Case Study

Lab automation

The APAS Independence instrument: Ticking all the boxes for accurate, practical, time-saving microbiology automation

Rising workloads and increasing staffing pressures mean microbiology laboratories all over the world are facing a double threat to capacity.

It's a challenge that automation can help overcome, but new artificial intelligence-based technologies are proving to be the real game-changer for busy, resource-challenged microbiology laboratories.

The Clever Culture Systems Automated Plate Assessment System (APAS®) Independence instrument utilizes a proprietary AI machine learning algorithm to quickly and accurately remove negative culture plates from workflows, helping microbiologists to streamline routine processes and maximize the value of their daily work.

The standalone system is the size of a typical workbench, its workflow is easy to use and to integrate with existing processes, and, by virtue of requiring no ancillary equipment such as robotics or incubators, is relatively inexpensive. In fact, because it requires a significantly lower threshold in terms of space, capital and time than typical total laboratory automation (TLA) systems, the APAS Independence can help laboratories economically build on an existing or planned investment.

But don't just take our word for it. New York State's Albany Medical Center microbiology laboratory recently adopted the APAS Independence instrument as part of a drive to meet an anticipated 40% increase in urine cultures. In doing so, they have cut the number of plates requiring hands-on reading and interpretation by a third and reduced the turnaround time for negative samples by two hours per test.

Here, Mary George, Ph.D., D. (ABMM), and the director of Albany's microbiology lab, explains how the APAS Independence instrument met every one of the team's needs, from accuracy and budgetary, to ease of use and implementation.

A familiar challenge

Dr. George's full-service laboratory, which serves a 766-bed tertiary care hospital, level one adult and pediatric trauma centers, and numerous outpatient sites, is expecting its annual number of urine samples to rise from 25,000 to 35,000 over the next year. This increase, she explained, is set to the backdrop of post-pandemic financial restraints and high local competition for skilled technologists.

"The bottom line is we have a very restricted budget and very decreased staffing," she said, adding that while the laboratory processes urine samples during two shifts Monday to Friday, it only has sufficient staff to do so during one shift on weekends and during holidays. The anticipated 40% increase in samples, then, has raised the question of how they will meet the demand.

Automation is the obvious answer, but selecting the right approach was less clear cut. "Microbiology has a lot of automation options, but there were still a lot of questions we needed to ask," said Dr. George.

Defining needs

The Albany team had several important considerations. Of course, accuracy was top of the list, but cost was also a major factor. "Our budget is very restricted, and many of the available instruments have a lot of ancillary equipment. Things like robotics to plate the specimen and attached incubators make the system more expensive," Dr. George explained.

They also wanted a solution that was easy to use, to minimize training time and help technologists to make the transition, and allow for further efficiencies later on. "Our thinking was, if a system was easy enough to use, we could potentially use non-clinical staff to help with improving the workflow," said Dr. George, adding that the team did not want to disrupt their existing, optimized workflow. "The other question we had to consider was where we would put the system," she went on, explaining that the laboratory, like many others, was "really cramped".

"The only system that checked off all these boxes was the APAS Independence instrument," said Dr. George.

What is the APAS Independence instrument?

Distributed exclusively in the U.S. and Europe by Thermo Fisher Scientific, the APAS Independence instrument uses image recognition machine learning (ML) to screen urine cultures and direct targeted laboratory work-up.

It is an automated, FDA-cleared solution for the reading and interpretation of culture media plates, able to automatically sort them into three categories: negative (no significant growth), positive (significant growth), and those needing further review by a microbiologist. Crucially, it can automatically remove negative culture plates from the workflow and log them in the laboratory management system (LMS), without the need for technologist intervention. This frees up skilled staff to concentrate on what they have been trained to do – interpreting positive samples.

As a standalone system, there are no robotics or incubators attached, making it "substantially less expensive" than other automation options, said Dr. George. With a footprint of just 78.74" x 31.52", it is the size of a typical workbench, and no assembly or laboratory alterations are required. All the team had to do, she went on, was "roll a bench out, then roll the system in and plug it in".

She also remarked on the system's ease of use, highlighting that training took a maximum of one day, and that there was potential to teach non-clinical staff how to load and unload the machine, thereby freeing up even more technologist time.

In addition, because the APAS Independence instrument deals solely with plate reading and interpretation, it fit seamlessly into the laboratory's preexisting workflow.

Evaluation

To evaluate the system, the Albany team manually inoculated 1,028 blood and MacConkey agar plates with 1µL of urine. The plates were then loaded into APAS carriers and incubated, before being transferred to the system at designated time intervals, according to the existing workflow, at least 18 hours later.

The APAS Independence instrument sorted the plates into no growth (n=157), and those with 103 CFU/mL (n=193), 104 CFU/mL (n=238), and ≥105 CFU/mL (n=427). In 13 samples, the system was unable to enumerate due to swarming Proteus.

The samples were then reviewed by laboratory technologists who had been blinded to the automated results.

"APAS accurately identified 98.1% of the negative cultures, when 'no growth' and 'doubtful' plate designations were considered a negative test, and 'review' and 'probable' classifications were considered a positive test," said Dr. George.

Ten cultures were read as a negative by APAS, but as a positive test by laboratory staff. However, on closer examination of the microorganisms involved, which included Gardnerella vaginalis and Candida glabrata, the team found that they were "unfairly comparing APAS to manual results". The automated interpretation was taking place on day one, whereas the human reads occurred later, after further incubation, explained Dr. George. She added that such organisms only tended to be significant in patients with complicated urinary tract infections (UTI), who usually provided urine samples via invasive or sterile means.

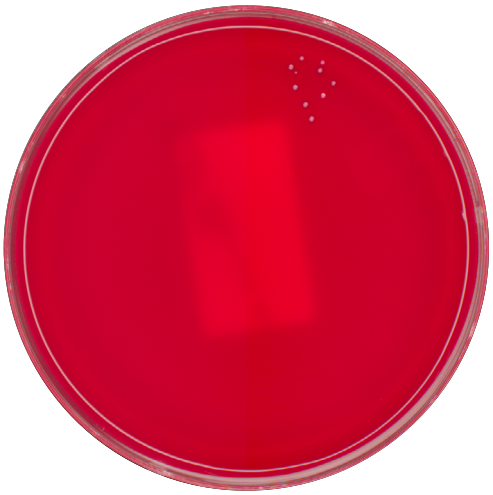
Establishing a workflow

Based on all the data collected and the review of the discrepancies, the laboratory has built an APAS reporting workflow that classifies samples with ≥105 CFU/mL as positive and passes them to a technologist for review. Those with <104 CFU/mL are classified as negative, auto-verified, recorded in the LMS, and removed from the workflow.

Overall, positive samples account for 67% of the workload, and negative for 33%. “The negatives are completely removed from the workflow,” Dr. George said. “The technologist never has to handle them or take any kind of intervention to send out those culture results.” The APAS Independence instrument, she went on, can process a negative sample in 17 seconds, compared to the 13 to 26 seconds it typically took a technologist.

In accordance with the discrepancy review results, straight catheter urines are flagged by the system as needing to be reviewed and re-incubated if negative on day one. In addition, those plated with 10µL of urine, for example those obtained via cystoscopy or suprapubic aspirate, are incubated separately from APAS samples. If they are accidentally loaded into the system, it automatically marks them for review.

During the first phase of implementation, the team experienced a two-hour reduction in the average negative test turnaround time. “Negative cultures are just as important to physicians as positive cultures, and if we can get them out earlier, we can make a big difference,” said Dr. George. This, combined with the significant reduction in hands-on time required for negative sample screening, implies that positive test turnaround times will also be faster. “That is the next monitoring project we will be working on.”



Ticking all the boxes

Dr. George said the APAS Independence instrument accurately identifies cultures with non-significant growth, removing them from the manual reporting and reading workflow. “This allows our technical staff to focus their time on significant cultures – which is where their expertise lies,” she added.

“Because it does not include the robotics or an incubator, the cost was substantially lower than some of the other forms of automation available, making it much more budget-friendly for our facility. It was an easy installation in our limited space, and training was simple.”

What’s more, it adapted to established laboratory workflows, making it easier for staff to accept as a productivity-boosting tool, and its integration with the LMS was critical in allowing for the auto-verification of negative samples, Dr. George concluded.

To learn more about the APAS Independence instrument, visit **thermofisher.com/apas**