# MICROBIOLOGY REVOLUTIONS

## Advancements in automated and rapid technology are explored By Theresa Castellone, MPH, MT(ASCP)

It was not until 1991 with the invention of the first continuous monitoring blood culture system by Biomérieux (BacT/Alert) that automated instrumentation found a place in microbiology. For the first time, an instrument was able to examine blood culture bottles completely independent of a technologist. While an explosion of instrumentation did not occur, slowly, new instruments found a place in the day-to-day workflow. These pieces of equipment provided advanced, rapid antibiotic sensitivity results, expanded databases for better phenotypic identification, automated platforms to diminish repetitive motions by technologists, and ultimately decreased overall tech time.

### A Revolution

Now the microbiology lab is experiencing a great revolution in regards to technology. New technology is bringing a level of automation to the lab that has never been experienced before and decreased turnaround times doctors dream about.

But what is behind the sudden urge to bring automation to a laboratory that has for so long successfully survived without it? Many laboratories stand on the precipice of a large retirement boom, continuously increasing workloads and decreasing numbers of new, skilled microbiologists graduating from accredited programs. Combining all of these factors together creates the need for an immediate solution.

Enter automation in the preanalytical area of microbiology laboratories. Automation allows laboratories to re-assign valuable technologists to areas of the lab where they can better utilize their interpretational talent and focus on resulting high value work. Instruments can automatically process specimens, bringing standardization to streaking, streamlining workflow, allowing better specimen traceability, and improving overall productivity. More advanced systems can bring plates directly to incubators, view and monitor plates via digital imaging, and utilize preferred identification and susceptibility methods of the lab.

**TABLE: INSTRUMENT CHARACTERISTICS**

| | WASP | Previ-Isola |
|---|---|---|
| Company (country) | Copan (Italy) | BioMerieux (France) |
| Inoculation device | Calibrated loop | Combs |
| Type of inoculation | Four quadrants, single streaking, bi-plate, etc. | Circular inoculation (semicircular for bi-plate) |
| Use of dispensable devices | Re-usable metal loops | Disposable combs and disposable pipette tips |
| Agar plate loading capacity | Nine silos ( 350 agar plates) | Five silos (270 agar plates) |
| Sample loading capacity | 72 e-swab tubes | 114 samples |
| Productivity (plates/h) | 180 plates/h | 180 plates/h |
| Decapping/recapping | Automated | Manual |
| Agitation/centrifugation | Automated agitation and centrifugation, per specimen | No automated agitation/ centrifugation |

Data from Automation in clinical bacteriology: what system to choose? Clin Microbiol Infect 2011; 17: 655–660 Available here: http://onlinelibrary.wiley.com/doi/10.1111/j.1469-0691.2011.03513.x/full

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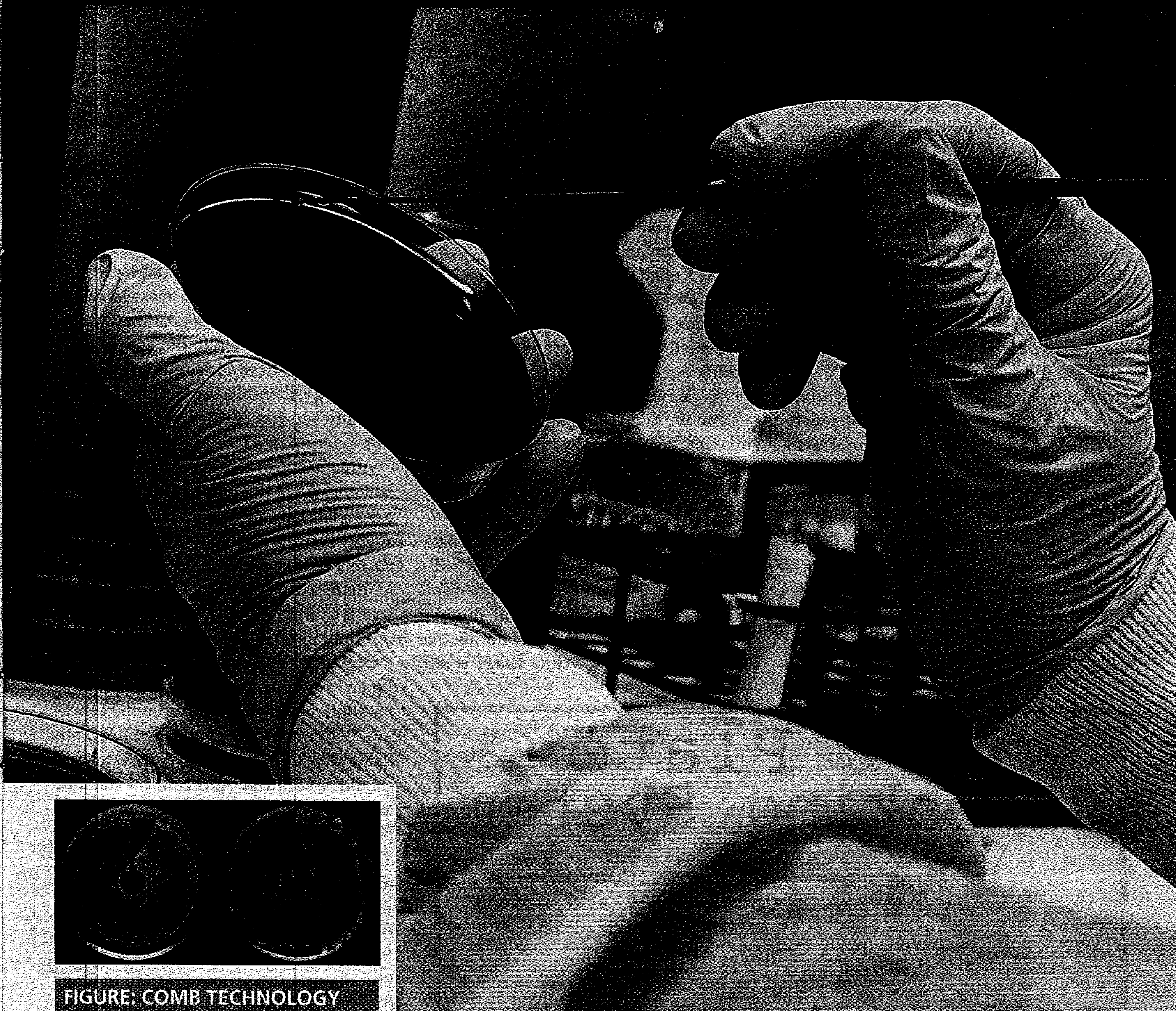

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FIGURE: COMB TECHNOLOGY

## Automatic Specimen Processor

In 2008, Copan introduced the WASP (Walk Away Specimen Processor) as the new way to automate plating and streaking of all microbiology specimens. In 2010, the next-generation WASP became the first instrument to allow laboratory personnel to load all samples onto a conveyor, then walk away while the machine scans the tubes and processes the specimens entirely, ultimately sending them out on an exit conveyor with the plates ready to incubate, says Copan executive vice president, Norman Sharples. Copan advertises the WASP as having a throughput equivalent to two or three full-time people.[1] The company was able to address the issue of the many different types of specimens that come to the microbiology lab by developing the Copan ESwab. The ESwab is a liquid based collection system that allows swabs to be utilized in an automatic plating instrument. This makes the WASP the first instrument of its kind to use a single universal platform to automatically process bacteriology specimens, including swabs, urine, feces or any liquid sample, regardless of the specimen's container style or specimen type.[2]

**New technologies allow for the identification of organisms in minutes rather than hours.**

A second option is bioMérieux's Previ Isola instrument. The Isola features an output of 180 plates per hour and advanced robotics to inoculate, streak and label specimens. A comb is used to inoculate media, ▶

assuring the customer that comb technology inoculates the maximum agar surface, that optimum pressure-controlled contact with the agar is maintained and that a standard quantity of inoculum is used every time.[1] The comb technology is a change to the traditional four quadrant streaking that most technologists are trained on; isolated colonies are consistently observed, allowing for more efficient culture workup and less time spent re-isolating poorly manually streaked plates (Figure).

Additional benefits to installing front-end automation include reducing repetitive stress and fatigue to technologists by eliminating the need to open, sample and close specimen containers. Barcodes and direct connection to the hospital's LIS allows specimens to be loaded directly into the specimen processor. An accurate time of receipt and inoculation is obtained, removing the significant lag time between when a specimen comes into the lab and when it is actually processed. This, in turn, allows a technologist to determine a true incubation time.

Automation for the front-end processing area will continue to grow rapidly. Planting and streaking instrumentation was just the first step; automation will move well beyond these two methods. Diagnostics companies such as Copan and bioMérieux as well as Becton Dickinson and Netherlands-based Kiestra are in the process of creating full lab automation set ups. These companies are offering solutions that fully automate the microbiology lab, using conveyors to continuously move samples from the planting and streaking area to automatic incubation to remote image analysis and digital workup.[3]

### Mass Spectometry

Rapid identification methods for bacterial and fungal organisms have reached a new peak with the creation of instruments that can identify organisms in minutes compared to traditional biochemicals that can take 6-48 hours. While usage is still research use only, Matrix-Assisted Laser Desorption Ionization – Time-of-Flight Mass Spectrometry (MALDI-TOF MS) is being analyzed to see how the technology can impact workflow.

MALDI-TOF MS is a technique used to simultaneously screen a multitude of molecules and determine their identity by analyzing their individual mass-to-charge ratio. These molecular "signatures" can be used for rapid bacterial and fungal identification (ID) from isolated colonies.[4] The technology identifies organisms in small quantity and from growth seen in an overnight culture.

Advantages to this method include the ability to make this instrumentation part of a complete lab automation set up or to more simply connect the technology to the lab's current ID and susceptibility machine. BioMérieux is developing integrated workflow solutions with its VITEK 2 range to ensure optimal user convenience, full sample traceability and quality of results.[4] Setting up an organism for identification requires no dilution and can be done on the benchtop. With minimal tech time required, utilizing this technology into daily workflow should be seamless. As organisms continue to morph into new species and increase in pathogenicity, MALDI-TOF mass spectrometry will provide a rapid and advanced methodology in identification.

### Making the Move Toward Automation

Big changes are coming as laboratories (both large and small) begin their move toward automation. Increased accuracy, more consistent quality, and reduced turnaround times to clinicians dramatically improve patient care. The technology available will allow for a smoother workflow, decreased cost and superior results for the patients behind each specimen. ■

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