



Instrument Business Outlook

February 2022

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SLAS2022 Chooses a Hybrid Format

This year, the Society for Laboratory Automation and Screening's (SLAS') annual conference and exhibition was held both in person and remotely after being solely remote last year (see *IBO* 2/1/21). The onsite conference took place in Boston, Massachusetts, from February 5 to 9. The location's close proximity to a number of major lab product vendors' headquarters eliminated the need to travel and there was a healthy turnout of exhibitors. As in years past, many of the lab automation market's largest suppliers attended including Hamilton, PerkinElmer and Thermo Fisher Scientific, as well as many software and informatics firms and protein-detection system firms.

An SLAS spokesperson told *IBO*, "We are extremely pleased with the attendance at SLAS2022 in Boston. We are confident that selecting Boston as our East Coast destination was the right choice. The regional biotech community was well-represented and added a fantastic edge to our already enthusiastic audience." She continued, "This year's conference was foreseeably more US centric in terms of attendees, but we had 38 countries represented among our registrations."

Many scientific conferences have gone to a hybrid format, which SLAS' experience indicates is significantly more work for conference organizers. "Conducting a hybrid conference such as this one is really like producing two conferences at the same time. There are myriad details to juggle to ensure that the online audience gets a valuable experience, while also keeping the in-person audience informed, safe and engaged. Our program committee and program chairs did an outstanding job putting together this program and finding speakers who were willing and able to present in-person as well as virtually depending on their individual circumstances."

IBO covered the show virtually. Presentations were available on-demand within 24 hours and featured excellent sound and picture quality. SLAS2023 will be held February 26–March 1 in San Diego, California.

SLAS2022 Participants

5,200 registrants with approximately 9% of those being virtual attendees.

317 exhibitors including the 17 in Innovation AveNEW for startups, plus 23 digital only companies

38 countries represented

885 first-time attendees

65% of our attendees were sharing their data with exhibitors via our event platform

Source: SLAS

Presentations

In a panel discussion entitled “AI in the Labs of Now and the Future,” moderated by Brian O’Sullivan, Senior Vice President Commercial of HighRes Biosolutions, panel participants discussed scientists’ barriers to entry for using AI, AI’s enablement of “scientists to do science” and predictions for how AI will be used in the lab in the future. A repeated theme of the discussion was AI’s “brittleness.” (Describing this concept, security expert M.L. Cummins has observed, “Brittleness occurs when any algorithm cannot generalize or adapt to conditions outside a narrow set of assumptions.”)

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Discussing barriers to entry, the panelists stressed the need for researchers trained in both AI and science. In addition, Josh Kangas, PhD, Assistant Teaching Professor at Carnegie Mellon University in Pennsylvania, commented, “They also need to understand the ways in which the choices they make during the experimentation affect the analysis they do in AI.” Panelists all agreed that for scientists using AI a scientific background must be combined with computer science training.

Daniel R. Rines, PhD, Senior Director, R&D Strategy at Strateos, a company providing an automated cloud R&D platform for remote experiments, noted the importance of bringing teams of bench scientists and information scientists together within an organization to work collaboratively. This led to a wider discussion of information gaps. Toby Blackburn, Head

of Business Development and Strategy at Emerald Cloud Lab, offering user-controlled remote experiments, commented, “Even getting to the point where we have enough context for the experimental conditions that generated any given experiment is a huge gap today,” adding that one needs, “The full definition of an experiment before moving onto the next step.”

One barrier to entry addressed was legacy computer systems. Here, Dr. Kangas observed, “My perspective right now is that a lot of AI takes some hacking to make it work, but it’s still doable at this point.” Charles Fracchia, CEO of BioBright, which provides laboratory software, pointed out that his company is making data portable and providing defined interfaces, and noted an important transition is taking place. “Biology, in particular, is becoming a more data-driven science. It used to be much more process driven by necessity. We used to have more control over the process, so that we could trust the output... You may not be able to trust your results of your AI if you cannot trust those individual steps.” This is new to scientists in many cases. He stressed, “[Scientists] need to know that the method is sound and what are the limits of a particular network? How well does the learning transfer; for example, one test to another or even dataset to another?” Similarly, Dr. Rines commented on the challenge of reproducible data and data that can be trusted by scientists.

On the topic of enabling scientists to do science, the panel reflected on the use of AI to determine what experiments will be done. Dr. Kangas noted that active machine learning (ML) methods can serve this purpose but emphasized, “You have to then integrate in a closed loop the AI that you’re running, the model building that you do and the robotics to run the experimentation.” If this process becomes widely used, then, observed Mr. Fracchia, the focus will move to the decision algorithm used for choosing next experiment.

The subject of cyber security was also raised, especially in the context of national interests. As Mr. Fracchia stated, “Machine learning is a particularly attractive target because it is very difficult to deconvolve exactly how a decision was made... We have to think adversarially about what we’re building.” He is involved in improving cybersecurity as a cofounder of BIOISAC (Bioeconomy ??Information Sharing and Analysis Center), an organization addressing security issues that could affect the bioeconomy.

Sharing of data was also a topic of interest. Panelists seemed to agree that using AI in science would benefit from widespread sharing of negative experimental results. For example, a journal could be devoted to publishing negative results, thus reducing duplicating experiments and methods.

In a talk entitled, “Bringing Biomarkers from Discovery to Clinical Impact” David R. Walt, PhD, Core Faculty Member of the Wyss Institute at Harvard University, the Hansjörg Wyss Professor of Bioinspired Engineering at Harvard Medical School and Professor of Pathology at Harvard Medical School and Brigham and Women's Hospital, proposed a new model for matching technology to clinical need. Describing his experiences with Illumina and Quanterix, two companies for which he was a co-founder, he reviewed the timeline it took for these research technologies to move from research to impacting patient treatment.

Although Illumina was founded in 1998, he recounted how the first clinical application was not until 2013. Quanterix faced a similar but shorter lag, Quanterix’s SiMoA (single molecule array) did not have its first real clinical applications until 2021, four years after the company’s founding and many years after Dr. Walt’s lab began work on the technology in the mid-2000s. Dr. Walt declared, “[T]he clinical application is not front and center at the beginning of these companies. And, in fact, it's very difficult for companies once they start making revenues in life sciences tools to pivot to a clinical type of company.”

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Dr. Walt has advocated for a different approach to the question, “How do we accelerate the development of technologies and purposefully apply them to diagnostics?” He has proposed a model that starts with identifying the clinical need, and the biomarkers for it, then finding the analytical specifications of the sensitivity and specificity need, and finally finding a technology to meet these specs or inventing it. Consequently, scientists and clinicians collaborate early on to evaluate the potential clinical utilization of the technology, such as identifying a suitably sized market, and may eventually establish a diagnostic company. “I propose to you today a new model, where first we start with the clinical need for a model; let's not think about the technology before we first identify the clinical need,” he stated.

The Wyss Diagnostics Accelerator, launched by the Wyss Institute of Biologically Inspired Engineering at Harvard University and Brigham and Women Hospital, is an example of this approach. Dr. Walt serves as the Program Lead of the Accelerator. The process starts with clinicians at Brigham and Women Hospital identifying unmet clinical needs. “We have a biomarker discovery facility at the Wyss, and we have a CLIA lab where we can test this technology out and work with our collaborating clinicians who have identified their unmet

need,” he said. According to the Accelerator’s webpage, its commercial partners are bioMérieux, Charm Sciences and Singular Computing.

New Products

At the show was **Agilent Technologies’** latest live-cell metabolism analyzer, the Seahorse XF Prof Analyzer. The new instrument is designed to fit into standard biopharma workflows, featuring a streamlined workflow and improved automation and ease of use. Applications range from drug discovery through bioprocess validation and address areas such as immunotherapy and cell and gene therapy. It replaces the existing Seahorse XFe96 Analyzer. Units begin shipping this month.

The new instrument features a lower limit of detection enabled by the ability to measure cell types with lower baseline oxygen consumption rates (such as naive or exhausted T cells) for functional analytical screening. New features also include automation allowing use of a gripper arm for automation of multiple steps.

The system features a complete end-to-end workflow, including kits, reagents, assays and cloud-based analysis tools. Among the new aftermarket offerings are Agilent’s first chemistry-based (nonbio) QC standard and designed to address edge well effects of plates. The available kits are: the T Cell Metabolic Profiling Kit, Real-Time ATP Rate Assay Kit, Cell Mito Stress Test Kit, Substrate Oxidation Test Kit, Glycolytic Rate Assay Kit, T Cell Activation Assay Kit, and the Mito Tox Assay kit, which will be released in April.

The new system also allows for connected workflow. A single UI can connect the XF Pro and the Cytation 1 Cell Imaging Multi-Mode Reader from BioTek Instruments, an Agilent company, providing cell function and morphology data as well as imaging from the same sample using a single user interface. The system began shipping this month.

BMG LABTECH introduced the VANTAstar multimode microplate reader at SLAS2022. The VANTAstar is a compact multi-mode microplate reader and is equipped with three features that enable an easier detection setup and improve data quality, according to the company, Enhanced Dynamic Range (EDR) technology, rapid full-plate auto-focus and automatic luminescence crosstalk reduction. These features allow for rapid auto-focus, automatic sensitivity settings and larger dynamic range. This flexible microplate reader is compatible with all plate formats up to 384 wells and sensitive detection of <10 cells/well

using a luminescence-based cell viability assay. The microplate reader comes with multiuser smart control and MARS data analysis software and is equipped with dual LV Monochromators system, filters and UV/Vis spectrometer. Also, the instrument is upgradable to include additional detection modes, reagent injectors and extended temperature control.

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At the show, **Corning Life Science** launched the semi-automated Matribot bioprinter for dispensing and printing Corning hydrogels, including Corning Matrigel Matrix and Collagen, in the lab rather than ordering the matrix gel directly and manually process it in the lab. Bioinks can also be printed. According to Kim Titus, Director of Global Business Operations for Corning Life Science, unlike other bioprinters, the Matribot features built in temperature control via a cooled printhead to maintain a cold temperature that some materials require, eliminating the need for a compressor or cooling equipment. It can also print at ambient temperature. It is designed to print layered geometries. Ms. Titus said the system is designed to meet the needs of labs that are working with multiple cell types to create mini-organs and are researching cell size, shape and structure and their interactions. It provides flexibility and an accessible price point, they emphasized. Corning also announced the Lambda EliteMax Semi-automated Benchtop Pipettor, which begins shipping next month. It is the company's first semi-automated pipettor, expanding beyond handheld pipettors, and is designed to be affordable. Among its performance features are plate filings from reagent reservoirs, serial dilutions and plate-to-plate transfers.

UK-based **Refeyn** announced the launch of its new TwoMP Auto Mass photometer in Solutions Spotlight presentation at SLAS2022. The instrument combines the ease and efficiency of automation with the unmatched sensitivity and simplicity of Refeyn's molecular mass measurement technology, according to the company. The TwoMP Auto Mass measures the mass of individual molecules directly in solution. Applications of the technology range from purity assessments to interaction analysis. It also enables rapid measurement of multiple samples with low sample consumption. A compatible liquid handling robot can autonomously analyze 14 samples in one hour.

Also at the show, **SPT Labtech** launched its first liquid handling platform for NGS library preparation, the firefly. According to Paul Lomax SPT Labtech Genomics Product

Manager, the system is unique in combining air displacement pipetting and noncontact dispensing in a one platform. The firefly consists of a 384-pipetting module with a volume range of 0.5 uL to 125 uL, and an option for pipetting up to 500 uL. Three or six dispense heads are available for dispensing volumes of 200 nL to 2 mL. The software is designed for ease of use with an approachable UI. In addition, protocols can be easily shared using a cloud-based network. The system is designed for flexibility for users ranging from core labs to those new to automation.

A vertical multi-deck configuration can fit accessories, such as a shaker and incubator, and features a gripper to move labware. The compact footprint measures 26 x 31 in. (660 x 780 mm) with a depth of 22 in. (560 mm). Currently validated for the platform are New England Biolabs' NEBNext Ultra II DNA; NEBNext Ultra II FS DNA; NEBNext Ultra II RNA, and Illumina DNA Prep kits. Orders are now being taken and the system is expected to start shipping this summer.

Vendor Presentations

To address the bottlenecks caused by traditional 3D culture methods in organoid research, R. Allysa Stern, PhD, Product Applications Scientist at **Cell Microsystems**, gave a presentation entitled “The CellRaft AIR System: A Novel System Enabling Organoid Imaging, Identification and Isolation.” Organoids are self-organizing 3D cell culture models that are derived from stem cells isolated from a variety of tissues and species. Their ability to closely replicate the pathophysiology of their original organs, provides opportunity for use in medical research, pharmaceutical development and toxicological studies. However traditional organoid culture models are labor intensive making them low throughput and possess heterogeneity and variability within and between the experiments. As Dr. Stern mentioned, “These structures are stuck in viscous extracellular matrix making it impossible to retrieve single intact 3D structures”.

The three key components of the CellRaft AIR system, according to Dr. Stern, is the ability to image, identify and isolate cells of interest. The CellRaft AIR system contains 3D Cytosort Arrays. Individual organoids on a 3D CytoSort Array can be tracked and imaged using brightfield and fluorescence microscope with 10x objective and 20x resolution.

Dr. Stern said the Cytosort array overcomes two challenges of traditional organoid methods by allowing you to “grow hundreds of segregated organoids per array.” Identification of

organoids is done by Raft cytometry software. Isolation of organoids is done by CellRaft, a microscale growth surface housed inside the Cytosort array. The organoids attached to the CellRaft are automatically transferred to 96-well plates for downstream analysis. Single organoids of interest, with sizes ranging from small (< 250 µm) to large (500 µm–1 mm) in diameter, can be subsequently released and isolated from the array into standard 96-well tissue culture plates. Dr Stern stated the efficiency of CellRaft collection and release as 96.4% and 90.3%, respectively.

Presenting a case study, Dr. Stern explained the application of CellRaft AIR system in drug and toxicity screening. She used Raft Cytometry software to identify and isolate two distinct populations of mouse hepatic organoids. The first plate isolated had organoid size of 50 µm and up, while a second plate held narrower sizes of 300–500 µm. Each plate was treated and tested for toxicity. Dr. Stern explained the variations of size in the first plate led to inconsistency whereas the second plate where the organoids' size range was identified and isolated using the AIR 3D system, leading to assay consistency and sensitivity.

Dr. Stern also mentioned the various applications of AIR 3D in clonal organoid development, transcriptomics and iPSC-derived organoids. Dr. Stern concluded, “Advanced cell culture requires advanced tools and AIR 3D is the one instrument solution for advancing organoid applications.”

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“Maximizing Multi-omic Insights with Single-Cell High-Throughput (HT) Gene Expression” was the title of a presentation given by Funien Tsai, PhD, Scientist at **10x Genomics**. Combinatorial drug treatment has been proposed as a strategy to overcome rare resistant clones. However, the number of possible combinations of compounds make it challenging to find suitable combinations with current limitations of single-cell gene expression assay. Dr. Tsai talked about how HT single-cell gene expression and multi-omic analysis coupled with cell multiplexing enables high-throughput screening of multiple combinatorial conditions.

Dr. Tsai discussed 10x Genomics' newly updated Chromium X platform, calling it is a one-stop shop for all single-cell assays. The Chromium X platform the standard assays with

vastly increased throughput. This increased throughput was achieved by redesigning the HT chips, which can now recover up to 16 sample inputs, up from 8 in the previous version.

Dr. Tsai explained there are applications across a breath of research areas enabled by the HT single cell studies. “From deep immune repertoire analysis across different patient cohorts to highly scaled single-cell CRISPR screens,” he said.

In the case study presented by Dr. Tsai, non-small cell lung cancer (NSCLC) cell lines were used to demonstrate the HT capabilities of Chromium X. 192 samples, or ~960,000 cells, on a single microfluidic chip were analyzed using the Chromium single-cell gene expression HT assay. UMAP (uniform manifold approximation and projection for dimension reduction) projection of all of the treatment and time point conditions showed that H1975 cells, bearing an EGFR mutation, are more responsive to combinatorial drug treatment than A549 cells bearing a KRAS mutation. Thus, single-cell analysis enabled deeper understanding of combinatorial drug treatments’ impact on different cell lines and that the pathway analysis is more statistically significant in HT assay versus the standard assay.