

Lean and Lab Automation:

Pursuing the new paradigm in Modern Microbiology

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What is Lean?

- Lean is modeled after the Toyota Production System.
- Lean is a series of processes that are designed to eliminate waste, error proof and add value to any product or service.
- While viewed as a Japanese concept, Lean actually began in America and was expanded and perfected at Toyota.

Overview of Lean Principles

- Correctly specify **value** from the standpoint of the patient.
- Identify the **value stream** from concept to launch and raw material to customer and eliminate the muda (**waste**).
- Make the remaining steps **flow**
- Let the customer **pull** just the value needed
- Pursue **perfection** (every step adds value)

excerpts from "Lean Thinking"

Types of Waste

Over Production	(Doing more than you need to - output of a process)
Waiting	(Things just don't happen when they should)
Transportation	(Shipping stuff to different locations)
Inventory	(Keeping stuff on-hand when it isn't required)
Processing	(Doing more than you need to - within a process)
Motion	(Excess movement - person/material - within a process)
Defects	(It just doesn't meet expectations)

What is Automation?

Laboratory Automation is a broad subject

- It is multi-disciplinary
- It is different in Micro from main lab.
- Can involve robotics of varying complexity
- Can involve information processing (IT).
 - It is designed to improve productivity and standardize processes.
 - It hopefully decreases errors (but a bad process can be automated- that isn't good!)

Examples of Automation In Microbiology

- Automated Blood Culture Machines
 - Automate the examination of blood cultures
- Automated Bacterial ID systems
 - Automates the basic identification of bacteria
- Automated Specimen plating systems
 - Automates specimen inoculation (to some degree)
- Intelligent Identification Systems
 - Uses AI to help with non-routine Identification

How Are They Complimentary

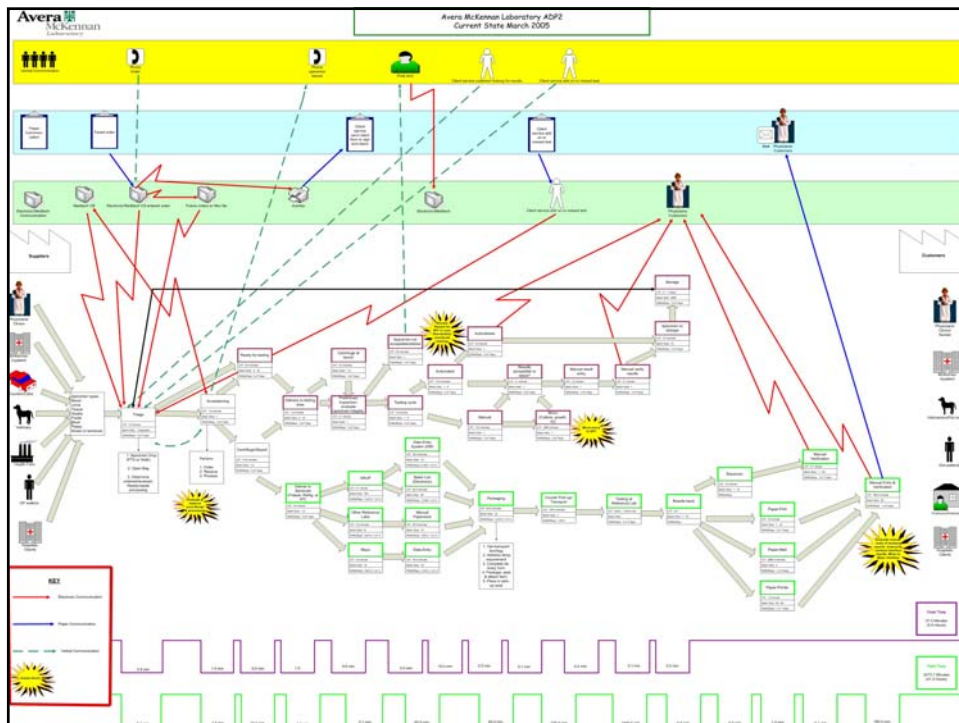
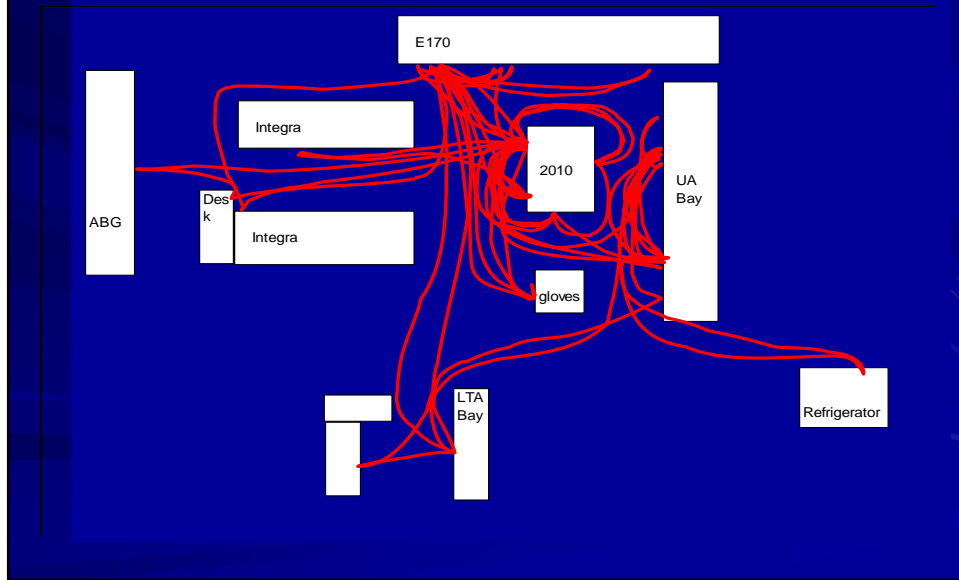
- Lean improves processes
- Automation standardizes those processes
- Lean organizes workflow logically
- Automation allows less people to do more
- Lean eliminates waste
- Automation automates processes that may help reduce waste.
- Together, they improve patient care

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

BASE Operator ANALYSIS

Example of Workflow Analysis



Work Area Design

- Area was designed to accommodate the workflow pattern (SPF/FIFO)
- Open area with special attention to air flow and filtration.
- No odor detectable nor aerosolization because of design.
- Employee safety was paramount. PPE is mandatory.

2008 Micro Statistics

- Total Cultures for 2008 = 67,555
 - Blood Cultures = 13,200
 - Virology = 2,300
 - AFB/Mycology = 2,100
 - Routine Cultures (aerobic/anaerobic)= 49,555

2009 is running 20% ahead with same staffing

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.





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.

Staff/Reading Schedule

■ Staff Shifts

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

■ Read Time

0800
1200
1600
2000

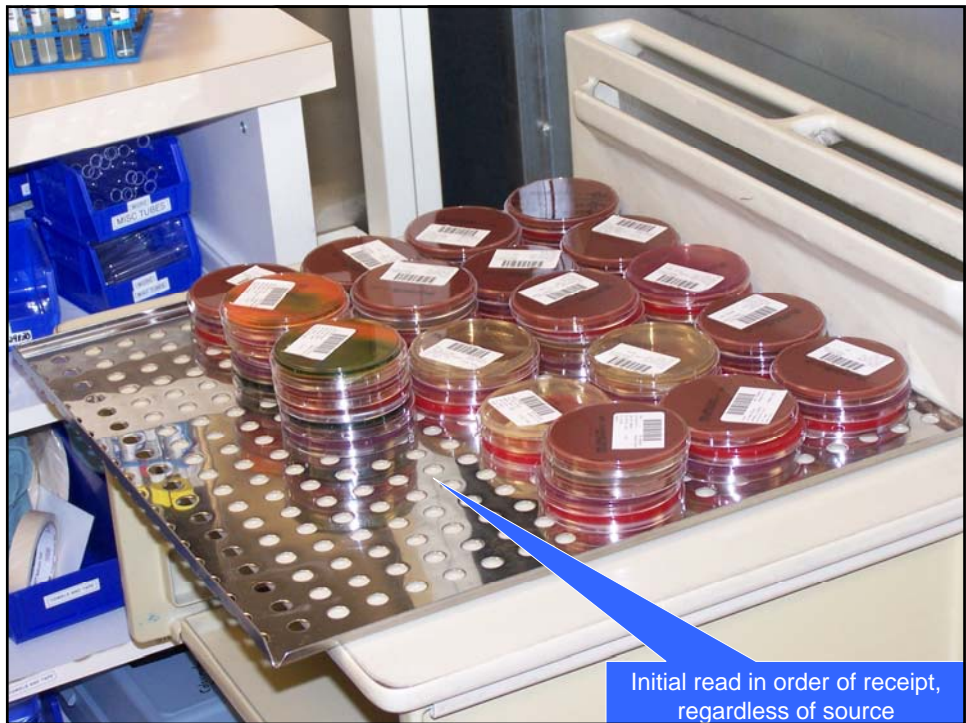
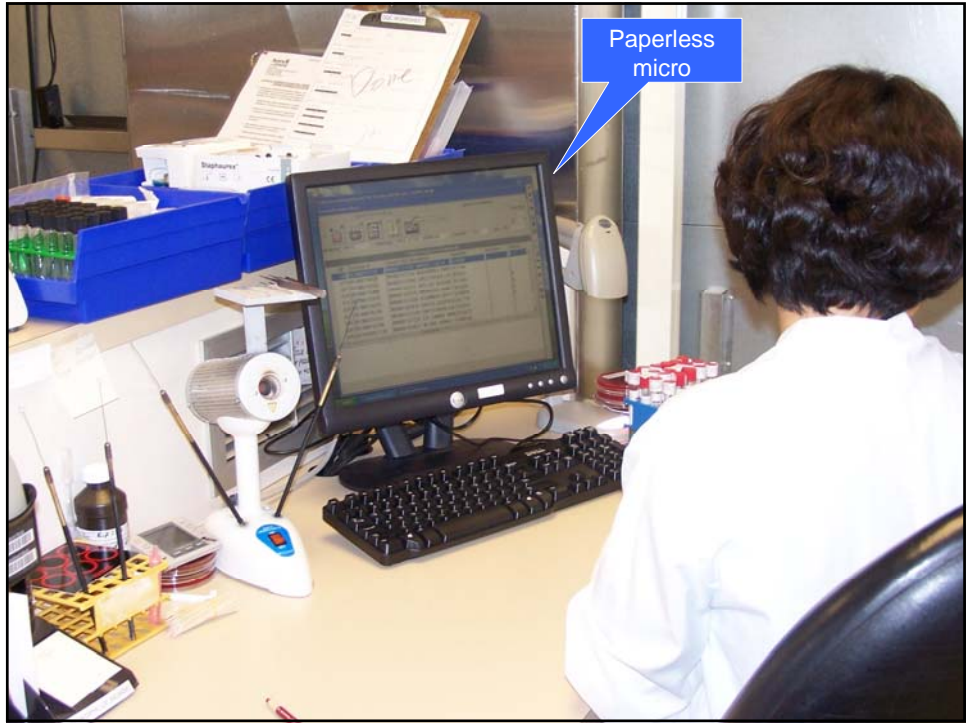
Plated Time

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

- 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.

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.

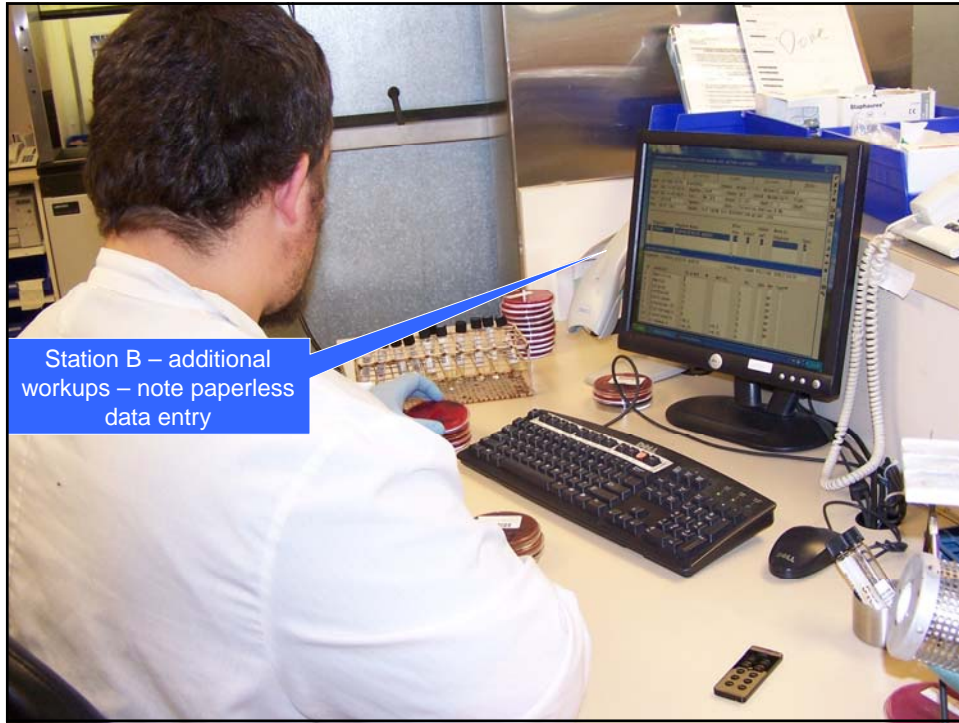






Additional Testing/Workups

- 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 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.

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.

Blood Cultures

- Blood cultures are monitored around the clock.
- As the instrument alarms a positive bottle, it is removed, gram stained and plated immediately.
- Gram stains are read and reported immediately. – Hospitalists and Clinical Pharmacists are available to initiate appropriate care immediately.



Parasitology

- Stools for parasites are processed daily.
- One of the few tests batched.
- Physicians can order “full parasitology” or Giardia/Crypto screen, depending on travel history.
- “Full parasitology” includes concentration, wet and stained examination.
- Malaria Smears performed as received.



Virology/AFB/Mycology

- We provide both DFA and culture services
- We buy commercial cells weekly
- Virology is performed daily on both first and second shifts. DFA testing has increased with H1N1 scare.
- All micro staff is trained to do virology.
- Selected members do mycology and AFB
- Mycology/AFB cultures are examined twice weekly (Tuesdays and Fridays) on day shift.

Closing Comments

- Lean can significantly improve productivity and turnaround time in microbiology.
- Automation is complimentary to good processes.
- Improved processes and technical competence PLUS quality automation leads to cost effective, quality microbiology.

Questions??

Thank You