

# Importance of LIS and Automation in Laboratory



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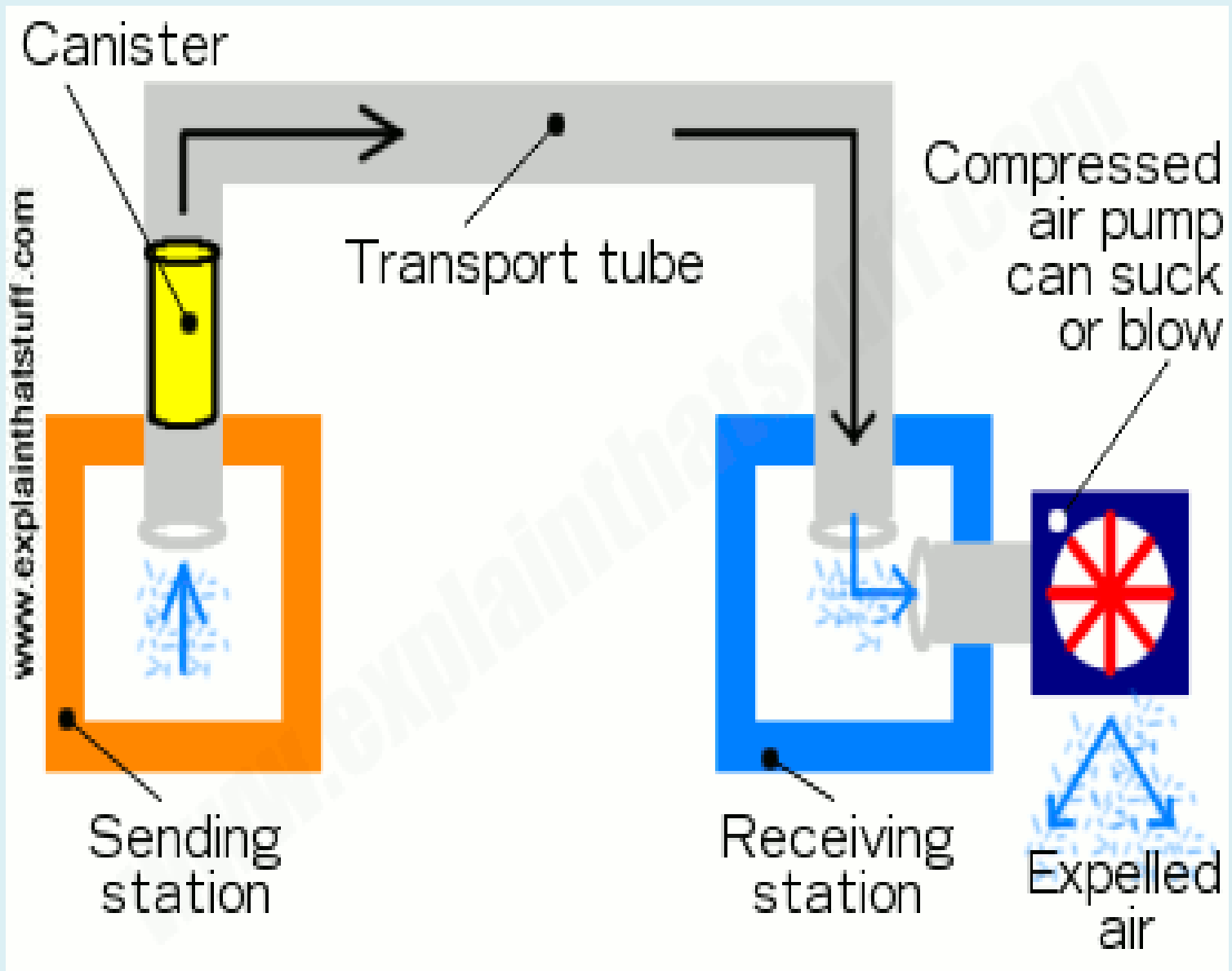
**Kidwai Memorial Institute of Oncology**

**Bangalore**

# Importance of Automation



# Pneumatic shoot system for specimen transport



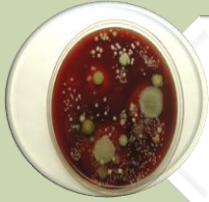
# Medical Specimen Transport System



# Importance of Media Preparation Systems



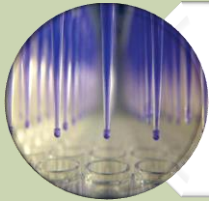
Preparing and dispensing media is easy and less time consuming



Manual media preparation has higher rate of contamination



Automation offers more consistency and uniform volumes independent of operator



Reproducible transfer of liquid agar or broth to plates and tubes or bottles.



Reduced 'out of stock' situations compared to ready to use media



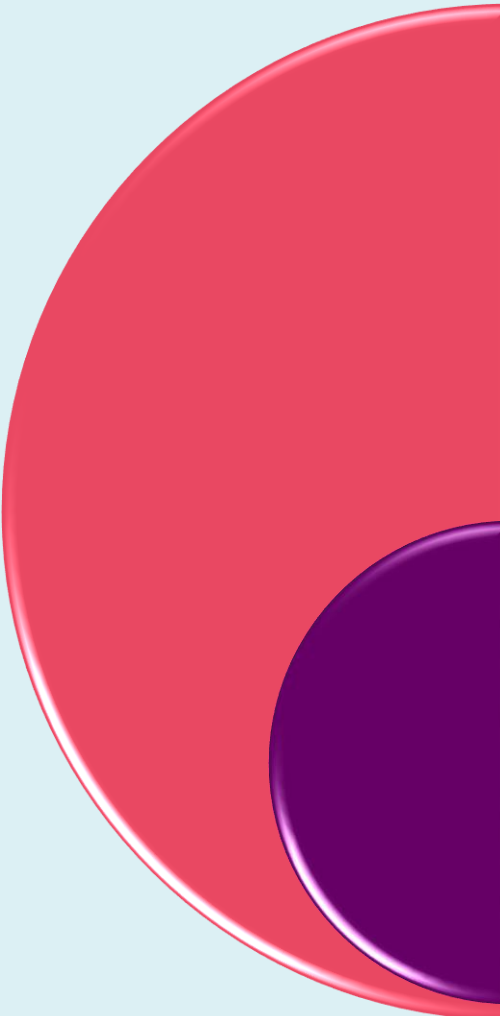
# Automation in Media preparation



# Automation in Media preparation



# Staining techniques



Quality of the stain often is directly related to the microbiologist's experience and technique.

Manually prepared slides are less reproducible compared with automated Gram-staining methods that eliminate manual steps



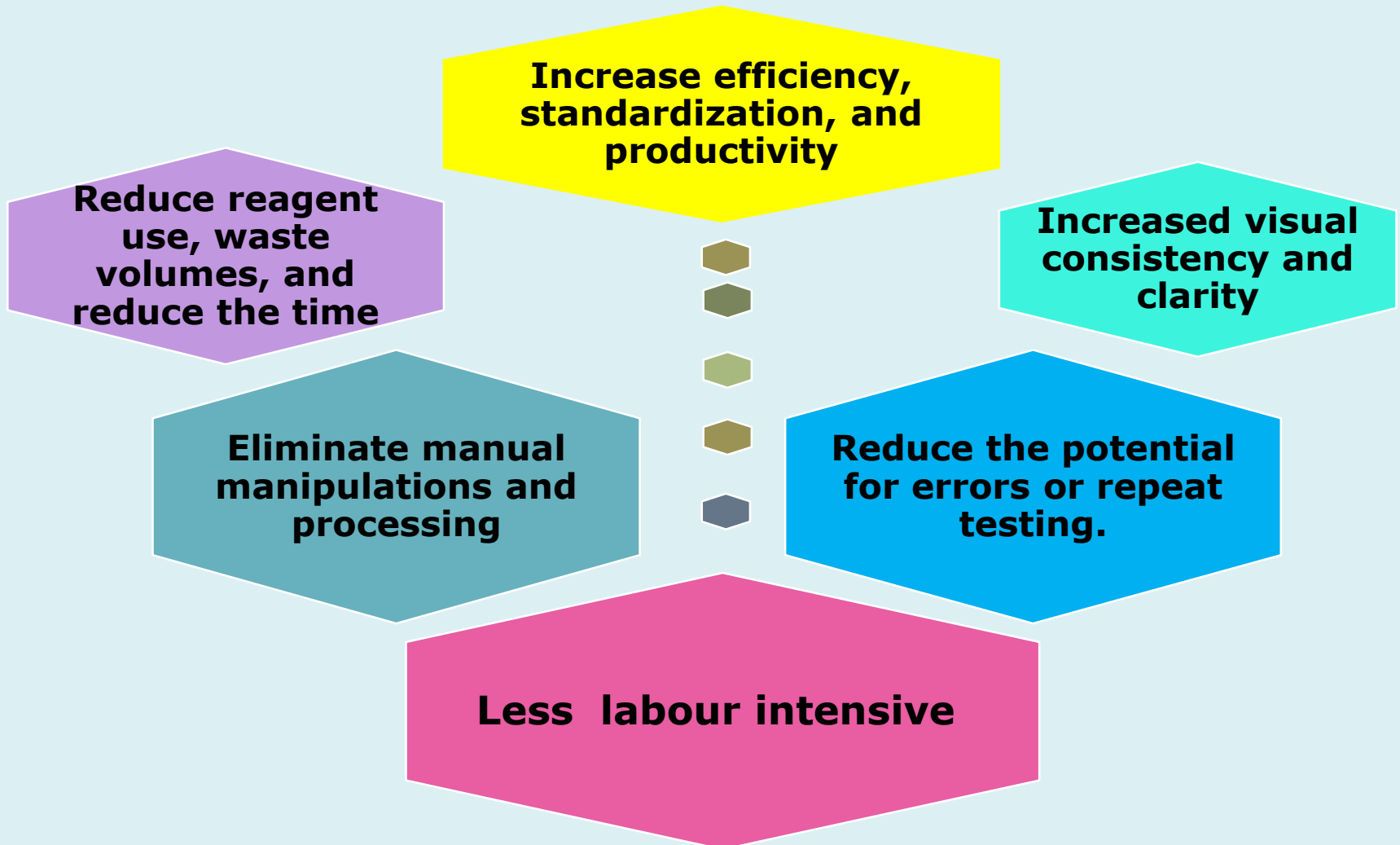
# Automated systems for staining



# Automated systems for staining



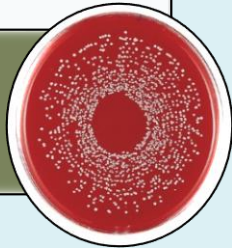
# Importance of Automated Gram Stainer



# Initial Processing of Samples – Plating of Cultures

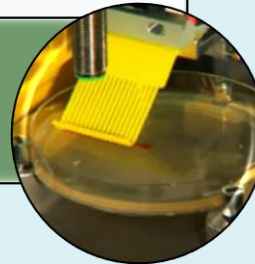
- In between Pre-analytical & Analytical Procedures

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- High scope for automation

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- Area where high chances for errors can happen

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# Automated Plating Devices



# Automated Plating Devices





# FMLA (Full Microbiology Laboratory Automation)



# Automated laboratory



# Importance: Automation in ID and AST

## Testing

- Early and accurate identification
- Less labour intensive

## Interpretation

- More reliable results
- Free from observational error

## Reporting

- Free from manual errors of typing
- Accurate and less time consuming

# Automated system for ID and AST

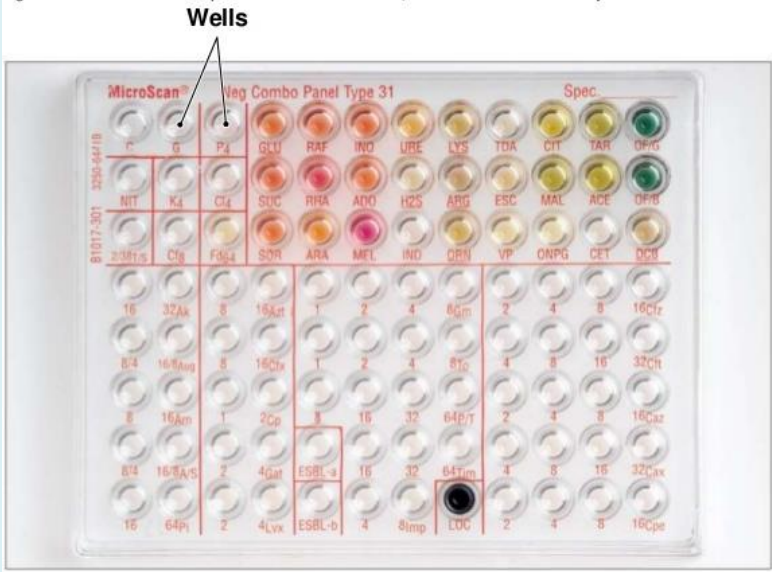




# Automated system for ID and AST



# Automated system for ID and AST



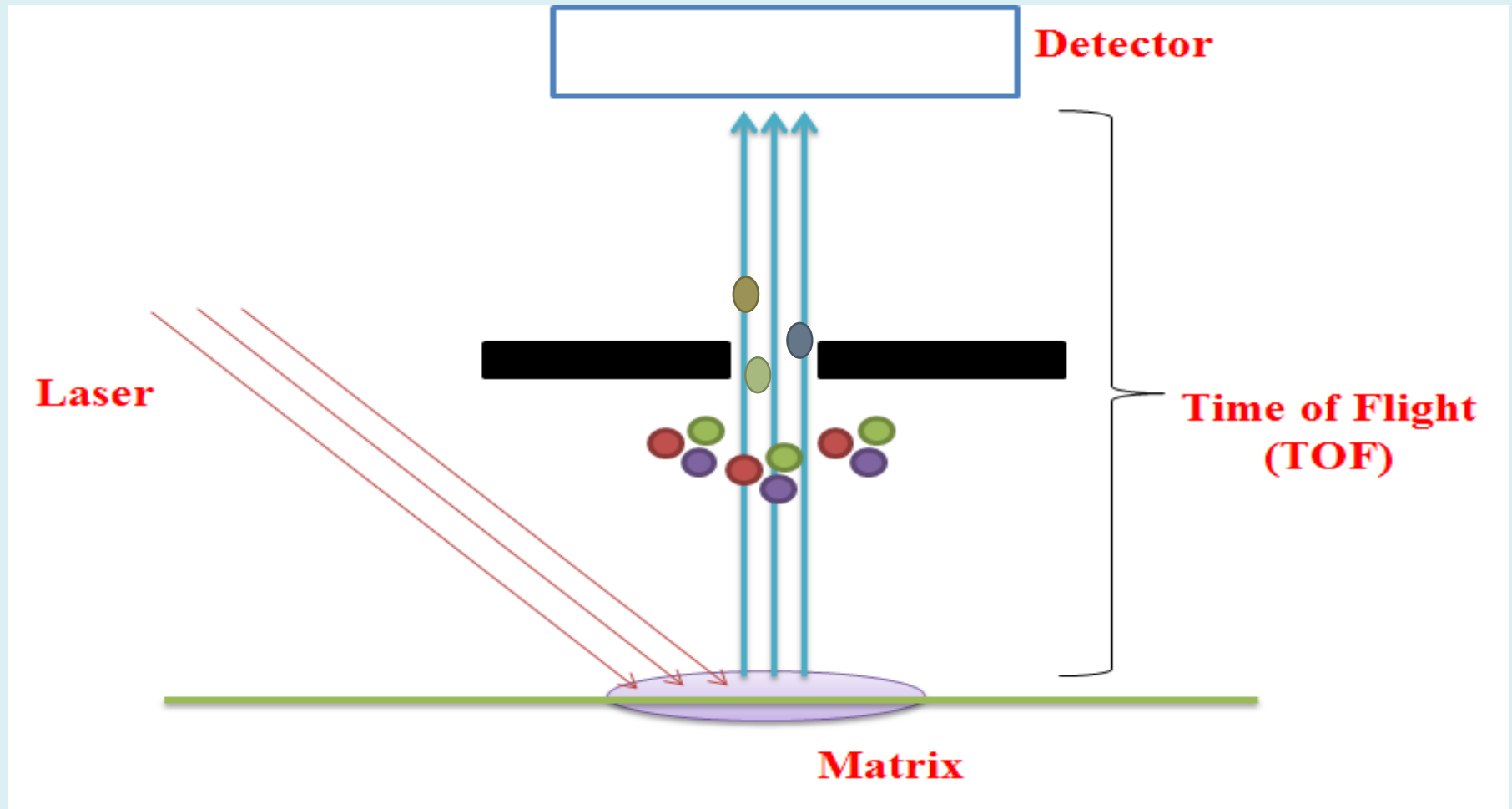




# Mass spectrometry based identification

- MALDI- TOF for rapid identification of bacteria
- Easy and less time consuming
- Identification within minute
- Bacterial toxin identification
- Detection of Resistant Phenotypes

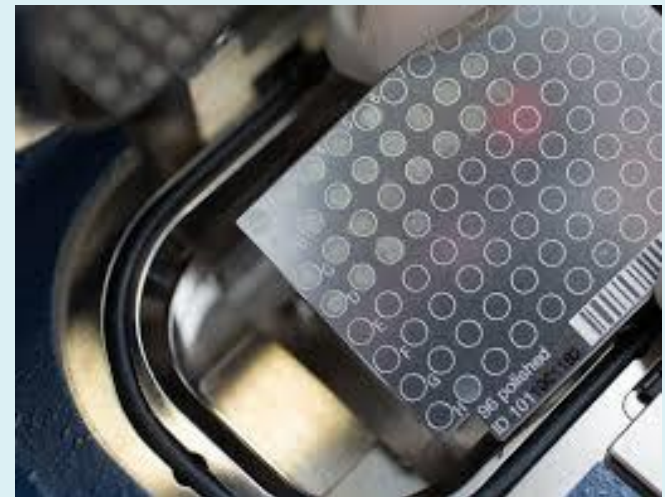
# Principle of MALDI-TOF



# MALDI-TOF for bacterial identification



# MALDI-TOF for bacterial identification





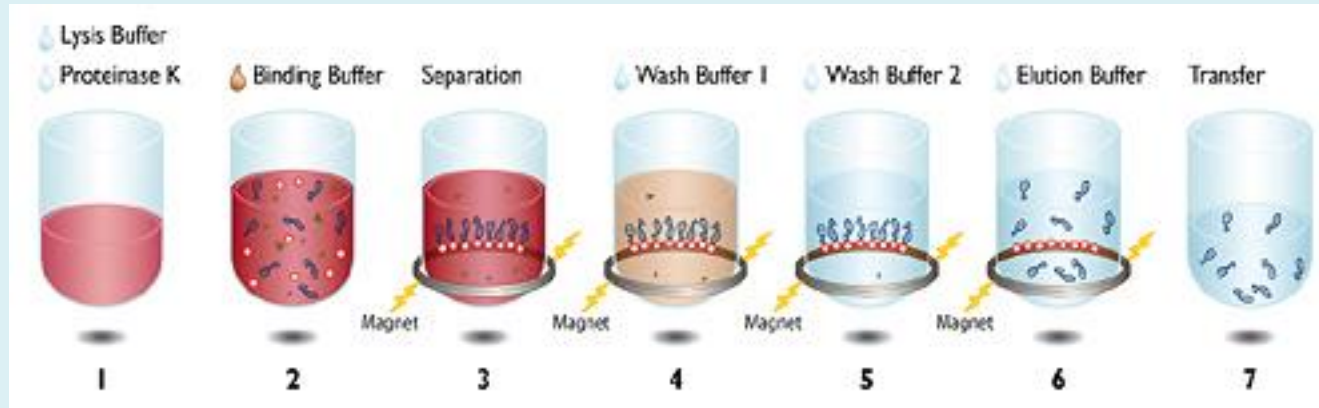
## **Detection of *Mycobacterium tuberculosis***

- Conventional methods are time consuming and take 3-4 week for diagnosis
- Semi automated methods like line probe assay are quick
- Fully automated methods- Gene expert
  - Accurate
  - Early detection
  - Direct from sample

# Molecular Biology



## Conventional Polymerase Chain Reaction

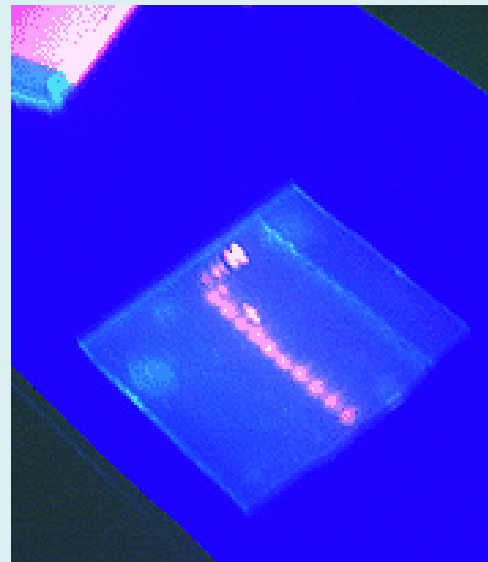


DNA  
Extraction

PCR



Gel  
Electrophoresis





# Real Time PCR

## Steps to a Successful qPCR Experiment



Assay design



Experimental set-up



RNA, DNA—  
isolate, purify, quantify



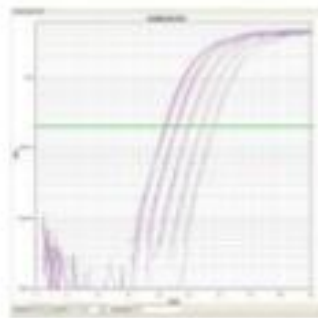
RNA



cDNA



qPCR reaction set up



Analysis of data

# Automated Molecular Techniques



Gene Expert

**1**

Sputum liquefaction and inactivation with 2:1 sample reagent



**2**

Transfer of 2 ml material into test cartridge



**3**

Cartridge inserted into MTB-RIF test platform (end of hands-on work)

**4**  
Sample automatically filtered and washed

**5**  
Ultrasonic lysis of filter-captured organisms to release DNA

**6**  
DNA molecules mixed with dry PCR reagents

**7**  
Seminested real-time amplification and detection in integrated reaction tube



**8**

Printable test result

Assay Name: MTB-RIF

Test Result: **MTB DETECTED LOW**  
**RIF Resistance NOT DETECTED**

Time to result, 1 hour 45 minutes



# Traditional Microbiology Vs Automated Microbiology

Traditional microbiology	Automated microbiology	Impact
Specimens processed in batches	Specimens processed on receipt in lab	Eliminates multiple handling steps and processing delays
Technologists select and inoculate media according to processing protocols	Automated programmed media selection and specimen inoculation	Decreased processing errors; reproducible inoculation of media; improved isolation of colonies
Inoculation of media with predetermined specimen volumes and streaking pattern	Inoculation of media with user-defined range of specimen volumes and streaking patterns	Specimen volumes and streaking patterns selected for optimal recovery of isolated colonies
Manual transfer of inoculated plates to incubator	Automated transfer of inoculated plates to incubator	Elimination of delays from inoculation of media to placement in incubator

Murray PR. Laboratory automation: efficiency and turnaround times. Microbiology Australia. 2014.





# Traditional Microbiology Vs Automated Microbiology

Traditional microbiology	Automated microbiology	Impact
Manual stacking of inoculated plates in incubator	Automated placement of plates in incubator slots	Improved circulation of incubator air; elimination of time required to find and retrieve inoculated plates
Manual examination of inoculated plates	Automated imaging of plates at user-defined intervals	Creation of progressive images of colony growth; ability to differentiate plates with growth from negative cultures; plates remain in incubator maximising culture growth
Written/electronic record of work	Electronic/digital record of work	Digital image library optimises processing of specimen by multiple technologists; decreases workflow inefficiencies; improves quality control of processing
Plates examined at workstation	Plates examined at workstation, in reading room, or remotely	Permits plates to be examined in a distraction-free area and review of plates remotely by expert microbiologists
Processing cultures determined by schedule of technical staff	Processing cultures determined by schedule of culture growth	Shortest time to results; maximum staffing efficiency

Murray PR. Laboratory automation: efficiency and turnaround times. Microbiology Australia. 2014.

# Advantages



Reduces Turn Around Time



Uniformity & Standardization



Reduces the Manual Workload



# ADVANTAGES



Minimum Direct Contact with Possible Biohazard

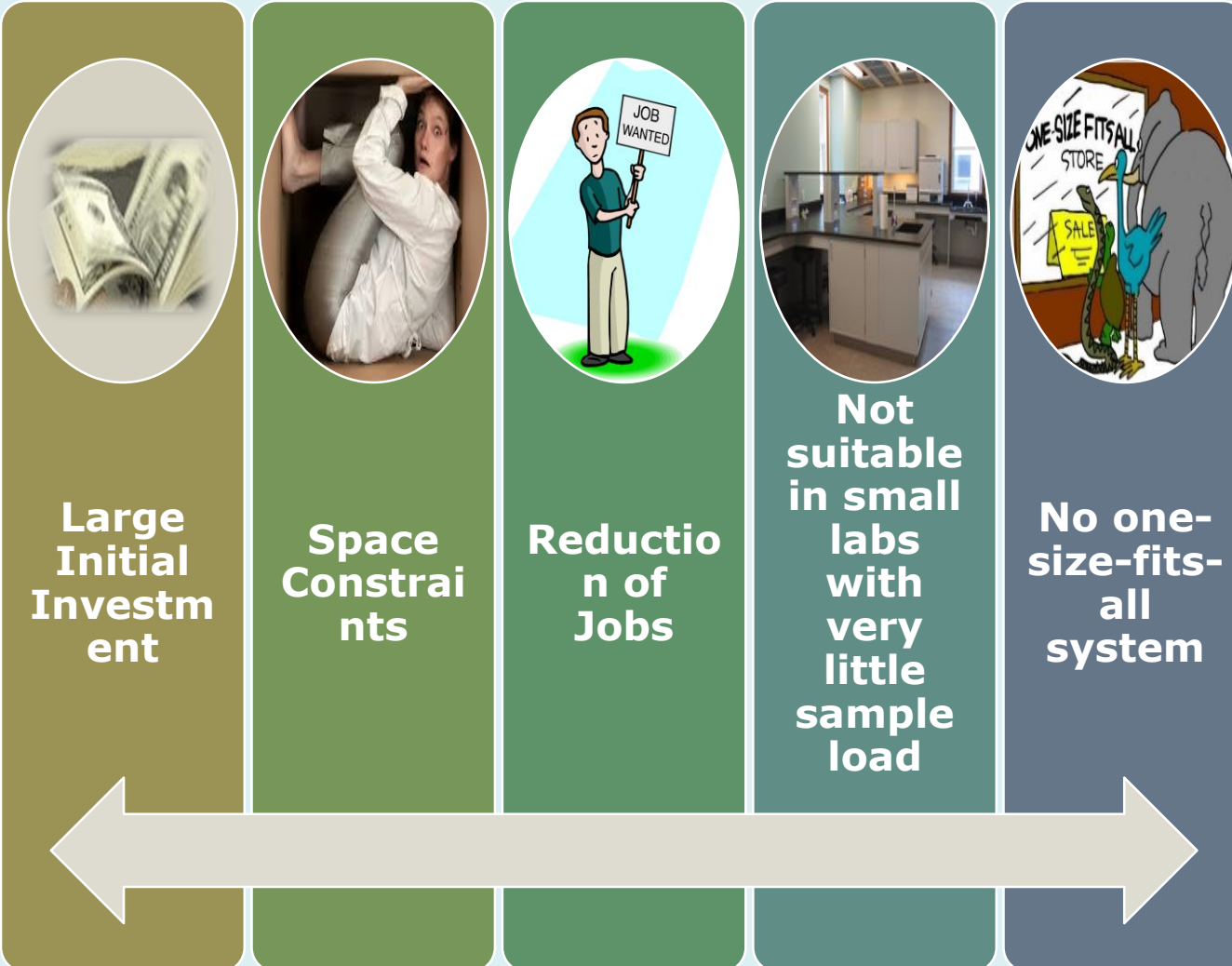


Minimum Errors, Increased Accuracy & Repeatability



High Efficiency

# Disadvantages











THANK YOU