Total Lab Automation in Microbiology:
Much Closer than You Might Think
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Specimen Processing of Yesterday

Microbiology Yesterday

Manual Microbiology

Trends to Automation?
- The Industry is Changing
  - Specimens increasing on average 10-15% per year
  - Laboratory consolidation
  - Reimbursement
- Workforce
  - Fewer students choose Medical Technology: reduction of 30-50%
  - Pay for technologists is substandard
- Quality
  - Physicians are demanding more services, in less time
  - Traceability
Requirements for Automation

• Automation / mechanization:
  – Flexible solutions
  – Open architecture
  – Expandable
• Embrace the human element
  – Use technologist knowledge for highly complex tasks
  – Selecting colonies for further work-up
  – Increase safety
• Embrace specimen diversity
  – Many specimens can be completely automated, others cannot
  – Standardize processing

Today…

Microbiology Processing Instruments

• BD Innova
• bM Previ
• Copan WASP

• Thanks to BD, bM, and Copan for providing pictures/slides

BD Innova

• Fresh plates loaded into input carousel (6 stacks)
• Different agar can be loaded into each stack or all stacks can hold same type of agar
• Streaked plates are ejected into output carousel (5 stacks)
• Plates can be organized in output stacks by ‘groups’ so that no sorting is required after streaking
• Each stack holds up to 45 plates
• Input carousel capacity = 270 plates
• Can accommodate bi-plates
• Reusable ni-chrome loops
  1, 10, 30 µL sizes

bioMerieux Previ

The Previ™ Isola:

• Inoculates
• Streaks
• Labels
bioMerieux Previ

- Throughput: 180 plates/hour
- Standardized result that is not user dependent
- Increased number of isolated colonies per plate
- Assurance of quality – new applicator used for each plate
- Plates labeled and sorted by environment
- HEPA filter manages instrument exhaust for added safety and security
- Not limited to batched sampling; can manage varying specimen types at one time

Copan WASP

- Universal decapper and docking station
- Sort out stacker
- Side Labeler

Evolution of the WASP

- Automatic loop changer
- Double-loops for faster streaking of bi-plates
- Improved image analysis
- Loop cleaner
• Broth inoculation, subculture, and labeling
• Advanced air purification system
• Slide-preparation module
• All electric

Factors to Consider When Selecting A Specimen Processor for Your Lab
• Reliability
• Accuracy
• Capacity
• Technical support
• Flexibility
  – Specimen types; loops; protocols; media options; LIS issues
• Modularity
• Cost-initial, any required disposables, and operational labor


...and Tomorrow...

The Future will Include:
• Automation
• Liquid Based Microbiology (LBM)
• Digital microbiology

The Players
• bioMerieux
• Copan
• Kiestra (BD)

“The 3 Solutions”
The Kiestra Solution

- Work-cell Automation
  - Sorting and coding of plates
  - Set-up of plates
  - Transport of plates
  - Incubation
  - Plate Imaging
  - Reading Plates
  - MALDI spotting/Identification
  - Susceptibility testing
- Total Lab Automation
  - Assemble all components onto a single, continuous platform

InoqulA

- Strengths
  - Fast, approximately 500 inoculations per hour
  - No consumables required
  - Flexible
    - Inoculates: plates, slides, broths
- Unique
  - Can be implemented as:
    - Work cell automation
    - Full lab automation
  - Uses magnetic bead to inoculate plates

Consistent Plating

InoqulA - up to 4 times more isolated colonies vs. manual streaking (bead technology)
**Automating Identification**

- **Biochemical Identifications**
  - Lack of standardization between manufacturers makes automated set-up difficult

- **Mass Spectrometry**
  - Standardized to two manufacturers and one matrix
  - Need for traceability
  - Remove subjectivity from identification
  - Reduce the need for subculturing
  - Decrease laboratory turn-around
    - Results available within 5-10 minutes using direct smear method

**Multi Imaging by ReadA Technology**

**Maldi-Tofa**
The Copan Solution

- What is it?
  - A barcode driven and conveyor-connected specimen processing system.
- What does it do?
  - It utilizes robotic plate management to automate specimen workup in microbiology.
- What are the implications for our labs of the use of a system such as this?
  - It could revolutionize the way that clinical microbiology is performed.

Copan WASP

Prototype Instrument
Robotic Incubation

- Upon completion of planting and streaking by WASP, plates travel by conveyor to the appropriate incubator designated by the bar code.
- Plates are scanned using photographic image analysis and loaded into the incubator.
- Protocol determines plate incubation time and number of scans.
- Culture images are stored in the patient specimen record file.

Robotic Incubation and Storage

- Double incubator - storage capacity of 1,400 to 2,044 plates
- Barcode reading and auto indexing
- Robotic loading and unloading
- Random access to plates
- Automatic inversion of the plate prior to incubation
- Imaging capability whenever requested or scheduled
- Variable incubation time as desired
- Conveyor track connection
- Works with all media manufacturers

Plate Image Analysis

- Plates are scanned using photographic image analysis and loaded into the incubator
- After incubation, plates are removed individually and scanned for growth
- Image analysis software compares before and after growth alerting lab staff to positive growth results.
- WASPLab™ software may be set to conduct multiple plate scans during incubation enabling early detection and reporting of positive growth

Digital Colony Targeting for Additional Workup

- X / Y / Z coordinates

Plate Image Analysis: Topography
Plate Image Analysis: Topography

MALDI-Prep

The bioMerieux Solution

Plate Management

How will this technology change microbiology?

- Quality of microbiology results
- Turn around times
- Quality of patient care
- Impact on the laboratory workforce and the “working day”

The bioMerieux Solution

- PREVI Isola
  - Maximizes bacteria colony isolation
  - Standardizes plate streaking
  - Streamlines laboratory workflow
**Smart Incubator System**

**Smart Incubator System**
- Modular & Flexible
- Quality of Imaging
- Cost efficient solution

**Smart Incubator System**
- Incubation Chamber + Plate Imager
  - Automatically manage the incubation of plates (up to 1000 plates within O_2 or CO_2)
  - Integrating technologies in optics to provide the best image quality according to the most appropriate light conditions.
- User Interface
  - Myla will monitor and pilot the Smart Incubator System remotely.
- Dispatcher
  - To manage the transportation of the plates around incubation chambers according to the plate workflow settings.
  - Avoid unnecessary plate handlings & prepare the work for next steps (e.g. ID/AST management).

**SIS – Smart Incubator System**
- SIS will get rid of negatives plates in a totally automated fashion (could represent a significant # of plates)
- SIS will allow an early warning of positives, preventing them out, and making it immediately available for technicians to keep with the ID/AST processes - Time To Results will dramatically decrease
- With a fully automated Microbiology Lab, the proposal is that the concept of shifts will vanich - no matter the time the sample arrives to the lab, it will be moved along the workflow chain - including Identification and AST on a 24/7 basis

**Plate Imaging System**
- bioMerieux indicates they are focusing on high quality optics

**Digital Microbiology**
- Specific sorting criteria
  - Patient,
  - Specimen,
  - Growth / No growth.

**Surface/Relief : P.Mirabilis / E.coli**
- Special lightning (B&W case) to enhance the colony aspect and elevation observation.
IPS
ID/AST preparation for McF & MS

PREVI Isola and Smart Incubator System
Modularity – Flexibility

Workflow with VITEK® MS

Implications for Implementation

- Embrace change or it will embrace you.