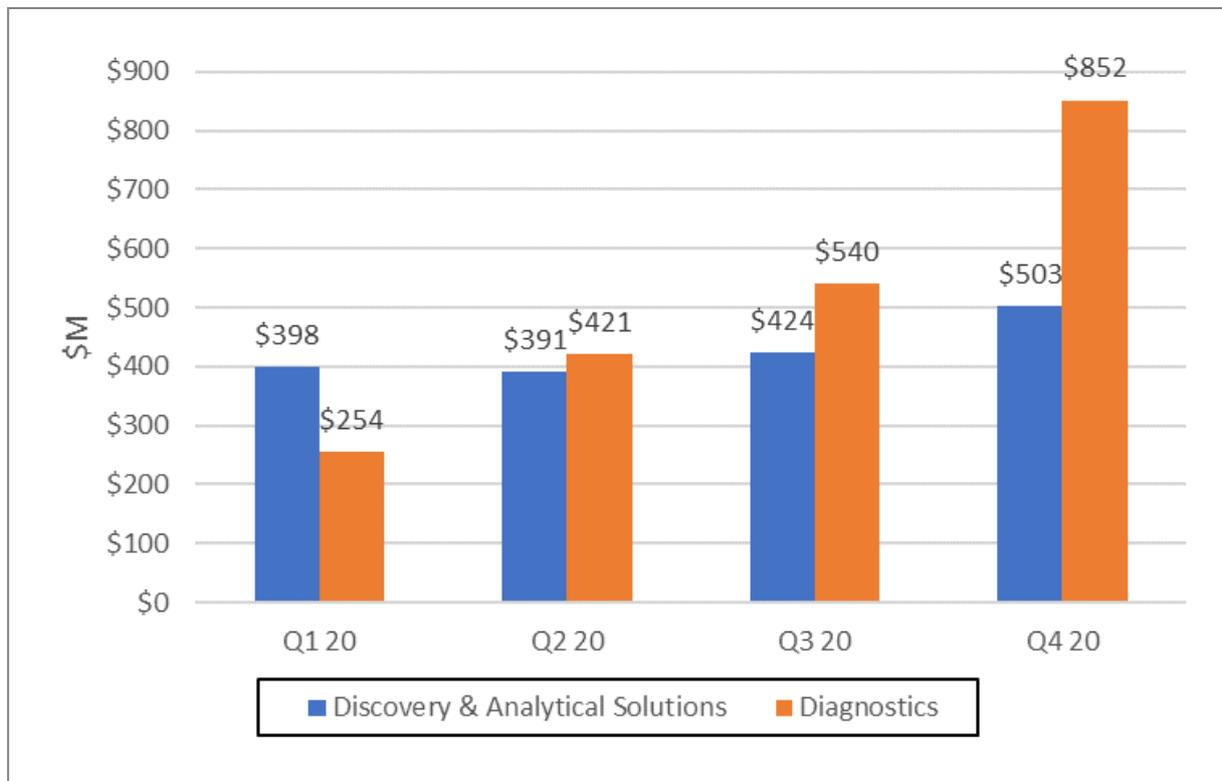
	Discovery & Analytical Solutions			Diagnostics		
	Rev. (M)	Chg.	% of Sales	Rev. (M)	Chg.	% of Sales
Americas	\$192	-3.0%	38%	\$276	172.3%	32%
Europe	\$153	6.1%	31%	\$435	424.9%	51%
Asia	\$157	2.2%	31%	\$141	13.1%	17%

Source: Science and Medicine Group

On a geographical basis, PerkinElmer posted gains across all regions. Europe was the best performer with triple-digit sales growth, followed by the Americas, which saw a double-digit uptick. Asia Pacific posted low single-digit growth, with China finishing the quarter in negative territory with a mid-teens percentage decline despite experiencing sequential growth.

PerkinElmer forecasts first quarter revenues to be approximately \$1.2 billion, which would result in 77% organic growth, including a 3% contribution from both acquisitions and currency. Within this guidance, the company anticipates a \$500 million contribution from COVID-19-related products and 1%–3% growth from non-COVID-19-related product sales.

PerkinElmer 2020 Quarterly Sales Comparison by Division



Source: Science and Medicine Group

FYE

PerkinElmer by Division FYE 20

	Rev. (M)	Chg.	Currency	Acq./ Div.	Org. Growth	% of Rev.
Total	\$3,782.7	31.2%	0%	2%	29%	
Discovery & Analytical Solutions	\$1,715.8	-1.7%	0%	2%	-4%	45%
Diagnostics	\$2,066.9	81.7%	0%	0%	81%	55%

Source: Science and Medicine Group

For 2020, PerkinElmer's annual sales grew in the double digits. DAS division sales fell 1.7%, while the Diagnostics division experienced an 81.7% surge. Total product revenue rose 37.8% to make up 73% of sales, while Service revenue increased 15.9% to make up 27%. For the year, COVID-19-related sales rose about 36% to \$1.0 billion, while non-COVID-19-related product sales fell 6% on an organic basis. Revenues in the Americas, Asia Pacific and Europe were up 29.2%, 0.3%, 72.2%, respectively. Additionally, the company's operating margin expanded 1,100 basis points to 31.8% because of volume, product mix and productivity.

PerkinElmer Operating Margin by Division FYE 20

	Adj. Op. Profit (M)	Chg.	Adj. Op. Margin	Chg. (bps)
Total	\$1,203.2	101.9%	31.8%	1245
Discovery & Analytical Solutions	\$266.7	-21.1%	15.5%	-1224
Diagnostics	\$1,010.4	219.7%	48.9%	2822

Source: Science and Medicine Group

DAS sales were negatively impacted by sluggish sales in the applied market, which offset a strong sales in the life science sector. Pandemic-related challenges faced by the food and industrial and environmental safety sectors were the primary reason for DAS' tumble in 2020 sales. However, the life science sector sales performed well due to the Informatics and OneSource businesses meeting consistent demand from the pharmaceutical and biotech sectors. In contrast, within the life science end-market, academic and government-related sales finished down.

PerkinElmer by End-Market FYE 20

End-market	Discovery & Analytical Solutions	Diagnostics	Chg.
Diagnostics	—	\$2,066.9	81.7%
Life Sciences	\$1,032.2	—	5.6%
Applied Markets	\$683.6	—	-11.1%

Source: Science and Medicine Group

The Diagnostics division was the company's best performing segment in 2020 thanks to its immunodiagnostics and applied genomics offerings meeting demand in the COVID-19-marketplace. However, annual sales for the reproductive health franchise declined.

PerkinElmer by Region FYE 20

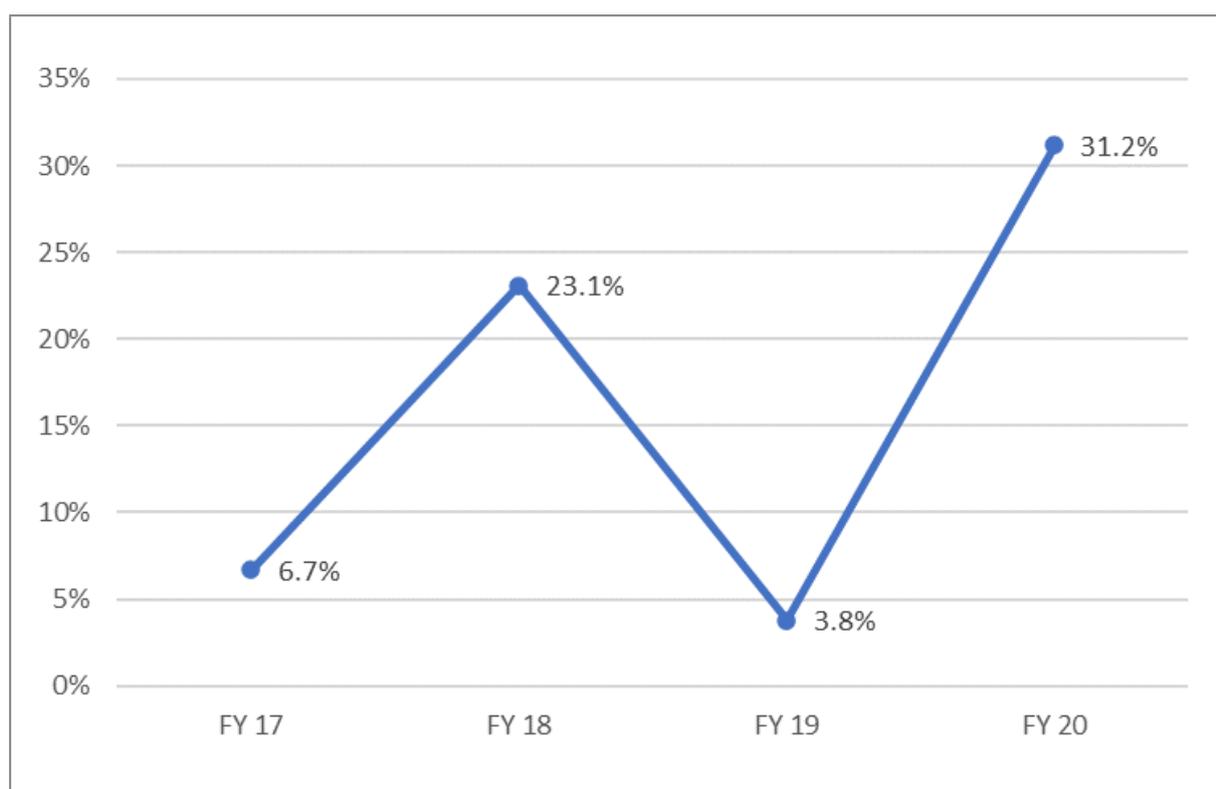
	Discovery & Analytical Solutions			Diagnostics		
	Rev. (M)	Chg.	% of Sales	Rev. (M)	Chg.	% of Sales
Americas	\$696	-3.0%	41%	\$751	86.9%	36%
Europe	\$491	-1.0%	29%	\$865	196.5%	42%
Asia	\$529	-0.8%	31%	\$452	1.6%	22%

Source: Science and Medicine Group

PerkinElmer forecasts full-year revenues to be approximately \$4.1 billion, which would translate into 7.9% reported sales growth and 3%–5% organic growth. Additionally, the company expects pandemic-related product sales to be flat, and non-COVID-19 product sales to experience organic sales growth of 5%–7%. PerkinElmer also anticipates a 2% contribution to total revenues from both currency and acquisitions.

PerkinElmer predicts annual sales in China to grow high single to double digits. Lastly, the company expects a sales recovery for its reproductive health business to finish the year with low single-digit growth.

PerkinElmer FY20 Sales Chg. Comparison



Source: Science and Medicine Group

Thermo Fisher Scientific Sees Significant 2020 Sales Growth from COVID-19 Needs

Q4

Thermo Fisher Scientific by Division Q4 FY20

	Rev. (M)	Chg.	% Organic Chg.	% of Total Rev.
Total	\$10,550	54.5%	51%	
Life Sciences Solutions	\$4,368	137.6%	134%	38%
Analytical Instruments	\$1,636	7.8%	5%	14%
Specialty Diagnostics	\$1,967	109.5%	107%	17%
Laboratory Products & Services	\$3,616	27.6%	25%	31%

Source: Science and Medicine Group

Thermo Fisher Scientific ended the fourth quarter 2020 with double-digit revenue growth, which included a 3% increase from currency and a negligible impact from acquisitions (see *IBO* 2/16/21). For the company's base business, organic sales grew about 5% and saw robust growth sequentially.

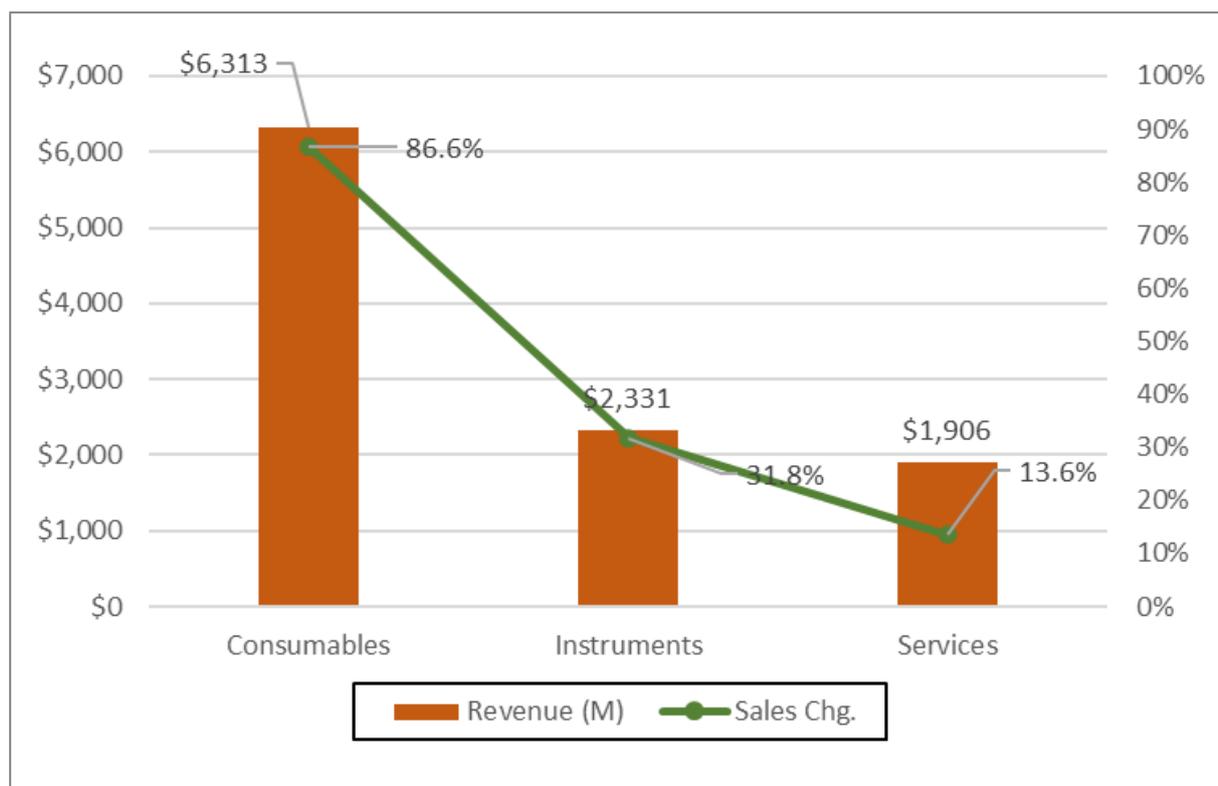
Thermo Fisher Scientific Operating Margin by Division Q4 FY20

	Adj. Op. Profit (M)	Chg.	Adj. Op. Margin	Chg. (bps)
Total	\$3,512	105.6%	33.3%	828
Life Sciences Solutions	\$2,321	236.4%	53.1%	1560
Analytical Instruments	\$331	-16.0%	20.2%	-572
Specialty Diagnostics	\$520	123.2%	26.4%	162
Laboratory Products & Services	\$340	-13.0%	9.4%	-439

Source: Science and Medicine Group

Thermo Fisher's quarterly sales rose significantly thanks to its response to the COVID-19 pandemic. Specifically, the company generated \$3.2 billion in the pandemic-related marketplace primarily driven by its testing-related and instrument product lines. By division, most COVID-19-related sales came from the Life Science Solutions segment, which posted strong sales for its testing kits, instruments, sample preparation and reagents products. Molecular controls products sales from the Specialty Diagnostics segment were strong due to its COVID-19 diagnostic kits. The pharma service business in the Laboratory Products and Services segment met the demand for COVID-19 vaccine and therapy development. Laboratory Products and Services also offered other products applicable to COVID-19-related activities, such as PPE, plastics used for testing workflows and cold storage equipment.

Thermo Fisher Scientific Q4 FY20 Performance by Product Line



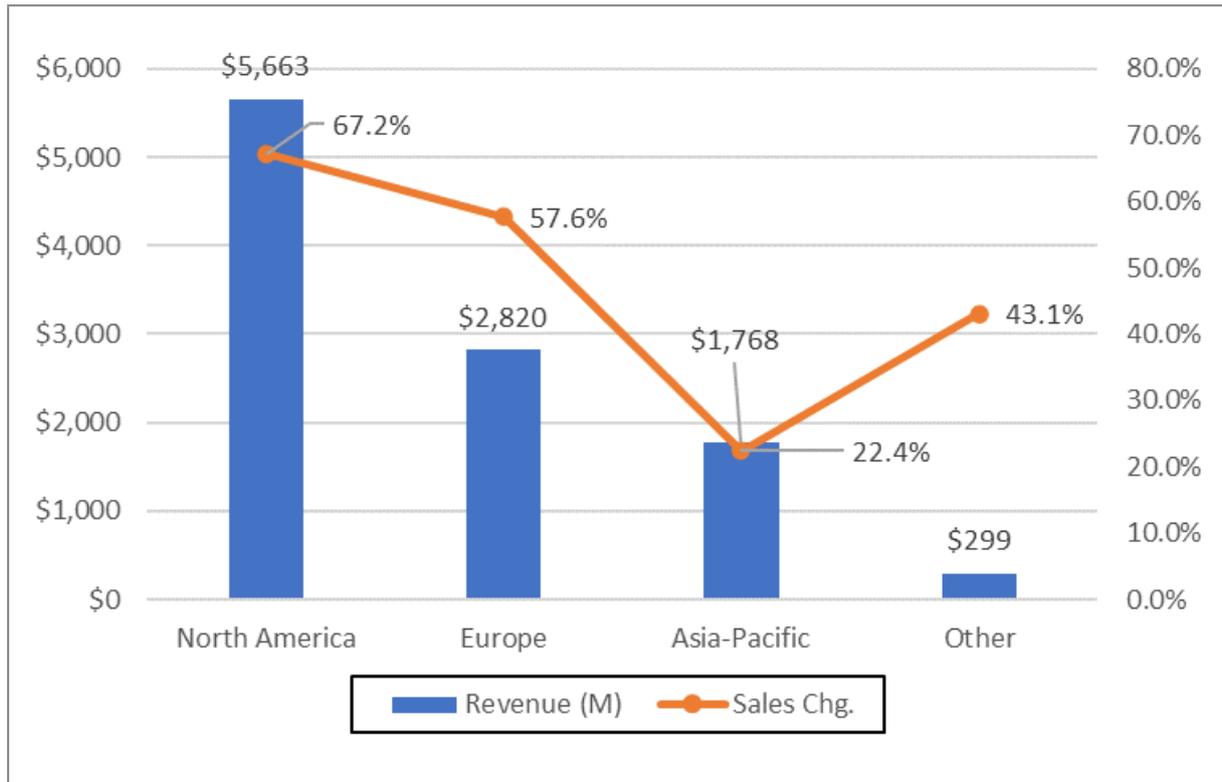
Source: Science and Medicine Group

Thermo Fisher’s total sales to the pharmaceutical and biotech end-market delivered about 25% growth. The company experienced strong demand across all business segments in the end-market, especially the bioproduction, pharma services, biosciences, and research and safety market channel businesses.

Due to increased global activity in the academic and government end-market during the fourth quarter of 2020, sector-related sales posted high single-digit growth. Thermo Fisher’s chromatography, MS, and research and safety market channel portfolios each grew strongly in this end-market.

The industrial and applied end-market also finished the fourth quarter of 2020 in positive territory with sales rising low single-digits, with the company’s microscopy franchise experiencing strength.

Thermo Fisher Scientific Q4 FY20 Performance by Region



Source: Science and Medicine Group

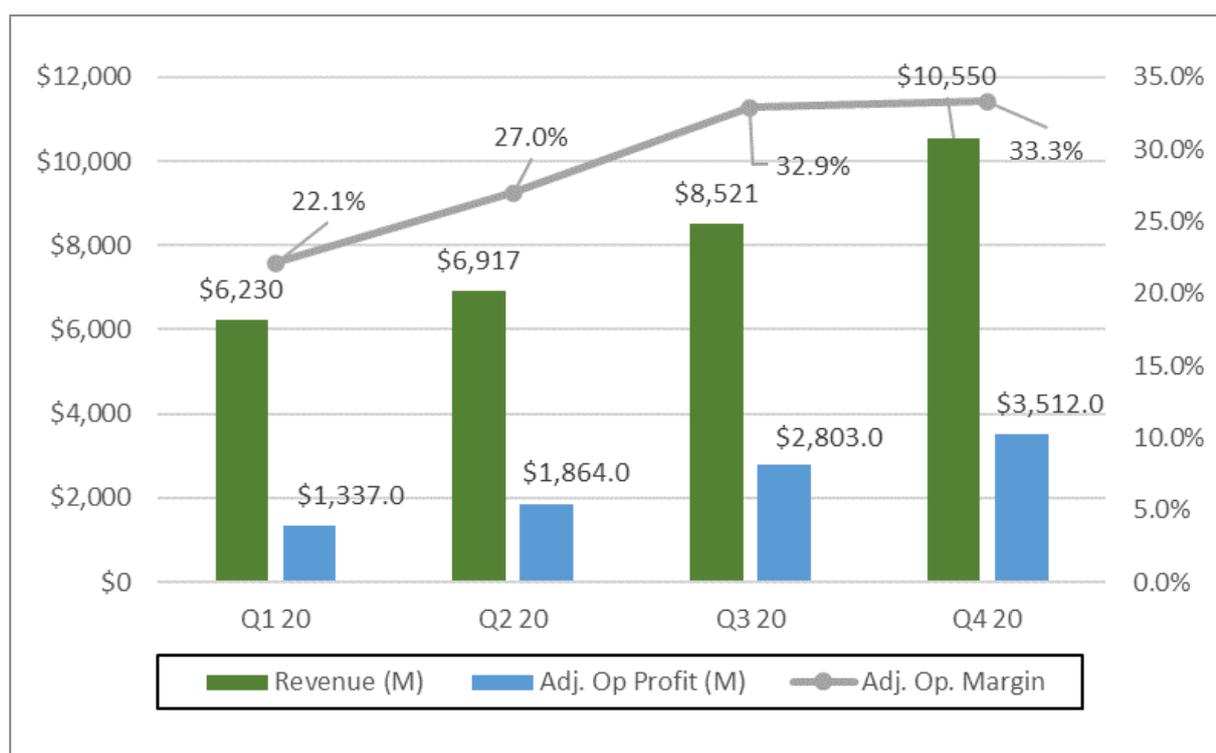
Geographically, all regions posted double-digit growth, with Europe and North America being the primary drivers. Within North America, US sales grew 65.1% to \$5.4 billion. Within Asia Pacific, Thermo Fisher posted 34% revenue growth in China due to strong demand for the company’s biologics and large molecule-related tools.

Bioproduction, biosciences and genetic sciences led revenue growth in the Life Sciences Solutions segment. Laboratory Products and Services posted double-digit growth on a reported and organic basis, with the laboratory products, pharmaceutical services, and research and safety market channel taking the lead.

During the fourth quarter of 2020, the Analytical Instruments business saw an uptick in activity as order growth increased and customers began to receive previously ordered items after facing pandemic-related challenges for most of 2020. As a result, business sales grew high single digits with strong demand for its chromatography, MS, and materials and structural analysis business, offsetting tepid demand from the chemical analysis end-market.

Thermo Fisher forecasts its financial performance for the first quarter to mirror the fourth quarter 2020. As a result, the company expects its first quarter sales to grow 7% organically.

Thermo Fisher Scientific 2020 Quarterly Sales Comparison



Source: Science and Medicine Group

FYE

Thermo Fisher Scientific by Division FYE 20

	Rev. (M)	Chg.	% Organic Chg.	% of Total Rev.
Total	\$32,218	15.7%	25%	
Life Sciences Solutions	\$12,168	77.5%	77%	35%
Analytical Instruments	\$5,124	-7.2%	-8%	15%
Specialty Diagnostics	\$5,343	43.7%	48%	15%
Laboratory Products & Services	\$12,245	15.5%	13%	35%

Source: Science and Medicine Group

For 2020, Thermo Fisher reported double-digit revenue growth, which encompassed a 1% increase from currency and no impact from acquisitions (see *IBO* 2/16/21). The company's base business was flat due to experiencing pandemic-related challenges earlier in 2020 despite sequential growth in the latter half.

Thermo Fisher Scientific Operating Margin by Division FYE 20

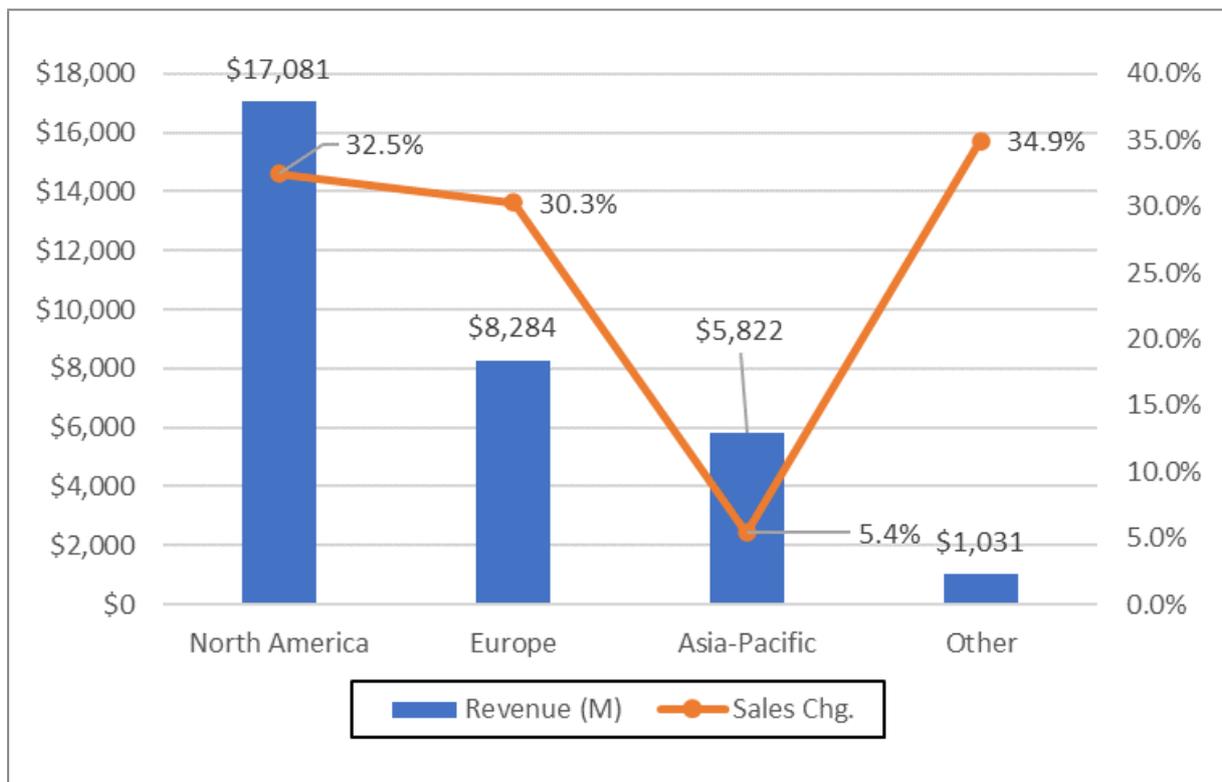
	Adj. Op. Profit (M)	Chg.	Adj. Op. Margin	Chg. (bps)
Total	\$9,556	60.0%	29.7%	821
Life Sciences Solutions	\$6,109	149.8%	50.2%	1453
Analytical Instruments	\$808	-36.5%	15.8%	-728
Specialty Diagnostics	\$1,368	47.1%	25.6%	59
Laboratory Products & Services	\$1,271	-4.0%	10.4%	-211

Source: Science and Medicine Group

Thermo Fisher reported a \$6.6 billion contribution from COVID-19-related product offerings, which included \$500 million of revenue from end-users participating in pandemic-related vaccine and therapies development.

End-market wise, Thermo Fisher's pharmaceutical and biotech end-market sales delivered mid-teens percentage growth driven by COVID-19-related vaccines and therapy development needs. In contrast, the company experienced a mid-single-digit sales decline in both the academic and government, and industrial and applied end-markets.

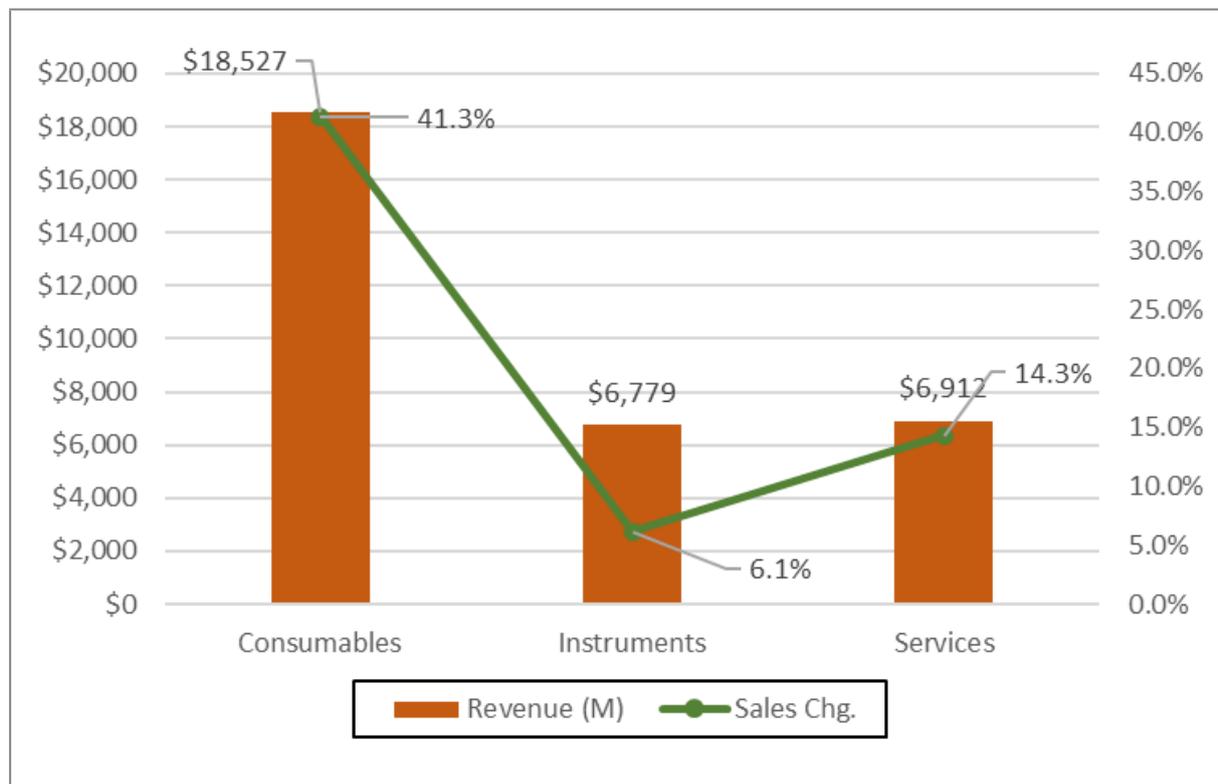
Thermo Fisher Scientific FY20 Performance by Region



Source: Science and Medicine Group

North America and Other led regional growth on a geographical basis, each with sales up double digits. Within Asia Pacific, sales in China posted a 1.6% increase to \$2.8 billion, while the US reported a 32.2% uptick to \$16.3 billion.

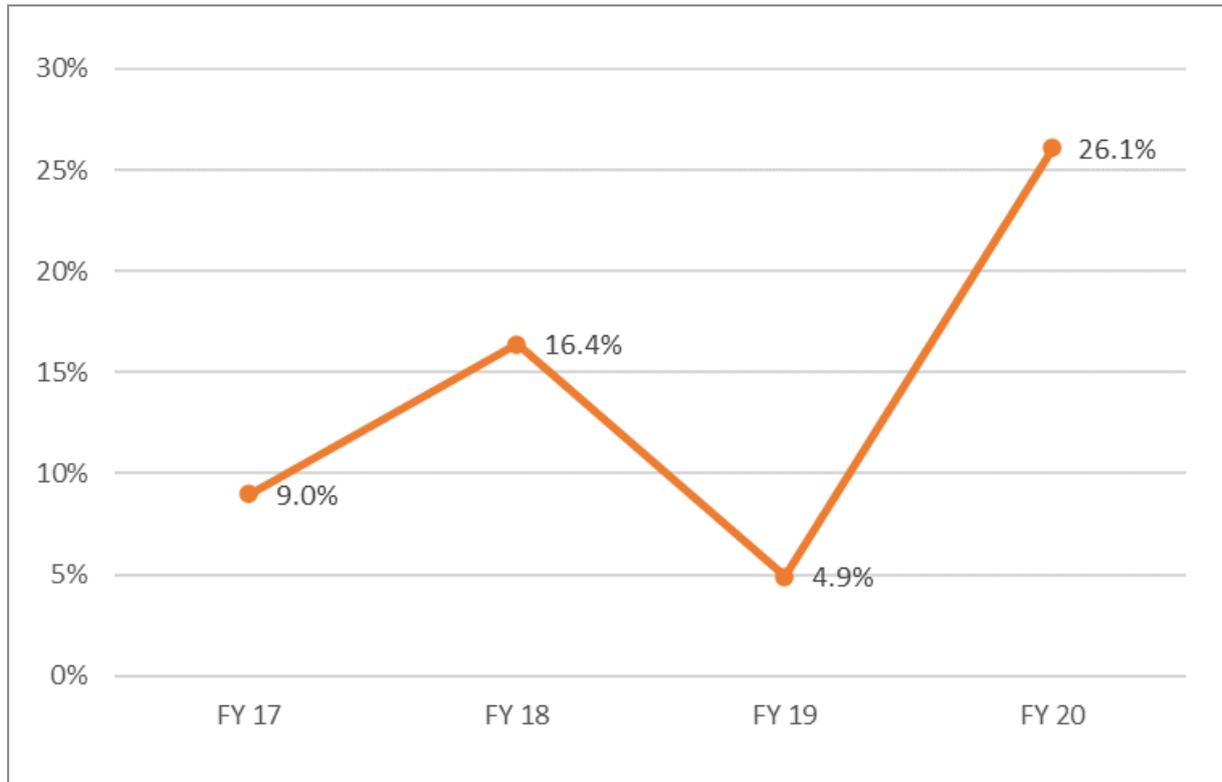
Thermo Fisher Scientific FY20 Performance by Product Line



Source: Science and Medicine Group

Thermo Fisher forecasts full-year 2021 sales to be \$35.1 billion, which would equate to 9% growth and 7% organic growth. The company also factored in a 1.2% or \$400 million tailwind from currency and a \$125 million contribution from acquisitions. Regarding the COVID-19 pandemic, Thermo Fisher expects to generate \$7.1 billion from the marketplace, encompassing a \$1.0 billion contribution in the COVID-19-related vaccine and therapy sector. Also, the company expects a recovery in sales for its Analytical Instruments business.

Thermo Fisher Scientific FY20 Sales Chg. Comparison



Source: Science and Medicine Group

Waters Able to End 2020 Positively Despite Mixed Results

Q4

Waters' fourth quarter 2020 revenues posted 7% growth in constant currency (see *IBO 2/16/21*). Reported growth included a 3% currency headwind. Recurring revenue, including a combination of service and chemistry products, grew 11%, while instrument sales increased 4%. Quarterly sales benefitted from an increase in capital spending by customers in the second half of 2020. Unless noted, all figures below are in constant currency.

Waters by Division Q4 FY20

	Rev. (M)	Chg.	Constant Curr. Chg.	% of Rev.
Total	\$786.6	9.8%	7%	
Waters Div.	\$703.7	10.9%	8%	89%
Instrument Systems	\$340.8	7.6%		43%
Chemistry	\$131.5	17.2%		17%

Service	\$231.3	12.6%		29%
TA	\$82.9	1.1%	-1%	11%
Instrument Systems	\$59.6	-0.7%		8%
Service	\$23.3	6.1%		3%

Source: Science and Medicine Group

The Waters-branded business finished the quarter in positive territory with its combined LC and LC/MS system sales up 5%. Sales were helped by global demand for the company's LC instruments as end-users ramped up capital equipment investment after delays in the first half of 2020. Other LC highlights included solid sales in the pharmaceutical end-market and end-users upgrading to new LC models. In contrast, the Waters-branded MS portfolio finished the quarter flat because of mixed reception in the biomedical research sector, and clinical diagnostics customers shifting to COVID-19-related projects. However, MS sales in the pharmaceutical end-market posted double-digit growth thanks to the BioAccord system showing a double-digit uptick in sales.

Other Waters division highlights included its service and chemistries businesses posting revenue increases of 10% and 14%, respectively. Chemistries sales were led by strength in the global pharmaceutical end-market, including solid sales of Premier columns. The Services business was positively impacted by the reopening of labs which led to the company being able to visit worksites for system maintenance.

Waters by Product Line Q4 FY20

	Rev. (M)	Chg.	Constant Curr. Chg.	% of Rev.
Instruments	\$400.4	6.3%	4%	51%
Service	\$254.7	12.0%	10%	32%
Chemistry	\$131.5	17.2%	14%	17%

Source: Science and Medicine Group

TA-branded fourth quarter 2020 sales declined 4% but improved sequentially from the first half of 2020. The business's core thermal line experienced demand in Asia and the life sciences end-market, which included strength in the pharmaceutical market and double-digit sales growth in the medical devices sector. However, these sales highlights could not offset the tepid demand from the industrial end-market.

Waters by Region Q4 FY20

	Rev. (M)	Chg.	Constant Curr. Chg.	% of Rev.
Asia	\$295.7	12.9%	12%	38%
China	\$151.6	21.3%		
Japan	\$48.7	9.7%		
Asia Other	\$95.4	3.0%		

Americas	\$251.4	2.6%	3%	32%
United States	\$213.2	4.0%		
Americas Other	\$38.2	-4.8%		
Europe	\$239.5	14.5%	6%	30%

Source: Science and Medicine Group

On a geographical basis, for the fourth quarter 2020, Asia made up the most significant portion of Waters' total revenues and posted the fastest growth. Within Asia, sales in China experienced double-digit growth led by solid demand from both the pharmaceutical and environmental markets. Pharmaceutical sales were driven by small and large molecule end-users, especially those in contract labs. Also, sales in India reported double-digit growth.

Within the Americas, the US pharmaceutical industry was the primary driver, yet growth was partially offset by waning demand from materials science, environmental and academic and government end-markets. In Latin America, revenues declined but improved on a sequential basis.

Waters by End-Market Q4 FY20

	Rev. (M)	Chg.	Constant Curr. Chg.	% of Rev.
Pharmaceutical	\$460.4	17.3%	15%	59%
Industrial	\$233.2	7.6%	5%	30%
Govt. & Academic	\$93.1	-13.2%	-15%	12%

Source: Science and Medicine Group

Like that of the US, Europe's pharmaceutical industry drove its quarterly performance, but this was offset by other end-markets, including materials science, food, and academia and government. For both the US and Europe, gains across the pharmaceutical end-market were broad, especially in big pharma, large molecules, genetics and contract labs customer bases.

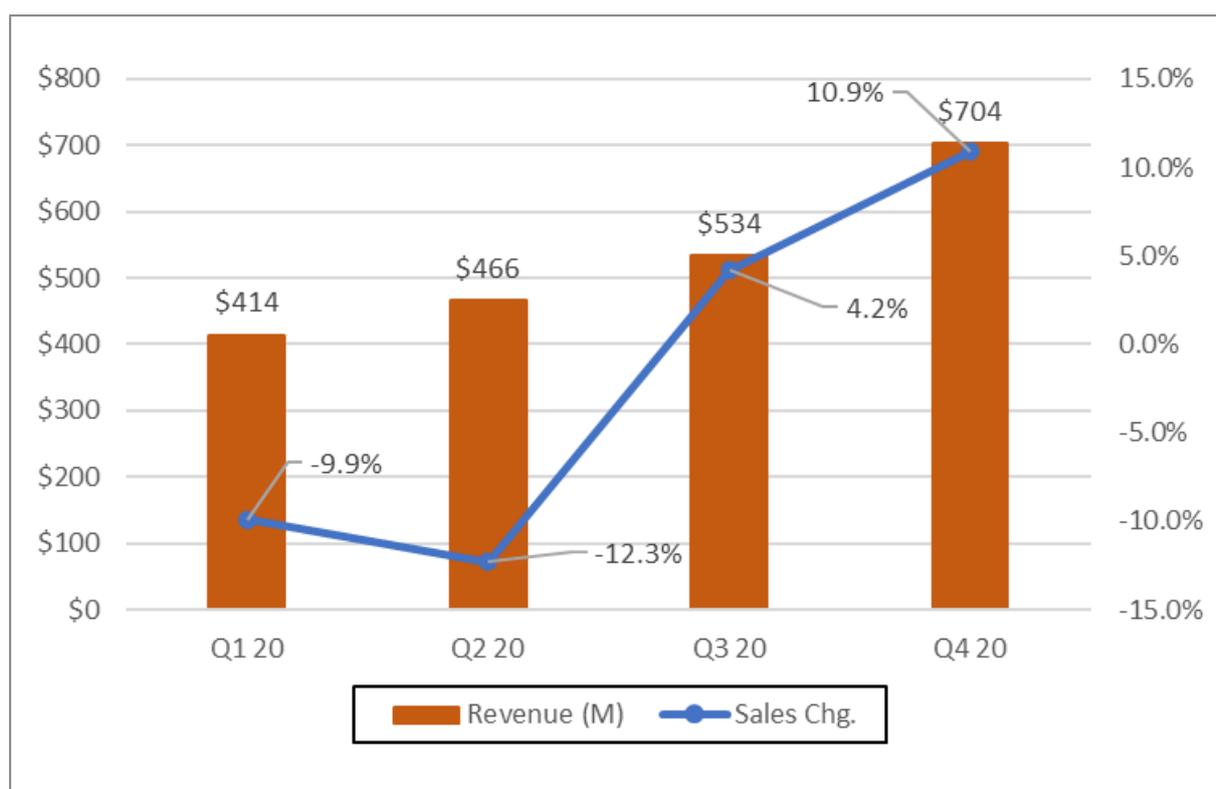
Waters Operating Margin Q4 FY20

Adj. Op. Profit (M)	Chg.	Adj. Op. Margin	Chg. (bps)
\$275.5	14.4%	35.0%	141

Source: Science and Medicine Group

Waters forecasts its first quarter revenues will increase 7%–10% in constant currency, including a three percentage point contribution from currency. Additionally, the company expects a 1%–2% tailwind from COVID-19-related revenues.

Waters 2020 Quarterly Sales Comparison



Source: Science and Medicine Group

FYE

For 2020, Waters revenues decreased 2%, with currency contributing less than 1% growth. Recurring revenue increased 3%. Waters annual sales declined due to the COVID-19 pandemic, which caused end-users to delay or stop capital expenditures in the first half of 2020. However, the company did see an uptick in end-user activity in the second half, resulting in a 7% sales increase for the period. Additionally, Waters benefitted from meeting a need in the COVID-19 marketplace, especially for pharmaceutical end-users developing coronavirus-related vaccines and therapies. Waters' COVID-19 product offerings generated a 1%–2% contribution to the company's total revenues.

Waters by Division FYE 20

	Rev. (M)	Chg.	Constant Curr. Chg.	% of Rev.
Total	\$2,365.4	-1.7%	-2%	
Waters Div.	\$2,117.1	-1.0%	-2%	90%
Instrument Systems	\$890.9	-7.6%		38%
Chemistry	\$432.1	4.9%		18%
Service	\$794.2	4.3%		34%

TA	\$248.2	-7.8%	-8%	10%
Instrument Systems	\$174.4	-8.8%		7%
Service	\$73.8	-5.1%		3%

Source: Science and Medicine Group

The underlying trend of the second-half 2020 ramp-up was broad-based across Waters' business. For instance, in the first half of 2020, Waters' overall instrument sales declined 22%, yet as end-user activity ramped up in the second half, sales increased 3%. Despite the sequential improvement, Waters' total instrument sales finished 2020 with a 9% revenue decrease.

Waters by Region FYE 20

	Rev. (M)	Chg.	Constant Curr. Chg.	% of Rev.
Asia	\$899.2	-4.3%	-4%	38%
China	\$404.4	-8.0%		
Japan	\$179.8	-0.5%		
Asia Other	\$315.0	-1.2%		
Americas	\$797.8	-3.9%	-4%	34%
United States	\$678.3	-2.0%		
Americas Other	\$119.5	-13.4%		
Europe	\$668.3	4.9%	2%	28%

Source: Science and Medicine Group

Recurring revenue for the year increased 3% thanks to a large installed base and strong demand for Waters' service business.

Waters by Product Line FYE 20

	Rev. (M)	Chg.	Constant Curr. Chg.	% of Rev.
Instruments	\$1,065.3	-7.8%	-9%	45%
Service	\$868.0	3.4%	3%	37%
Chemistry	\$432.1	4.9%	4%	18%

Source: Science and Medicine Group

On a geographical basis, Europe was the only region to finish 2020 in positive territory. In contrast, Asia and America reported a low double-digit revenue decline due to the COVID-19 lockdown measures earlier in 2020.

Waters by End-Market FYE 20

	Rev. (M)	Chg.	Constant Curr. Chg.	% of Rev.
Pharmaceutical	\$1,387.0	1.6%	1%	59%
Industrial	\$707.8	-1.6%	-3%	30%
Govt. & Academic	\$270.6	-15.9%	-16%	11%

Source: Science and Medicine Group

Waters' industrial end-market sales were significantly impacted due to a sales decline of TA instruments within the sector. End-users facing pandemic-related challenges caused demand in the academic and government market to wane, especially in China. Pharmaceutical sales landed in positive territory thanks to customers shifting focus to COVID-19-related activities such as diagnostic testing and vaccine and therapies development. On a geographical basis, pharmaceutical sales were driven by demand in Europe, India and the US.

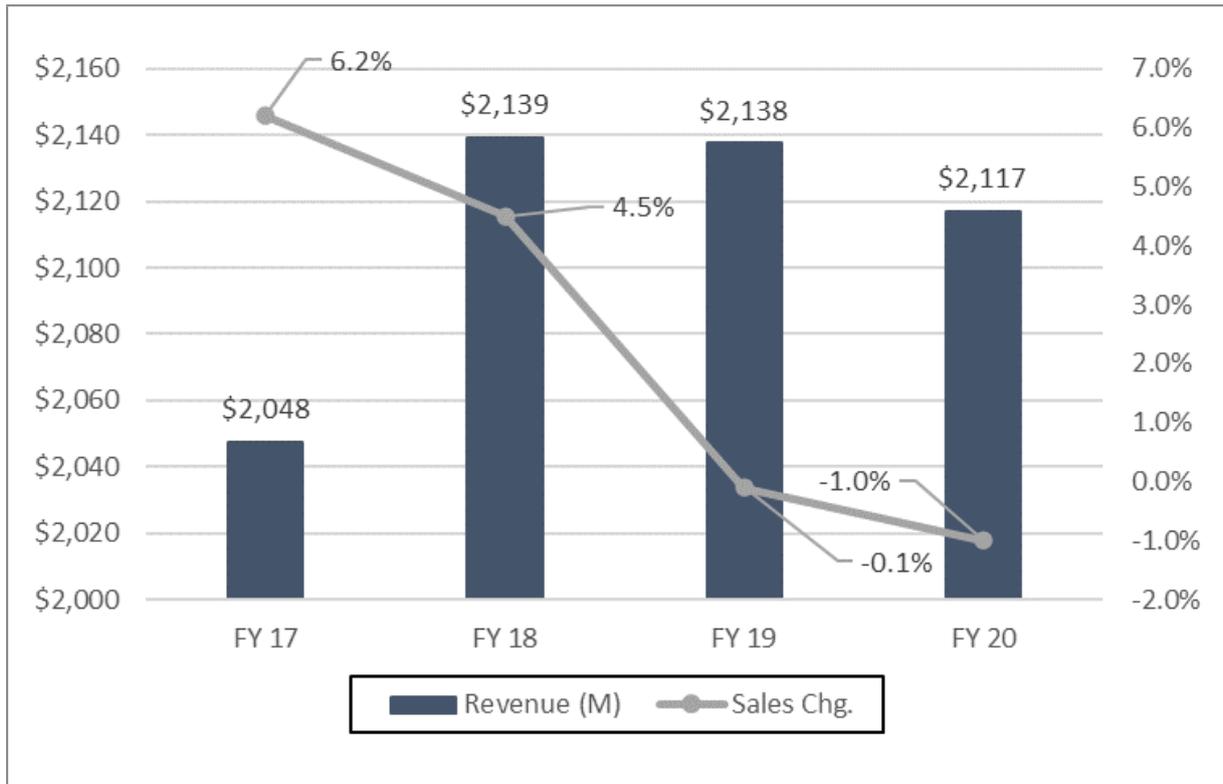
Waters Operating Margin FYE 20

Adj. Op. Profit (M)	Chg.	Adj. Op. Margin	Chg. (bps)
\$699.4	-4.8%	29.6%	-95

Source: Science and Medicine Group

Waters forecasts its full-year 2021 sales to increase 5%–8% in constant currency, including a 1%–2% contribution from currency. Additionally, the company anticipates COVID-19-related sales to contribute 1% to its total revenues.

Waters 2020 Annual Sales Comparison



Source: Science and Medicine Group

Market Profile: Scanning & Diode Array NIR

The NIR spectrum ranges from wavelengths of about 500 nm to 2000 nm. Similar to other vibrational spectroscopy techniques in Raman and IR spectroscopy, modern iterations of NIR spectroscopy have been around since the 1950s. While the basic analytical principle has remained unchanged, advances in technology have benefited the technique with more efficient light sources, more precise optical components and more sensitive electronic components.

There are many different types of NIR instruments on the market today, ranging from small handheld instruments to large on-line analyzers. Among these, scanning and diode array NIR systems account for the largest share of the laboratory NIR instrument market.

The basic principle of operation for NIR instrumentation is similar to that of other molecular spectroscopy techniques like UV/vis spectroscopy or IR spectroscopy. The energy from a light source, typically an LED in modern instrumentation, is split into two and sent through both a sample and reference path. An optical grating then separates the transmitted light from the sample into individual wavelengths. The sample spectrum produced gives information on the chemical structure of the sample, namely the vibrational modes of different chemical bonds within the sample.

In scanning NIR instruments, sometimes called dispersive instruments, each wavelength is measured individually, allowing for a high degree of precision and sensitivity. Scanning NIR instruments can use a variety of different detectors, but silicon and indium gallium arsenide detectors are common choices as they cover a wide spectral range when combined.

Diode array instruments work on a similar principle. Instead of measuring the transmitted light from a sample, they measure the light reflected off a sample. As the name implies, diode array instruments use a dedicated diode detector which allows for analysis of all wavelengths of the reflected sample light simultaneously, resulting in very fast analysis times.

The main application area for scanning and diode array NIR instruments is in the agriculture, food and beverage end-market. The nature of the technique allows for little to no sample preparation for a variety of samples, making it ideal for analysis of raw, semi-finished and finished food products. Some common applications in this end-market include fat analysis of meats and dairy, moisture analysis of cereals and grains, and determination of sugar in fruits, sweets and beverages.

While the agriculture, food and beverage end-market is the largest for scanning and diode array instruments, pharmaceuticals and chemicals are other key end-markets for the technique. Here, NIR spectroscopy is used to measure various chemical parameters including viscosity, API, and filler content, and to identify raw materials.

The largest vendor of scanning and diode array NIR instruments is FOSS. Nearly all of FOSS' product portfolio is geared towards the agriculture and food end-market, with products like the NIRS DS2500 L, designed for liquid oils, and the Infratec NOVA, designed for fast analysis of most grains or oilseeds. The next largest vendors are Metrohm and PerkinElmer. Similar to FOSS, PerkinElmer's NIR product offerings in the DA6200 and DA7250 are both designed for samples from the agriculture and

food industry. On the other hand, Metrohm's DS2500 and XDS analyzers are more general-use analyzers and also combine visible spectroscopy in their analyses. Other notable vendors include Unity Scientific and Malvern Panalytical (Spectris).

The total market for scanning and diode array NIR spectroscopy was just over \$150 million in 2020. Growth is forecast to be in the mid-single digits over the next five years. The majority of these instruments are utilized in the agriculture, food and beverage end-market, which will be the main source of growth over the next several years. This market saw steep declines as a result of the coronavirus pandemic but with international trade and demand slowly returning to normal, so should demand for these instruments. Growth from recovering post-pandemic industrial end-markets in chemicals, polymers, and oil and gas will also benefit these instruments' demand over the next several years.

Leading Vendors

- FOSS
- Metrohm
- PerkinElmer

Largest Markets

- Agriculture, Food & Beverage
- Pharmaceuticals
- Polymers

Instrument Cost

- \$5,000–\$55,000

Industry Watch

Biopharmaceutical

COVID-19 vaccine manufacturing has scaled up at a remarkable rate, and capacity is expected to meet 2020 demand. But these estimates are plagued by a vast uncertainty about the ability of production to keep up with demand due to unknown circumstances. These challenges were the focus of the COVID-19 Vaccine Manufacturing and Supply Chain Summit held early this month.

Manufacturers aim to produce 14 billion doses of COVID-19 vaccines this year, with 11–13 billion consisting of vaccines currently approved or under review. This would meet the estimated 2021 global demand of around 10–14 billion doses. As of March 3, an estimated 400 million doses had been produced, with mRNA vaccines accounting for approximately 45%.

Manufacturing and control of each vaccine batch is completed in 90–120 days on average, regardless of vaccine technology. This is facilitated by the over 150 partnerships between drug companies and CDMOs and other vaccine manufacturers for COVID-19 production. Geographically, this capacity (stage 3 products or later) is spread between East Asia (55% of capacity), Europe and North America (40%), and Africa and South America (less than 5%).

Among the challenges currently faced are the inability to adequately forecast the needs of suppliers and manufacturers, creating short lead times; increasing holding of safety stocks, which can contribute to supply shortages; and trade and regulatory barriers. For all four vaccine platforms (viral vectors, protein subunits, RNA and inactivated viruses [bioreactor based]), the most serious supply chain challenges indicated by 15 stakeholders for upstream processes were bioreactor bags, single-use assemblies and cell culture media. For downstream, they were single-use assemblies and filters. For fill/finish, the top challenge was obtaining vials. Also of particular concern are supplies of gamma sterilization and lipid nanoparticles.

Out of the current yearly bioreactor capacity, only 5% would be required to meet viral vector-based vaccine production targets in 2021, while less than 1% could be utilized to meet production goals for protein subunit-based vaccines. In the case of mRNA vaccines, stakeholders have indicated sufficient supplies to make 2021 production goals. For inactivated virus-based vaccines, exact data is unavailable. It is also unknown whether the up to 2.8 billion vial fill-and-finish capacity that is required for this year can be met.

Potential solutions designed to meet capacity demands over the next 3 to 6 months are: increasing efficiency of existing capacity, improved equipment effectiveness and utilization, improved yield via supplier collaboration, examination of export restrictions, increasing public stockpiles of essential products and aligned procurement approaches.

Source: *International Federation of Pharmaceutical Manufacturers and Associations* (March 9)

Government

On March 11, US President Joe Biden signed into a law a \$1.9 trillion bill designed to provide COVID-19 relief. Selected portions addressing R&D, science and labs are listed below alongside sections of the law's text from the bill.

Selected Sections of the American Rescue Plan Act of 2021

Amount	Purpose
\$47.8 billion	"to carry out activities to detect, diagnose, track and monitor SARS-CoV-2 and COVID-19 infections and related strategies to mitigate the spread of COVID-19," including lab capacity
\$7.5 billion	"vaccine distribution and administration"
\$1.75 billion	"to strengthen and expand activities and workforce related to genomic sequencing analytics, and disease surveillance"
\$600 million	"to fund or extend new and existing research grants, cooperative agreements, scholarships, fellowships, and apprenticeships, and related administrative expenses to prevent, prepare for and respond to coronavirus"
\$500 million	"evaluation of the continued performance, safety and effectiveness; facilitation of advanced continuous manufacturing activities; facilitation and conduct of inspections related to the manufacturing of vaccines; review of devices authorized for use for the treatment, prevention, or diagnosis of COVID-19; oversight of the supply chain and mitigation of shortages of vaccines, therapeutics, and devices"
\$150 million	"to fund awards for research, development, and testbeds to prevent, prepare for, and respond to coronavirus"
\$10 billion	"COVID-19 emergency medical supplies enhancements," including "testing, PPE, vaccines and other materials"

Source: Science and Medicine Group

Source: *CNN* (March 11) and *Congress.gov* (March 11)

Water

The US EPA has signaled new interest in setting limits on per- and polyfluoroalkyl substances (PFAS) in drinking water. Because there are no federal standards, PFAS compounds are currently unregulated.

In January, the EPA published its latest proposal for updating the Unregulated Contaminant Monitoring Rule, which regulates public water systems (PWS). The proposal identifies 29 PFAS compounds whose frequency PWS must monitor. This is a further step in the process of determining whether standards, such as maximum contaminant levels (MCLs), should be set for these compounds under the Safe Drinking Water Act (SDWA). Seven of these compounds are already being

evaluated as the result of a 2012 EPA issuance. The document also indicated the Agency is working to establish toxicity assessments for seven PFAS compounds.

Also issued in January, a pre-publication of Regulatory Determination provided a final determination for regulation of two specific PFAS compounds that had already been studied, perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA). Rulemaking will now begin for the two compounds to establish MCLs. The rule proposals are due within 24 months.

Indicating further regulatory steps will be taken shortly regarding PFAS, this document also stated the EPA “will continue to prioritize regulatory determinations of additional PFAS in drinking water.” To begin the process, the EPA will have to place a PFAS compound on the Contaminant Candidate List (CCL).

Source: *Environmental Law & Policy Monitor* (February 25)

Region Watch

China

China's 2020 spending on experimental R&D grew an estimated 10.3% to CNY 2,442.6 billion (\$354 billion) which was 2.4% of GDP, according to preliminary figures. In 2019, R&D spending rose 12.5%.

In 2020, basic research accounted for 6% of total R&D expenditures. The National Natural Science Foundation funded 45,700 projects, and there were 198 national science and technology major projects. The number of state key labs totaled 522.

Announcing details of its latest five-year plan, the government stated that it intends to boost R&D spending 7% annually over the period. Funding for basic research will rise 10.6%. Among the technology areas emphasized in the plan are brain science, genetic research, biotechnology and clinical medicine. Further support was announced to help foreign companies establish R&D operations in the country. Plans were also revealed for a new international science organization.

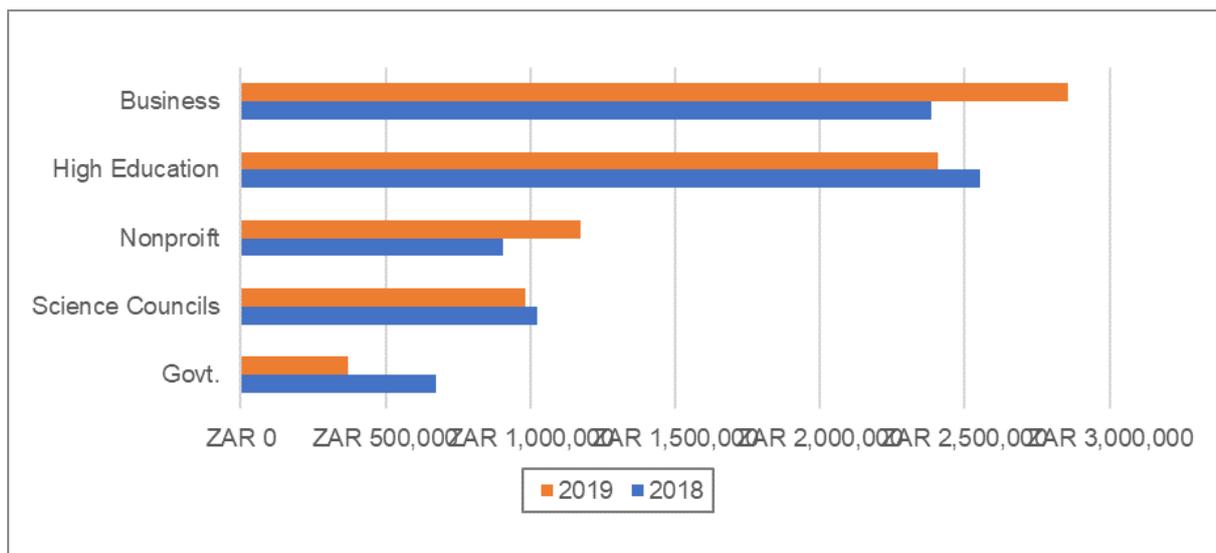
Source: *National Bureau of Statistics of China* (February 28) and *Reuters* (March 4)

South Africa

South Africa's 2019 gross domestic expenditure on R&D fell 5.0% to ZAR 36.8 billion (\$2.5 billion), the first decline since 2012. In constant 2010 prices, it declined 8.6% to ZAR 23.7 billion (\$1.6 billion). R&D as a percentage of GDP was 0.75%.

Although the country's basic research spending grew 1.4% to represent 28% of all expenditures, applied and experimental development spending declined 6.3% and 9.8%, accounting for 53% and 19%, respectively.

South African R&D Spending Change by Selected Sectors, 2019

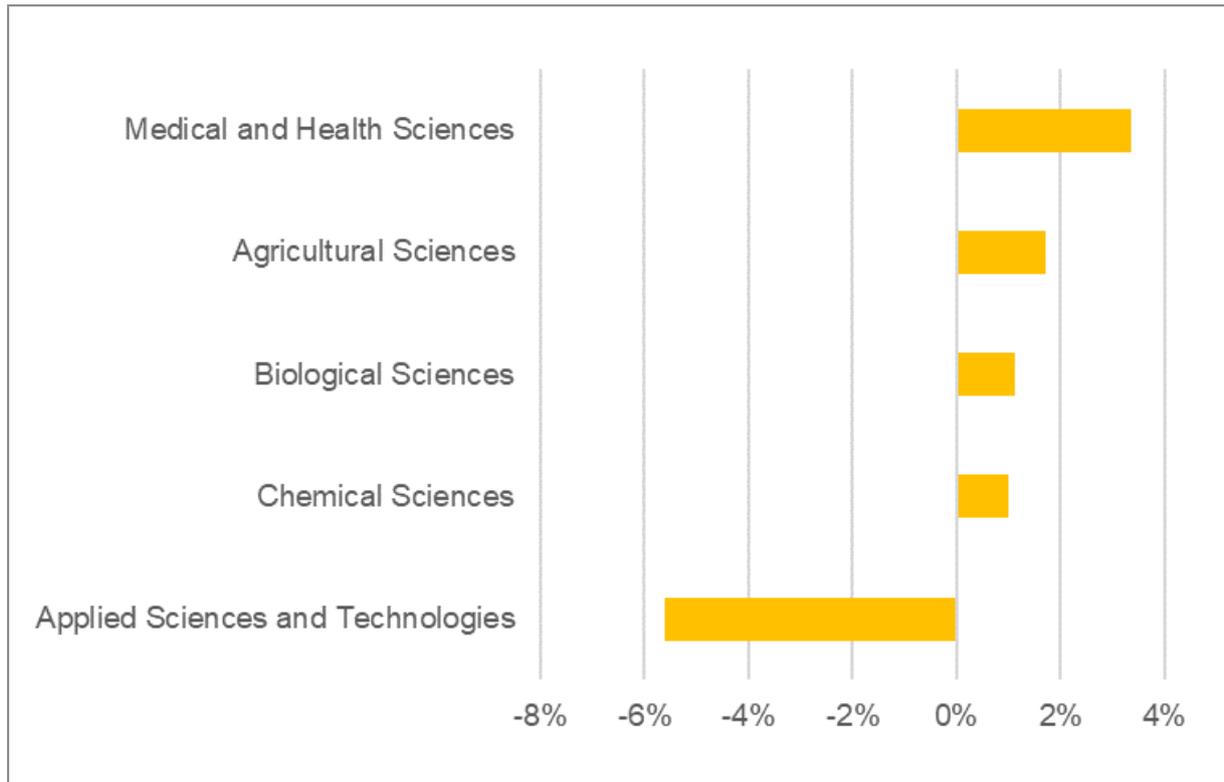


Source: Department of Science and Innovation

Nonprofits and higher education were the only segments to experience gains (see graph above), with R&D expenditures up 22.2% and 1.3% to account for 4% and 36% of the country’s total R&D spending, respectively. In contrast, science councils, business and government spending fell 13.8%, 8.9% and 4.4% to represent 15%, 39% and 6%, respectively.

Nonetheless, spending on TB, HIV/AIDS and malaria research gained 10.5% to ZAR 5.1 billion (\$347 million), while nanotech research expenditures grew 14.7% to ZAR 824 million (\$56 million), and R&D in the area of new materials rose 13.5% to ZAR 965 million (\$66 million). Other areas showing growth were environmental and environmental-related R&D, up 9.5% to ZAR 3.1 million (\$210 million).

South African R&D Spending by Selected Fields, 2019



Source: Department of Science and Innovation

Other gainers were Medical and Health Sciences (see graph above) for which total R&D expenditures jumped to ZAR 8 billion (\$530 million) and Agricultural Sciences which emerged with R&D expenditures at ZAR 3.1 billion (\$208 million).

On the funding side, business R&D funding plummeted the most, dropping 9.5% to ZAR 14.5 billion (\$988 million). Government funding dipped 3.4% to ZAR 17.5 billion (\$1.2 billion), while foreign R&D funding inched up 1.6% to ZAR 4.0 billion (\$272 million).

Source: *Department of Science and Innovation* (February 18)

EU

The EU is making major investments in electronic battery technology and raw materials in order to obtain technology self-sufficiency. One goal is for regional companies to meet all EU supply demands for lithium batteries by 2025. The batteries will have to meet new environmental regulations, expected to be adopted next year.

EU Commission Vice President Maros Sefcovic commented at a recent press conference, "We expect that we will be able to cover all the industrial needs of our car manufacturers when it comes to batteries already by 2025." This would require annual production of 7–8 million batteries. Large-scale training of workers will be required.

Among the mechanisms designed to assist the region's development in this area is the European Battery Alliance, established in 2017. Seventy projects with \$24 billion in funding are currently underway. Additional efforts will include €50 billion (\$60 billion) coming from the private sector via a partnership with the European Investment Bank.

Source: *Techxplore* (March 12)

News

Sequencing

Company Announcements

In January, **Split Biosciences**, a company providing researchers with scalable and flexible single-cell sequencing solutions, announced \$7 million in Series A funding. The funding round was led by **Bioeconomy Capital** with participation from new and existing angel investors. Split Bio also announced a rebrand of the company to **Parse Biosciences**.

Direct electronic sequencing technology firm **GenapSys** named Jason Myers as CEO, effective February 15, and he will also join the Board. He currently serves as a member of the management team and a Director at **Invitae**. He succeeds Dr. Hesaam Esfandyarpour, founder and CEO of GenapSys since 2010, who will remain as Chairman.

In February, **Illumina** announced an agreement with the **Belgian Society of Medical Oncology (BSMO)** which is running a new national pilot to evaluate the use of comprehensive genomic profiling (CGP) in 864 patients with advanced metastatic cancer. The BALLETT (Belgian Approach for Local Laboratory Extensive Tumor Testing) study will recruit patients from 12 participating sites to be offered CGP from 1 of 9 NGS laboratories across Belgium. Illumina will provide its CGP panel, TruSight Oncology 500 (TSO500), as well as NovaSeq 6000 and NextSeq sequencing platforms.

Clinical genomics knowledge provider **PierianDx** announced in February a partnership with **BSMO** to study the impact of CGP on clinical outcomes of late-stage cancer patients. As part of the study, nine sites across Belgium will use the firm's Clinical Genomics Workspace (CGW).

Illumina entered into an agreement in February with the **Institute of Medical Genetics and Applied Genomics at the University Hospital of Tübingen** to assess the value of whole genome sequencing (WGS) as a first-line diagnostic test for patients with genetic diseases and familial cancer syndromes. Illumina will support the new investigator-initiated study, called the Ge-Med Project, with sequencing, analysis and health economic expertise. The Institute is the first laboratory in Germany accredited to perform clinical WGS.

Due to **Pacific Biosciences** raising \$900 million through the issuance of convertible notes (see **IBO** 3/2/21), the company will return \$52 million of the \$98 million **Illumina** paid to the company as part of the termination of Illumina's agreement to purchase Pacific Biosciences (see **IBO** 1/15/20).

In response to the rulings of the Patents Court within **the High Court of Justice for England & Wales** against the company in a patent infringement suit involving **Illumina** (see **IBO** 2/1/21), on February 18, **MGI** stated, "We welcome the Court's decision to give us the permission to appeal the judgment, and we intend to file its appeal with the Court of Appeal. As permitted by the Court, we will continue to supply sequencing reagents to our existing customers in the UK during the appeal period."

In March, **Illumina**'s NextSeq 550Dx platform and associated reagent kits received medical device registration in Russia, as have reagents for the MiSeqDx which was approved previously as a medical device. Sequencing platforms and associated reagents must be approved separately in Russia by the medical device regulatory agency, **Rosdravnadzor**. Illumina's strategic partner in Russia and CIS, R-Pharm, led the regulatory process and this is the first approval of complete sets of sequencing instruments plus reagents.

In February, **CELLINK** signed an agreement to commercialize **seqWell**'s products to a wider audience outside of the US. The agreement encompasses seqWell's plexWell library preparation kits. In addition, the companies will collaborate on additional integrated solutions that address the need for multiplexing of complex genomic assays.

In February, **QIAGEN** launched the QIAGEN Digital Insights Partnership program. The first group of five new partnerships involves **DNAexus**, **GNS Healthcare**, **Personal Genome Diagnostics**, **Thermo Fisher Scientific** and the **Wellcome Sanger Institute**. The partnerships will deliver improved AI services and databases in oncology, secondary analysis, and combined NGS panels and interpretation for commercial hereditary and oncology panels.

QIAGEN and **INOVIO Pharmaceuticals** extended their partnership in February with a new master collaboration agreement to develop liquid biopsy-based companion diagnostic products. The initial project in this expanded collaboration focuses on the co-development of a diagnostic test that identifies women who are most likely to benefit from clinical use of VGX-3100, INOVIO's immunotherapy to treat advanced cervical dysplasia associated with HPV. The assay will now be developed for use on the Illumina NextSeq 550Dx platform, the first development based on a partnership QIAGEN and Illumina signed in October 2019 (see *IBO* 10/15/19).

Twist Bioscience, a company providing synthetic DNA using its silicon platform, announced in February that **Berry Genomics**, a commercial NGS provider in China, will add Twist's NGS target enrichment and library preparation tools to its offering. Berry Genomics and Twist Bioscience will also work to develop NGS panels to identify inherited diseases and to provide Berry's customers with solutions for research and IVD.

In February, **Twist Bioscience** and **Watchmaker Genomics** announced a broad partnership to enable research across a wide range of high-throughput sequencing applications including oncology and tumor profiling, inherited disease detection, liquid biopsy assays and minimal residual disease monitoring. In their first product, Twist Bioscience will leverage Watchmaker's expertise in enzyme engineering by incorporating the company's high-fidelity library amplification master mix into Twist's enzymatic library preparation kit, providing a solution that can be accessed from Twist as a single source.

In February, **Phase Genomics**, a supplier of proximity-ligation solutions for the genomics community, received a \$1.7 million grant from the **National Institute of Allergy and Infectious Diseases (NIAID)**. This funding will fuel the commercialization of a solution for the discovery of DNA viruses employing a novel reagent kit and software platform that leverages the firm's Hi-C technology. This method is used to assemble viral genomes from metagenomic samples and link these viruses with their microbial hosts.

In March, **Swift Biosciences**, a developer of DNA and RNA library preparation kits for NGS, and **SPT Labtech**, a provider of liquid handling solutions, announced a collaboration to leverage Swift's kits on SPT Labtech's mosquito genomics and dragonfly discovery systems.

In February, **Miroculus** completed a Series B extension, bringing total capital raised in the Series to \$45 million. Expected to launch this fall, Miroculus' Miro Canvas platform can automate complex protocols, such as NGS library prep, in a compact, cartridge-based system.

Product Introductions

In February, **SeqWell**, a provider of NGS library preparation products, introduced its plexWell Single Cell Rapid Kit for single-cell RNA sequencing. The kit adds to the Smart-seq2 method by combining cDNA synthesis and amplification, and reducing the QC and normalization burden by 75%, to achieve a single-day library prep workflow, according to the firm.

In February, **Verogen** released expanded capabilities for the National DNA Index System (NDIS)–approved MiSeq FGx Sequencing System with the commercial launch of the ForenSeq Kintelligence Kit, a solution optimized for low-input and degraded samples. The kit targets 10,230 forensically curated SNPs, alleviating genetic privacy concerns by minimizing medically informative markers. Verogen is a dedicated developer of human identification products for sequencing and analysis of forensic genomic samples.

Parse Biosciences released its Single Cell Whole Transcriptome Kit in February. The Kit, previously available only through an early access program, is now generally available in North America. The Kit contains everything needed to run a single-cell experiment with 100,000 cells across 48 samples. Through the early access program, the Kit has already been used in 50 labs.

In February, **Twist Bioscience** introduced the Twist NGS Methylation Detection System, an end-to-end sample preparation and target enrichment solution for identifying methylated regions in the human genome. The Twist NGS Methylation Detection System begins with **New England Biolabs'** Enzymatic Methyl-seq (EM-seq) for preparation of enzymatically converted libraries, and includes the Twist Methylation Enhancer, Universal Blocker and FastHyb as well as Twist NGS Custom Methylation Panels.

In February, life science consumables provider **New England Biolabs** introduced three kits based on the **ARTIC Network** protocols for multiplexed amplicon-based sequencing of viral RNA: the NEBNext ARTIC SARS-CoV-2 Library Prep Kit and NEBNext ARTIC SARS-CoV-2 FS Library Prep Kit, both for **Illumina** sequencing; and the NEBNext ARTIC SARS-CoV-2 Companion Kit for **Oxford Nanopore Technologies** sequencing. The ARTIC Network, an international consortium of researchers, has developed protocols for the epidemiological monitoring of viral genomes to provide insights into virus evolution and transmission for multiple viral outbreaks.

In March, **OmniTier** announced that its CompStor family now supports mitochondrial analysis in both its secondary and tertiary analysis appliances. CompStor Novos identifies structural variants in the nuclear genome which have been copied at some point in time from the mitochondrial genome.

OmniTier develops AI and multiomics appliances and software for bioinformaticians and clinical researchers that deliver affordable analysis solutions.

ROSALIND (formerly **OnRamp Bio**), which supplies technology to extract meaningful insights from diverse pools of life science data, released a new analysis module in March that enables web-based collaboration and the analysis and interpretation of 10x Genomics–generated single-cell data. It is built on the company’s cloud-based platform which is designed for analyzing RNA-Seq, **NanoString** nCounter, as well as other data types.

Sales & Orders of Note

In February, **Corteva Agriscience** signed a multi-year agreement with **Genestack** to implement and license the use of Omics Data Manager (ODM), Genestack’s multi-omics data catalog, curation and integrative search product.

In February, **Pacific Biosciences** announced that Labcorp increased its commitment to HiFi sequencing with the addition of new PacBio Sequel II Systems. These data are being used by the **US CDC** to track the spread of existing SARS-CoV-2 variants and detect the emergence of new variants circulating in different geographic regions. Most recently, **Labcorp** and the CDC utilized PacBio HiFi sequencing data to identify the first-known cases of infection from the B.1.351 variant in both South Carolina and Virginia.

Pacific Biosciences announced in February that **Children’s Mercy Hospital Kansas City** increased its investment in HiFi sequencing with 4 new Sequel IIe Systems to add to its existing Sequel IIe Systems. Children’s Mercy is scaling their sequencing capacity with the goal of completing Pacific Biosciences HiFi whole genome sequencing for approximately 1,000 exome-negative cases over the next 12 months.

In February, **Seven Bridges**, a bioinformatics ecosystem provider, announced it is supporting **Pfizer** in the development of a data management and collaboration solution for the biopharmaceutical company’s single-cell RNA sequencing data.

Informatics

Company Announcements

Software development firm **OnQ Software** signed a co-operation agreement in December 2020 with UK-based LIMS company **CSols Software**. The agreement will focus on creating a bidirectional integration between the CSols Links for LIMS and AqcTools software, and OnQ Software’s QLIMS system. Links for LIMS is an integration software tool that can provide a uni- or bi-directional link between analyzers or instruments of any type and LIS/LIMS systems.

In February, **Accelerated Technology Laboratories (ATL)**, a LIMS provider, signed a referral partner agreement with Germany-based application developer **Labforward**, provider of the Labfolder ELN. The agreement grants ATL the right to market and promote Labfolder products to its LIMS users. When used with a LIMS, Labfolder provides connectivity among data, instruments and users.

IDBS, a supplier of biopharmaceutical lifecycle management (BPLM) solutions, and **Scitara**, a provider of laboratory IoT, entered into a strategic partnership in February to create a combined solution that will significantly extend IDBS Polar BPLM's laboratory data connectivity and instrument integration capabilities. This solution integrates IDBS' Polar BPLM solution with Scitara's Digital Laboratory Exchange (DLX) to address the challenge of sharing and digitalizing laboratory data across the biopharmaceutical lifecycle, while ensuring data integrity and supporting insight.

In February, cheminformatics and drug discovery software firm **Optibrium** announced significant investment from **Kester Capital**. Currently, more than 150 organizations worldwide deploy Optibrium's technology in their research programs, including 5 of the top 10 global pharmaceutical companies.

In February, **Riffyn**, a provider of cloud systems for intelligent process design, announced that in 2020, for the fourth year in a row, the company doubled its annual recurring revenue and customer base. Riffyn Nexus supports digital transformation at 3 of the top 6 largest biopharma companies and 3 of the top 5 largest industrial biotech companies. Riffyn customers expanded their deployment scale 154% in 2020 while doubling its customer base.

BC Platforms, a healthcare data management, analytics and access firm, entered a collaboration with AI-driven genomics company **Genomenon**. To advance clinical genomics, Genomenon's Mastermind Genomic Search Engine will be integrated into BC Platforms' genomic analysis and interpretation platform, BC|GENOME. On the research side, Mastermind will be integrated into BC Platforms' research platform BC|INSIGHT to facilitate complex genomic research by simplifying genomic data annotations and thus enabling AI/ML applications.

In March, **Biosero** and **Celltrio** announced the integration of Biosero's Green Button Go Automation Scheduling Software with Celltrio's RoboCell Automation Platform to accelerate and integrate cell line culturing and harvesting processes, including cryogenic storage, into a highly flexible and modular end-to-end system.

L7 Informatics, a supplier of enterprise-scale digital transformation and automation of scientific processes in the life sciences and healthcare domains, closed its Series B financing round in March. The financing was supported by previous investors along with several new investors, including **Phoenix Venture Partners**.

In March, **DeepMatter**, a company focusing on digitizing chemistry, signed a co-distribution agreement with **Elemental Machines**, an organization helping biotech and pharmaceutical companies identify research problems through its sensor-based products.

Product Introductions

In January, **ENPICOM**, a bioinformatics software engineering company, announced a major release of its ImmunoGenomiX (IGX) Platform featuring the new Antibody Discovery Module (ADM). This solution will allow scientists in biopharmaceutical companies and academia, as well as service providers working in the antibody discovery field, to make the most of their Sanger and NGS data and independently perform complex analyses.

In February, **MediSapiens** released its MediSapiens Genomics Software Suite (GSS), a high-performance, cloud-based genomics back-end solution enabling genomic and clinical data integration and analytics. The solution assists in combining genomic, phenotypic and other biomedical data.

In February, **LIMS Wizards**, a scientific software solutions provider, introduced its first product. SampleVision is a customer portal that automates sample analysis and results retrieval through a mobile friendly, cloud-based solution that can be accessed anywhere, anytime, on any device. The purpose-built system gives remote sites that require outside testing a better way to send samples to the central lab.

In March, **Scitara** announced version 1.0 of its Scitara Digital Lab Exchange (DLX) SaaS cloud platform for data connectivity and automation in scientific laboratories. The system combines the benefits of modern cloud-based architecture with a vendor-neutral peer-to-peer platform with robust security, compliance, and laboratory-specific functionality.

Sales & Orders of Note

SC Laboratories announced in February that it licensed **Napro Research's** data visualization tool, PhytoFacts. Clients testing cannabis through the lab will now have access to a reporting format and algorithm that provides a visual profile of each strain's chemical makeup, such as the plant's chemical profile, proportion of terpenoids to cannabinoids, organoleptic attributes and potential entourage effects.

In March, **Dotmatics**, a scientific informatics software and services firm, entered a licensing agreement with **Compugen**, a clinical-stage drug discovery and development company focused on immuno-oncology. The multi-year agreement will provide Compugen scientists based at its R&D facility in Israel with a single information management platform.

Surface Science

Company Announcements

TESCAN, a provider of charged particle optics, 4D micro-CT and bespoke solutions, and **3D-Micromac**, a maker of laser micromachining systems, announced a collaboration in December 2020 to provide a more efficient workflow to diagnose a variety of materials and root cause defects in functional materials and devices. The collaboration involves the companies' respective plasma-focused ion beam-SEM technology and microPREP PRO using an ultra-short laser pulse ablation technique.

In January, **ZEISS** formed a research collaboration partnership with the **Max Planck Florida Institute for Neuroscience (MPFI)**. Utilizing an LSM 980 NLO next generation confocal microscope supplied by ZEISS, MPFI will investigate using implanted GRADIENT INDEX (GRIN) lenses in combination with the Airyscan 2 area detector for deep brain functional neuroscience research. Combining Airyscan with

GRIN lens technology enables increased resolution and signal-to-noise while imaging regions of the brain that are unreachable with traditional in vivo microscopy, according to MPFI.

Oxford Instruments Asylum Research announced in January that it joined the **MIT.nano Consortium**. Asylum Research is providing MIT.nano with a Jupiter XR large-sample AFM. MIT.nano has also recently acquired and installed the Cypher VRS video-rate AFM. Asylum Research will embed a visiting scientist at MIT to support research activities and to recognize the joint benefits of technical collaboration on emerging nanotechnology innovations. The MIT.nano Consortium was founded in 2019 to foster corporate partnerships. Oxford Instruments Asylum Research joins 13 other global companies as a member.

In January, **Luxel** entered into an exclusive license agreement with **Harvard University** to manufacture and commercialize GridTape for research purposes. Initially developed by connectomics researchers led by Wei-Chung Lee, PhD, at Harvard Medical School, GridTape will be a key component of Luxel's new high-volume serial section TEM imaging platform with nanometer-scale resolution. Luxel's LUXFilm is an electron-lucent film with properties which enable this application. Luxel is a producer of freestanding films ranging from five nanometers to several microns.

In January, **Leica Microsystems** partnered with **Imperial College London** in the field of optical imaging to set up a dedicated imaging hub at Imperial College, which will be equipped with advanced confocal and widefield microscopy systems. The Hub will also serve as a platform for Imperial and Leica Microsystems to maintain a close dialogue on the value of microscopy in R&D applications as well as to collaborate on joint research projects.

In March, **MBF Bioscience**, a provider of bioscience image analysis tools, completed the acquisition of **Vidrio Technologies**. Vidrio Technologies is a supplier of software and hardware components for laser scanning and two photon microscopes.

Product Introductions

In January, **AMETEK EDAX**, a supplier of x-ray microanalysis and electron diffraction instrumentation, added a fast, low-noise CMOS camera to its Velocity Electron Backscatter Diffraction (EBSD) Camera Series. The Velocity Pro offers high-speed EBSD mapping with the highest indexing performance on real-world materials, according to the company.

In January, **ZEISS** launched ZEISS Solutions Lab, a service that provides its customers with rapid access to new applications for their microscopy systems or correlative microscopy suites. Developed for agile response, a fast acting team and intelligent software toolkit are able to rapidly implement specialized solutions that enhance microscope functionality, provide specific measurement or analysis capabilities, or automate complicated workflows, unique to customer requirements. To date, solutions have been created in the fields of geoscience, mining, metallurgy, additive manufacturing and semiconductor R&D.

In February, **ZEISS** launched the ZEISS Correlative Cryo Workflow. The solution provides hardware and software optimized for the needs of correlative cryogenic workflows, from localization of

fluorescent macromolecules to high-contrast volume imaging and on-grid lamella thinning for cryo-electron tomography. ZEISS Correlative Cryo Workflow connects widefield or confocal microscopes (the ZEISS Axio Imager or ZEISS LSM 900/980 with Airyscan) and focused ion beam SEM (the ZEISS Crossbeam) to enable volume imaging and efficient production of TEM lamellae. The ZEISS microscopes involved in the workflow can be used not only for cryogenic microscopy, but also for room temperature applications.

In January, **Scientifica** announced the HoloStim-3D, a compact module that integrates with the HyperScope multiphoton imaging system, providing a turnkey, fully integrated spatial light modulator–based photostimulation solution. By shaping laser beams to generate defined light patterns, with individual points projected onto specific cells or cell structures in a biological sample, holographic photostimulation enables the active interrogation of large 3D networks. This all-optical solution enables simultaneous imaging and photostimulation of hundreds of individual cells in 3D to identify the role of neural subtypes and individual neurons in brain circuits and behavior.

ibidi introduced in January new features to its all-in-one eight-well chamber slide. The new features include extra-high, individual walls to keep cross-contamination between wells as low as possible when performing cell culture experiments.

In February, **ibidi** released the new μ -Slide I Luer 3D, a slide with 1 channel and 3 wells for 3D cell culture under flow. Due to the ibidi Polymer Coverslip on the slide's top and bottom, the cells can be imaged using high-resolution microscopy. Scientists can create a cell monolayer on the gel matrix for polarization assays or transendothelial migration studies.

In February, **TESCAN ORSAY** introduced its Nanomanipulator, a fully integrated solution that supports lift-out as well as micro- and nanoscale manipulation under both room temperature and cryo conditions on TESCAN SEM and focused ion beam–SEM instruments. TESCAN Nanomanipulator is a solution for TEM lamella lift-out, manipulation for prototyping and local charge dissipation applications that do not also require sample rotation or advanced manipulation capabilities.

Nikon Instruments launched in February the ECLIPSE Si biological microscope, featuring intelligent time saving features, an automatic shut-off mode and an ergonomic design. A new feature called Light Intensity Management (LIM) automatically records the light intensity level set for each objective. As the user switches between objectives, the previously set intensity for each objective is automatically recalled.

In February, **Oxford Instruments Asylum Research** introduced the NanoRack in situ tensile and compression sample stage accessory for the Jupiter XR AFM. The NanoRack is a high-strain, high-travel stage that enables polymer films, fibers and other materials to be examined in situ by AFM under controlled tensile or compressive loads.

JEOL USA introduced in February a new configuration of its ion beam milling instrument, the Cross-section Polisher (CP). The CP is widely used for preparing pristine samples prior to high-resolution imaging and elemental analysis with SEM. The upgraded configuration includes high-speed milling, sputter coating, cryo-preparation (down to liquid nitrogen temperature) and air-isolated transfer for atmosphere-sensitive specimens (for example, lithium batteries).

In February, **Shimadzu** released the SPM-Nanoa SPM. This high-sensitivity instrument provides high-resolution observations, features a low-noise detection optical mechanism, and automates optical adjustments and the work of setting the observation conditions, according to the firm. With the newly added Simple Mode, automation has been incorporated for all processes, from probe positioning to optical axis adjustments, sample positioning, setting of observation conditions via proprietary algorithms, and correction of the acquired images.

In March, **Thermo Fisher Scientific** debuted the Thermo Scientific Spectra Ultra (S)TEM that offers structural and chemical insight on a wide range of materials at atomic-scale resolution. To fast-track materials research and improve throughput, users can now rapidly adjust accelerating voltage with high stability. Spectra Ultra includes a new energy-dispersive x-ray analysis system, the Thermo Scientific Ultra-X, with the largest detector area available in a commercially released (S)TEM, according to the company. Combined with the new objective lens design, the EDX detector architecture makes it possible to capture x-rays twice as fast as currently available commercial solutions, according to the company.

In March, **Bruker** released the OPTIMUS 2 detector head as part of a new “Augmented On-Axis Transmission Kikuchi Diffraction (TKD)” solution in EBSD. A comprehensive package of new hardware and software expands the EBSD applications range and improves the spatial resolution when characterizing nanomaterials and nanostructures in a SEM. OPTIMUS 2 enhances Bruker’s eFlash EBSD detectors for crystal orientation mapping on electron transparent samples with even higher spatial resolution in SEMs.

Materials Testing

Company Announcements

For fiscal 2020 ending October 3, 2020, **MTS Systems’** Materials made up 30% of the company’s Test & Simulation sales (see *IBO* 12/15/20), or \$147 million. The firm reported weak sales for the business unit. Test & Simulation manufactures and sells testing and simulation solutions including hardware, software and services that are used by customers in product development to characterize a product's mechanical properties along with simulation systems for human response features. A sale of the business to **ITW** is pending (see *IBO* 2/1/21).

In December 2020, **ITW Test & Measurement**, a manufacturer of metallographic and hardness testing equipment, consumables and accessories, announced it has been working with **OMNILAB-Laborzentrum**, an independent specialist laboratory distributor. Buehler's sales, service, marketing and application teams will continue to serve existing customers in Europe from the European headquarters in Esslingen and further sites in Germany, as well as in France and the United Kingdom. OMNILAB has 140 employees.

In January, **Stanhope-Seta** announced that **ASTM D1655** Standard Specification for Aviation Turbine Fuels now includes ASTM D7236/IP 534 Test Method for Flash Point by Small Scale Closed Cup Tester

(Ramp Method) as an alternative to ASTM D93 Pinsky-Martens, ASTM D56 Tag and IP 170 Abel. The company's Setaflash Tester employs the method.

On February 1, the **National Institute of Advanced Industrial Science and Technology (AIST)** and **HORIBA** jointly established the HORIBA Institute for Particle Analysis in AIST Tsukuba (HIPAA) under the National Metrology Institute of Japan. HIPAA promotes R&D through an open innovation platform. Research activities will include development of a particle measuring system that can help in satisfying more stringent environmental regulations, and development of a system for analyzing and evaluating nanomaterial properties. A tentative staff number of 18 was announced.

In February, **Microtrac** and **OleiniTec Nordic** entered into an exclusive distribution agreement for OleiniTec to distribute the CAMSIZER product line in Sweden and Finland. This adds to the Microtrac laser diffraction, DLS and gas adsorption products OleiniTec is already distributing in the region. Oleinited Nordic is now the distributor for the Microtrac product lines in Sweden, Finland, Denmark and Norway.

In March, biotech firm Leukocare and **Malvern Panalytical** announced a collaboration to improve the availability of vaccines for COVID-19. They will combine Leukocare's expertise in biopharmaceutical formulation development with Malvern Panalytical's analytical knowhow to understand how the stability of vaccines can be improved, increasing production and simplifying distribution. Malvern Panalytical provides particle characterization systems.

Product Introductions

In January, **Grabner Instruments**, a leading manufacturer of analytical laboratory testing equipment, introduced the new MINIFLASH FPA Vision Autosampler, developed for use with any MINIFLASH FP Vision analyzer. A single autosampler can handle flashpoint measurements between -13°F and 752°F (-25°C and 400°C), and exchanging analyzers takes seconds.

In February, **Instron** released the Torsion Add-On 3.0 for universal testing systems. The redesign employs the latest functionality offered by the new Instron 6800 Series. Users of the 6800 Series testing systems can now take advantage of the integrated handset for a safer and more ergonomic operation.

Testa Analytical Solutions announced in February the new HK Series Differential Refractometer. The HK Series dn/dc Differential Refractometer is a flexible device that may be used in either static or dynamic mode. Where the dn/dc specific refractive index increment value of the sample is already known, the HK Series dn/dc differential refractometer can be used for precise and sensitive concentration determination.

Bottom Line

Reported Financial Results

\$ in Millions USD	Period	Ended	Sales	Chg.	Op. Prof.	Chg.	Net Prof.	Chg.
Bioanalytical Systems (Products)*	Q1	31-Dec	\$853.00	9.9%	\$167.00	NM	NA	NA
Brooks Automation*	Q1	31-Dec	\$249.50	18.5%	\$30.30	184.1%	\$26.03	99.3%
Brooks Automation (Life Science)*	Q1	31-Dec	\$118.00	9.3%	\$58.00	7.4%	NA	NA
IDEX (Health & Science Tech.)	Q4	31-Dec	\$235.86	3.8%	\$55.79	13.6%	NA	NA
IDEX (Health & Science Tech.)	FYE	31-Dec	\$895.96	-2.0%	\$206.36	3.1%	NA	NA
Kewaunee Scientific****	Q3	31-Jan	\$33.34	-2.6%	-\$0.38	81.9%	-\$0.10	95.0%
Maravai LifeSciences	Q4	31-Dec	\$98.35	173.5%	\$31.25	2329.6%	\$14.47	NM
Maravai LifeSciences	FYE	31-Dec	\$284.10	98.5%	\$119.90	399.8%	\$78.82	NM
Meridian Biosciences*	Q1	31-Dec	\$92.92	95.9%	\$34.66	542.6%	\$26.78	847.3%
Meridian Biosciences (Life Science)*	Q1	31-Dec	\$62.60	395.6%	\$39.80	1609.5%	NA	NA
NanoString Technologies	Q4	31-Dec	\$36.26	-1.8%	-\$3.94	NM	-\$23.00	NM
NanoString Technologies	FYE	31-Dec	\$117.32	-6.6%	-\$22.03	NM	-\$110.08	-170.5%
Olink	FYE	31-Dec	\$54.07	29.7%	-\$5.37	49.6%	-\$6.78	62.1%
Quanterix	Q4	31-Dec	\$26.13	64.2%	-\$9.93	13.5%	-\$9.82	10.4%
Quanterix	FYE	31-Dec	\$86.38	52.2%	-\$31.58	24.1%	-\$31.53	22.7%
Other Currencies								

(in Millions)								
Abcam**	H1	31-Dec	£147.50	6.7%	£15.50	-41.7%	£211.90	139.4%
Bio-Works	FYE	31-Dec	SEK 7,234.00	29.8%	-SEK 44,730.00	-6.2%	-SEK 288.00	-1957.1%
CELLINK	4 mo.	31-Dec	SEK 239,216.00	376.6%	SEK 14,161.00	NM	SEK 13,718.00	NM
CELLINK	16 mo.	31-Dec	SEK 416,009.00	167.3%	-SEK 51,927.00	-97.7%	-SEK 48,170.00	-163.0%
Genovis	Q4	31-Dec	SEK 19,850.00	54.7%	SEK 4,604.00	NM	SEK 6,347.00	NM
Genovis	FYE	31-Dec	SEK 61,030.00	0.8%	SEK 3,140.00	-68.8%	SEK 1,973.00	-79.3%
Immuno-Biological Laboratories***	Q3	31-Dec	¥414,578.00	6.3%	-¥230,684.00	22.8%	-¥303.80	9.9%
Merck KGaA	Q4	31-Dec	€ 4,598.50	5.0%	€ 611.10	18.8%	€ 435.80	37.0%
Merck KGaA (Life Sciences)	Q4	31-Dec	€ 2,029.90	13.9%	€ 451.00	37.0%	NA	NA
Merck KGaA	FYE	31-Dec	€ 17,534.00	8.6%	€ 2,985.00	40.8%	€ 1,987.20	201.1%
Merck KGaA (Life Sciences)	FYE	31-Dec	€ 7,515.00	9.5%	€ 1,599.00	24.9%	NA	NA

Notes: *For year ending Sept. 30, 2021

**For year ending June 30, 2021

***For year ending March 31, 2021

****For year ending Apr. 30, 2021

NA = Not Available

NM = Not Material

Source: Company financial reports