

Lean Microbiology

Merging Automation and Process
Improvement for Improved
Patient Care

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Working Definitions

- Automation:- automatically controlled operation of an apparatus, process, or system by mechanical or electronic devices that take the place of human organs of observation, effort and decision.
- As such, there is no "true" automation existent in microbiology today, only "islands" of automation or partial automation.

Historical Perspective

- Microbiology has historically been the slowest of the laboratory disciplines to adopt automation or work re-design.
- Due to its innate subjective nature, the ability of the professional microbiologist has been and will continue to be highly valued.
- There is much to be said for experience and for "feel" in clinical microbiology.

- Contrast this to clinical chemistry or hematology where the extent of total automation has essentially removed the interpretive, observational and decision making out of the field for a significant portion of patients.
- However, Lean has taken a strong hold in these disciplines.
- It is this contrast that makes microbiology such a challenge.

Application of Lean In Microbiology

- The application of Lean Principles in Microbiology require that our long held tenets be discarded or at the very least be severely modified.
- Microbiology needs to migrate towards a "first in – first out" (FIFO) philosophy.
- Batches need to be reduced as much as possible and work needs to be based on "single case flow"

How Do We Start?

Basic Lean Principles

- Work should flow (product and operator)
- FIFO (First In/First Out)
- Single Piece/Case Flow
- 5 S (sort, segregate, shine, strengthen, sustain)
- Eliminate Waste
- Value Stream Mapping
- Standardized Work

Real Life Application

- Specimens placed in bins in order of arrival to department.
- Specimens are accessioned and set up as they arrive. Maximum WIP is 5 to be set up.
- Set up is done under a laminar flow hood.
- Culture set up done by LTA or Tech.
- Culture plates are segregated by set up time in the incubator.
- Contributes to the FIFO concepts.

Specimen Receipt and Inoculation

- It is imperative to move towards a level loaded mechanism for receiving of specimens.
 - Avoid batch drops as much as possible.
 - Strive for FIFO in specimen receipt
 - Keep Work In Progress (WIP) to small numbers (small batches processed quickly)
 - Standardize Inoculation Protocols as much as possible – limit variations.

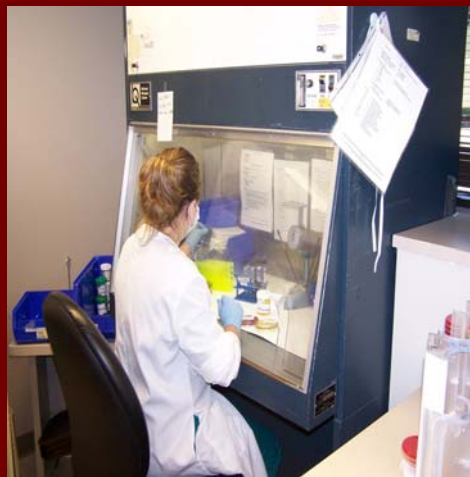
Inoculation Manual or Automated?

- Media Inoculation can be done by non-professional laboratory staff.
- Whether automated or manual, the bench still needs to be manned if for no other reason than to load the automated plater.
- A Lean workflow can be very helpful in avoiding the need and expense of inoculation automation.

Specimen receipt
bins



Inoculation Bench



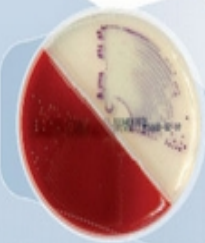
Classical Inoculation



Automated Inoculation System



Maximized colony isolation



Standardized inoculation
for regular plates or biplates

Plate Identification

- It is important to have positive patient identification of specimens and plates.
 - Bar Coded LIS labels can accomplish this.
 - Specimens are inoculated one at a time.
 - Label includes barcode, identification, source and other necessary information
 - Main label has daughter labels for each plate required based on standard protocol.

Sorting and Incubation

- Specimens are inoculated as they are received (FIFO).
- As they are inoculated, they are placed in the incubators based on the time of day.
- Specimens are not sorted or separated by source – only by time of receipt.
- All are incubated for a minimum of 14-18 hours before reading.

Staff/Reading Schedule

■ Staff Shifts

- 0500 to 1330
- 0700 to 1530
- 1430 to 2300

■ Read Time

0800
1200
1600
2000

Plated Time

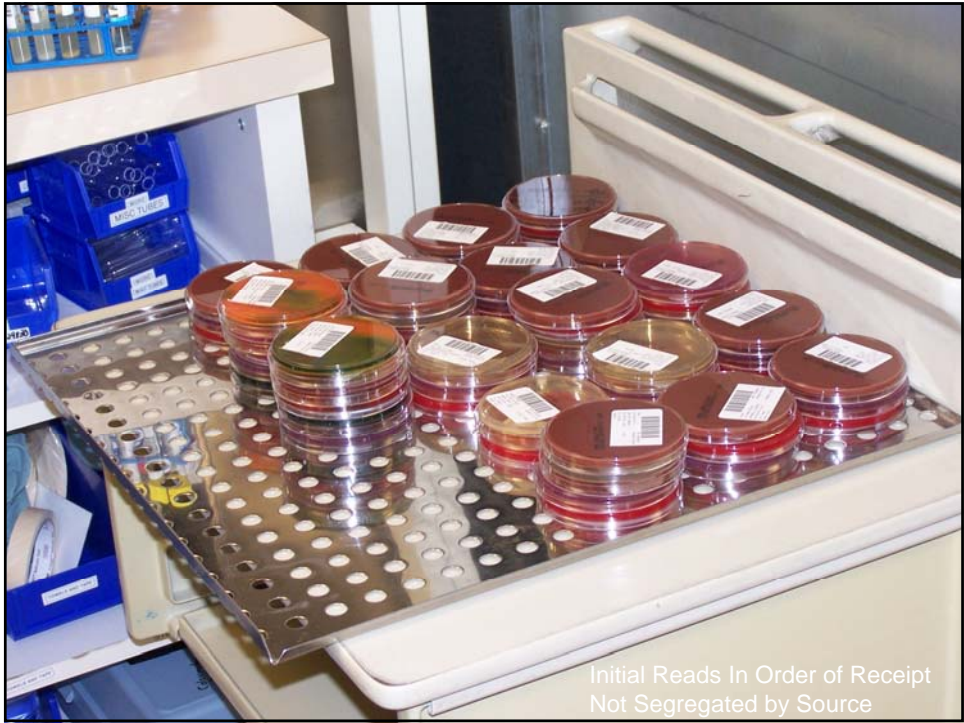
0801 -1400 (T-1)
1401 – 2000
2001 – 2400
0000 – 0800



Initial Reading and Processing

- Initial reading is done FIFO.
- We do not sort by source.
- All cultures are read in order regardless of source.
- Cultures with insufficient growth or immature growth are re-incubated for 8 hours or longer before re-examination.
- Technical judgment is required.

- Cultures with adequate growth are evaluated by the microbiologists.
- Discrete colonies are picked and set up in Vitek II with the appropriate cards.
- Vitek rack is loaded in single case mode-all different discrete colonies from 1 case are set up in a single rack.
- Vitek II rack is loaded and a new rack is selected for the next case. It takes 3 minutes for a rack to do its cycle.
- Once the rack is loaded, the plates are placed on the save rack for re-incubation.

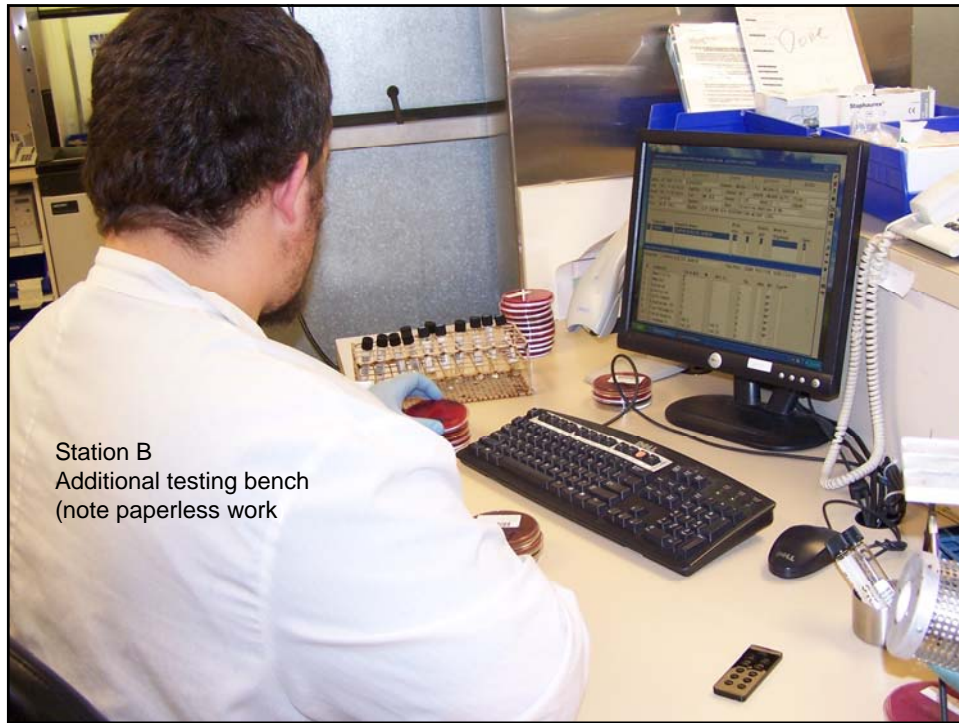


Additional Workups/Report Finalization

- The placing of the initial isolates into the Vitek 2 is only the beginning of the process.
- While the Vitek is processing the cards, additional tests (if indicated) are processed on a single case basis.
- All work is paperless – all data is entered in the computer.

Additional Testing/Workups

- Cases read at Station A which require additional workup, are moved across the counter to Section B.
- Section B is responsible for additional testing for final ID.
- It is also the station that does final disposition from the Vitek II.
- The save rack/re-work incubator is separate from the initial culture incubator



Final Reporting

- Station B is responsible for the finalization of the report.
- That includes additional testing necessary to provide a definitive identification and/or susceptibility/MIC level.
- Most cultures are reported within 35 hours of receipt in the lab.

Staff Expectations

- Microbiology staff are expected to be able to read cultures in order of arrival regardless of source.
- Average experience for staff is 20 years (range from 3 years to 35 years).
- We have a succession plan for all positions and areas. The philosophy is to have the experienced techs mentor the young ones.

Paperless System

- Because of the reduced number of stations and staff, the system is paperless.
- Data is entered in the computer and is available on the screen.
- Standardized work allows one tech to follow another with no loss of continuity.
- Notes and observations from plates are entered as comment notes.

Special Considerations

- Test volume – 67555 accessions/2008
- Micro Staff – 5.0 FTE with 3 additional staff that rotate periodically.
 - 4 FTEs Days (flexible shifts)
 - 1 FTE – Evenings
- Dept staffed from 0500 to 2300 with dedicated staff.
- Micro Staff is also cross trained in the Core Lab for redundancy.

Summary

- Rethink microbiology
 - Go to First In/First Out set-up and reading
 - Do not sort by source – sort by time
 - Redesign workspace for efficiency
 - Place instruments in order of use
 - Reduce movement of product and staff
 - Avoid redundant actions/processes
 - Standardize procedures- everyone does it the same way.
- Change is traumatic for all, but the results are worth it.

Thank You

Questions?