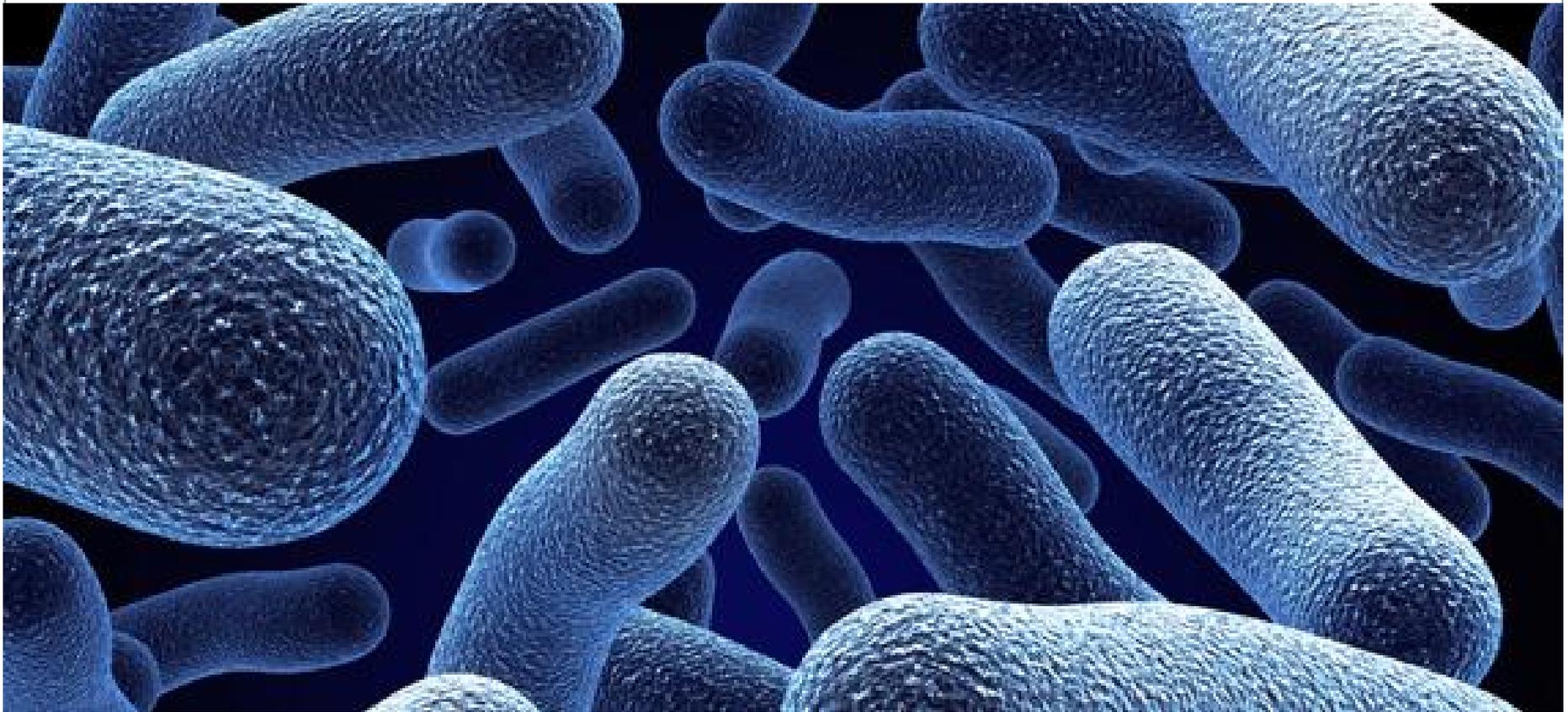


Automated methods in the Microbiology Lab-Issues and Troubleshooting!



Overview



- Background/history
- Plate streakers and Gram stainers
- Blood cultures
- Automated Susceptibility Testing
- Automated ID testing
- Automated Urine Analysers
- Molecular assays
- MALDI-TOF

Background



- Manual streaking of plates has not really changed since solid agar plates were first used
- Microscopy is mostly unchanged
- Incubators while probably more reliable are essentially the same
- Plate reading has not really changed over the years



Obstacles to automation in Microbiology



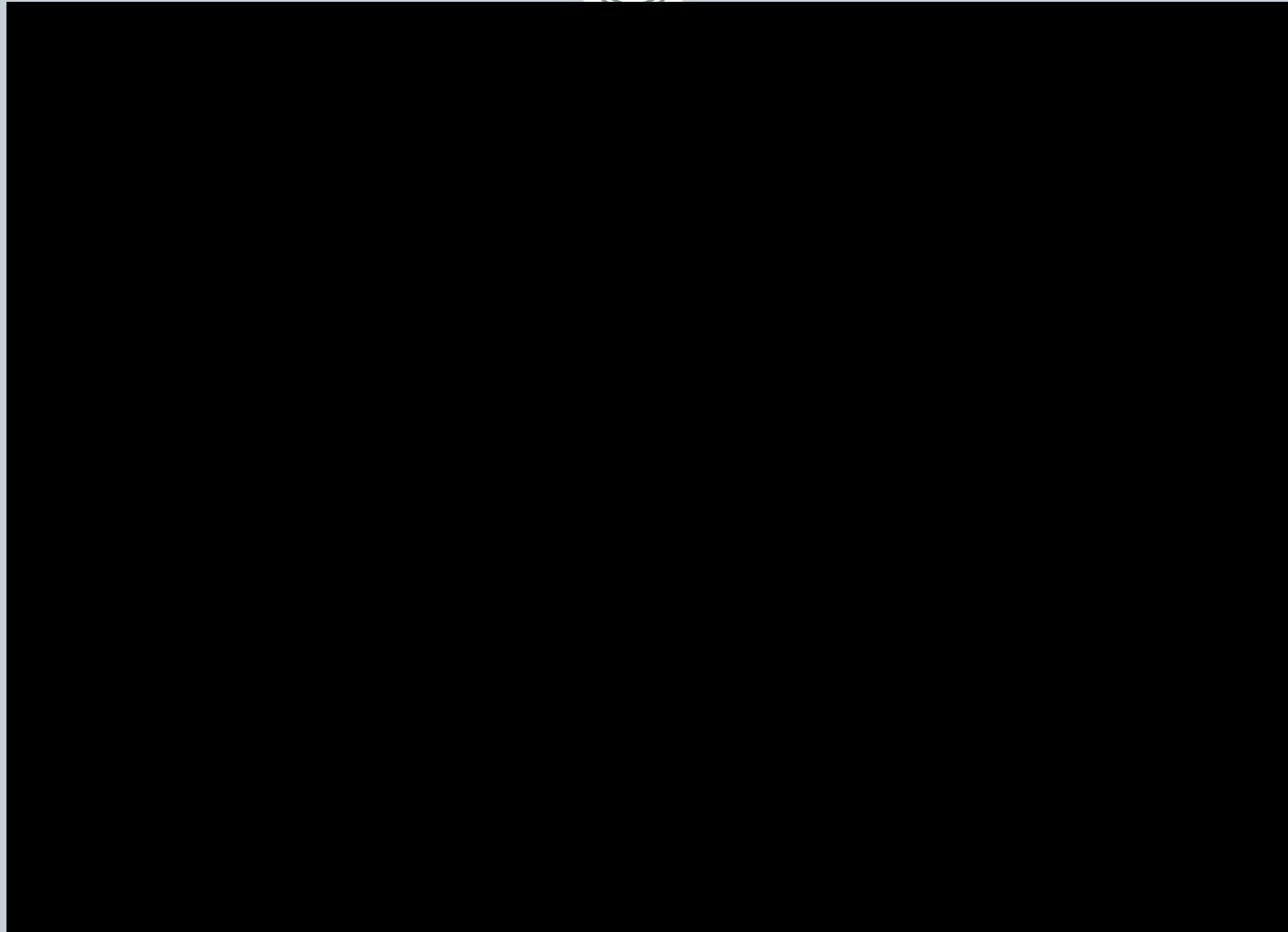
- Microbiology is too complex to automate: blood, sterile body fluids, urine, catheter tips, tissues, prosthetic devices, lower respiratory tract specimens
- Variations in the processing of specimens: tissue digestion, urine colony count, impression smears preparation
- Machines are programmable but humans are flexible
- Costs of automation
- Microbiology labs are small for automation

Pre analytical



- Specimen separators
- Media pouring
- Issues with each are unique

Media preparation-Aseptic precautions



Automated media preparation



Issues and solutions



- Sterility at every point or risk of contamination
- Tubings need to be autoclaved
- U-V light needs to be regularly inspected and maintained

Conventional blood culture



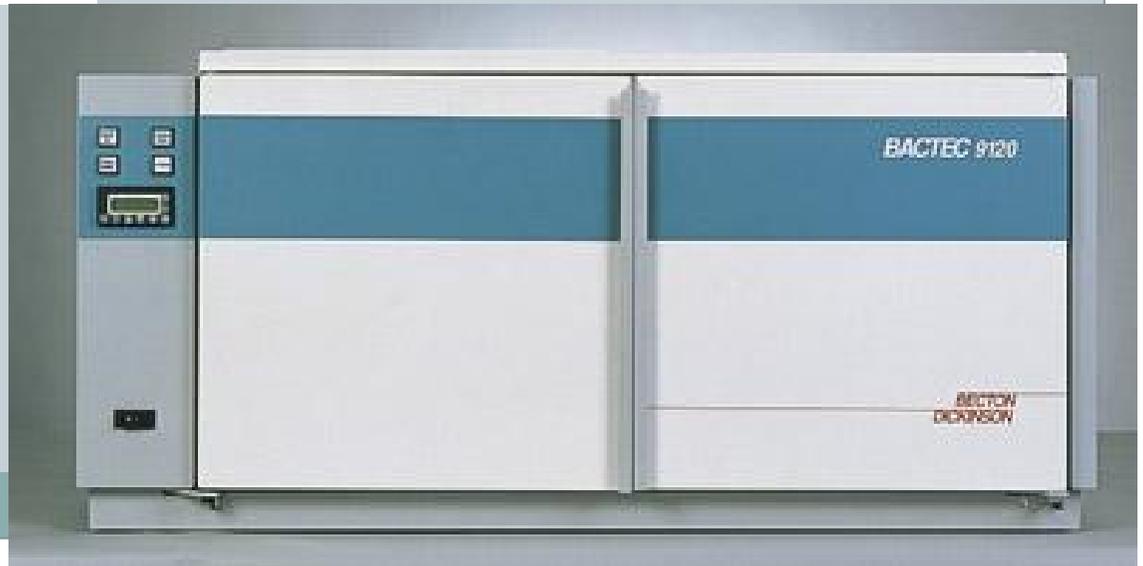
7 days

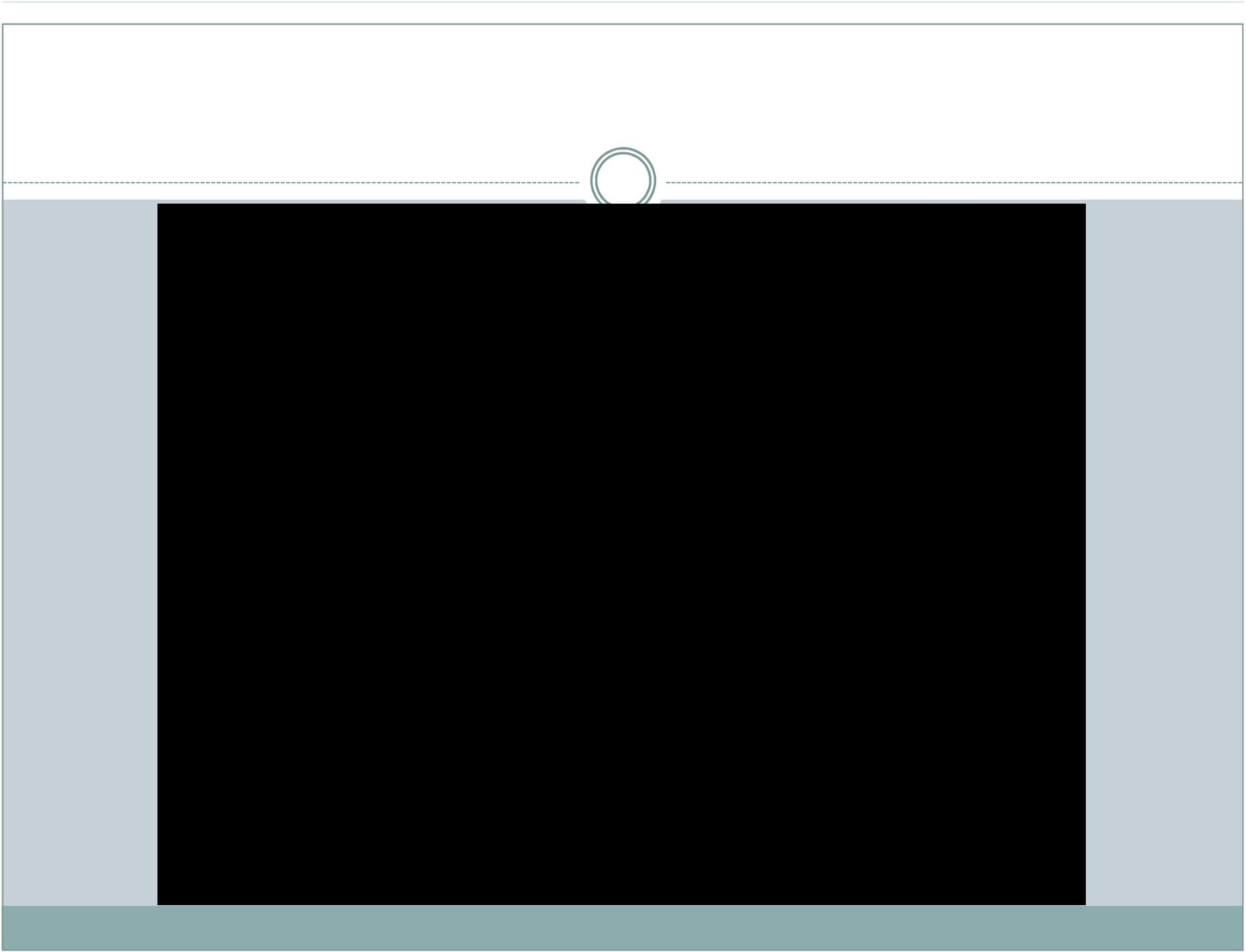


Blood Cultures



- Standard in most diagnostic labs, varying sizes.
- Better detection times
- More advanced media
- Reduced total incubation before calling a bottle a final negative
- Suppliers: BacT/Alert (BioMerieux), BACTEC FX (BD), Versa TREK





Issues with blood culture systems

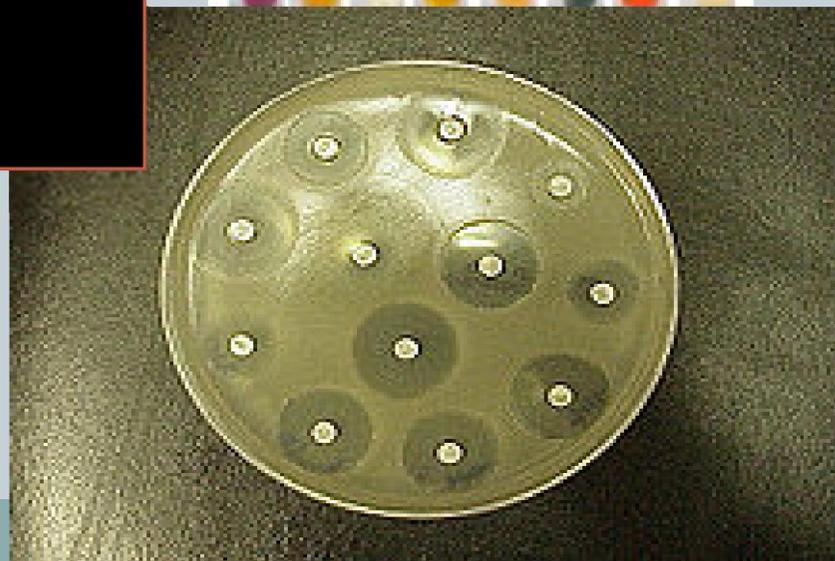


- False positives due to high TLC count
- Continuous power supply needed
- Cost

Conventional ID and susceptibility testing



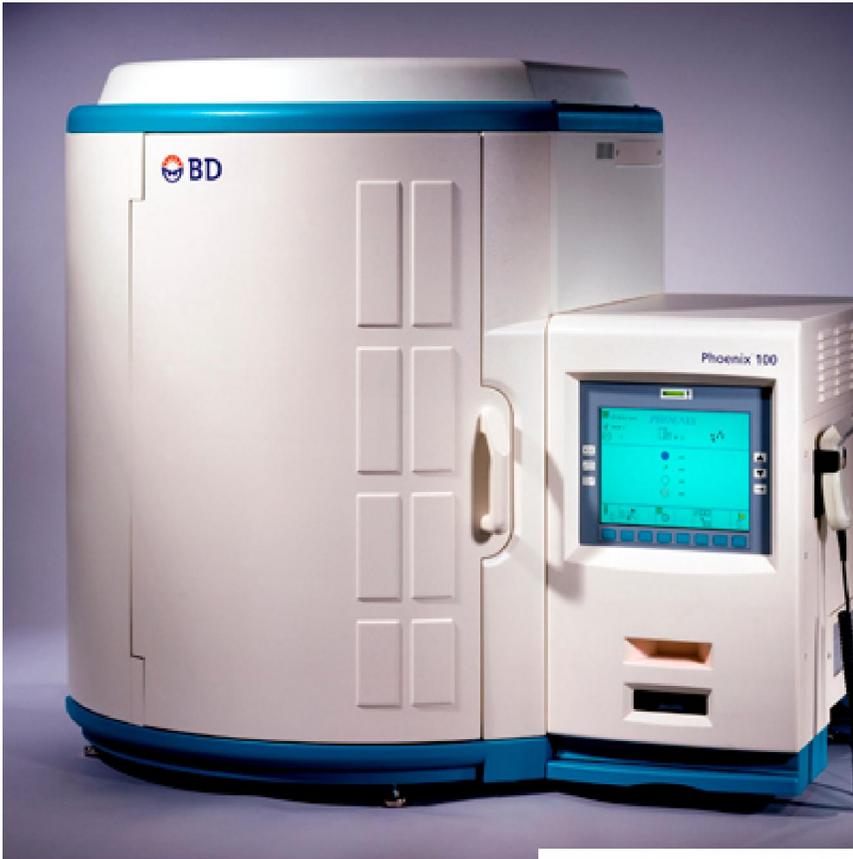
24-48
hours



Automated ID and Sens



- Automated ID testing available since 1977
- Biochemical substrates miniaturised and read by colorimetric or fluorometric means
- Available in many labs
- Multiple Antibiotics in different dilutions available on Cards or panels to ascertain MIC
- Suppliers: Microscan Walkaway (Dade Behring) Vitek2 (BioMerieux) BD Phoenix (BD)





Issues with identification systems



- Pure culture
- Simple tests are not covered like oxidase, catalase, motility, pigment production
- Variability of identification in rarer organisms
- Only organisms covered in database
- Inoculum size can affect MIC interpretations
- MICs of some antibiotics are not actual MICs but extrapolations from related antibiotics

Automated Urine Analysers



- Automated Dip-strip inoculation and reading
- Cell counts performed automatically – either by flow cytometry or (more recently) high resolution optics taking pictures of cells
- High Negative predictive value for urine cultures

Issues with urine analysers



- Back to basics
- Appropriate specimen collection
- Early transport

Molecular methods

- GeneXpert- not just for TB,
- MRSA, *C. difficile*, etc.



Issues with molecular methods



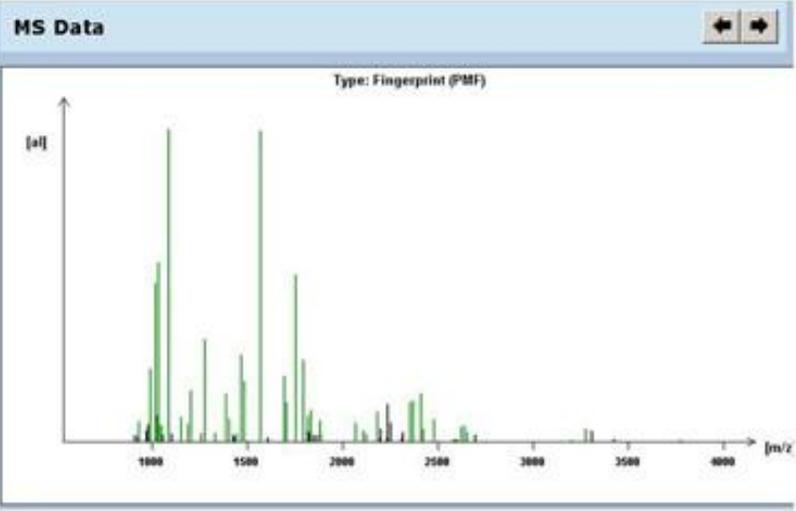
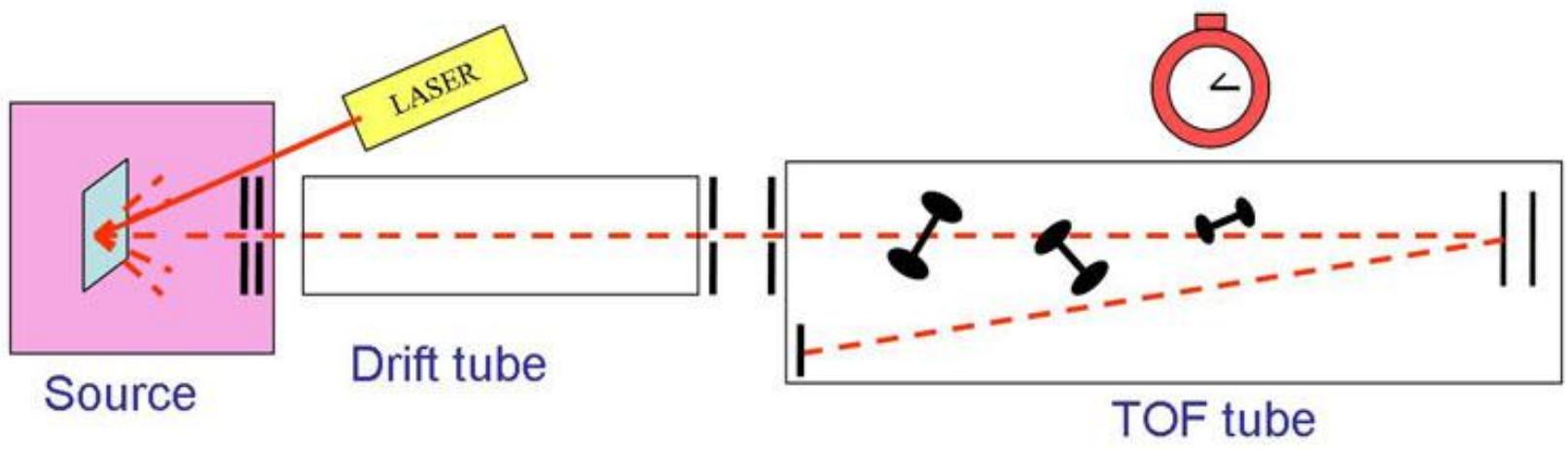
- Cannot differentiate live from dead
- Negative results do not rule out infection

MALDI-TOF(Matrix assisted LASER Desorption Ionisation-Time of Flight Mass spectrometry)

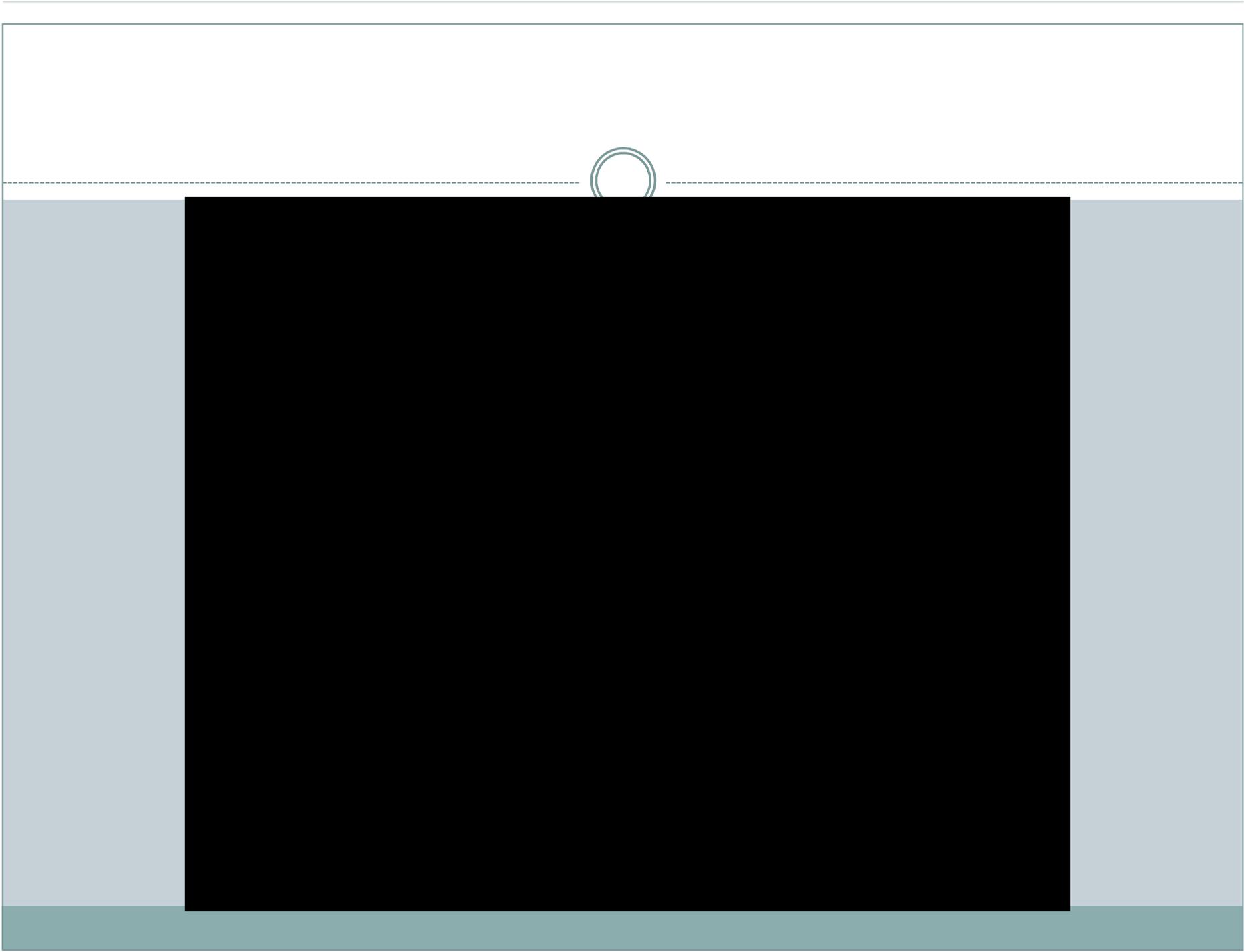


- Protein based spectral identification of bacteria
- Identifications available in literally minutes – not hours
- Tiny amount of bacterial growth needed – not affected by media or incubation conditions
- Minimal cost per test (in cents not even dollars), virtually no consumables
- Suppliers : Bruker, BioMerieux

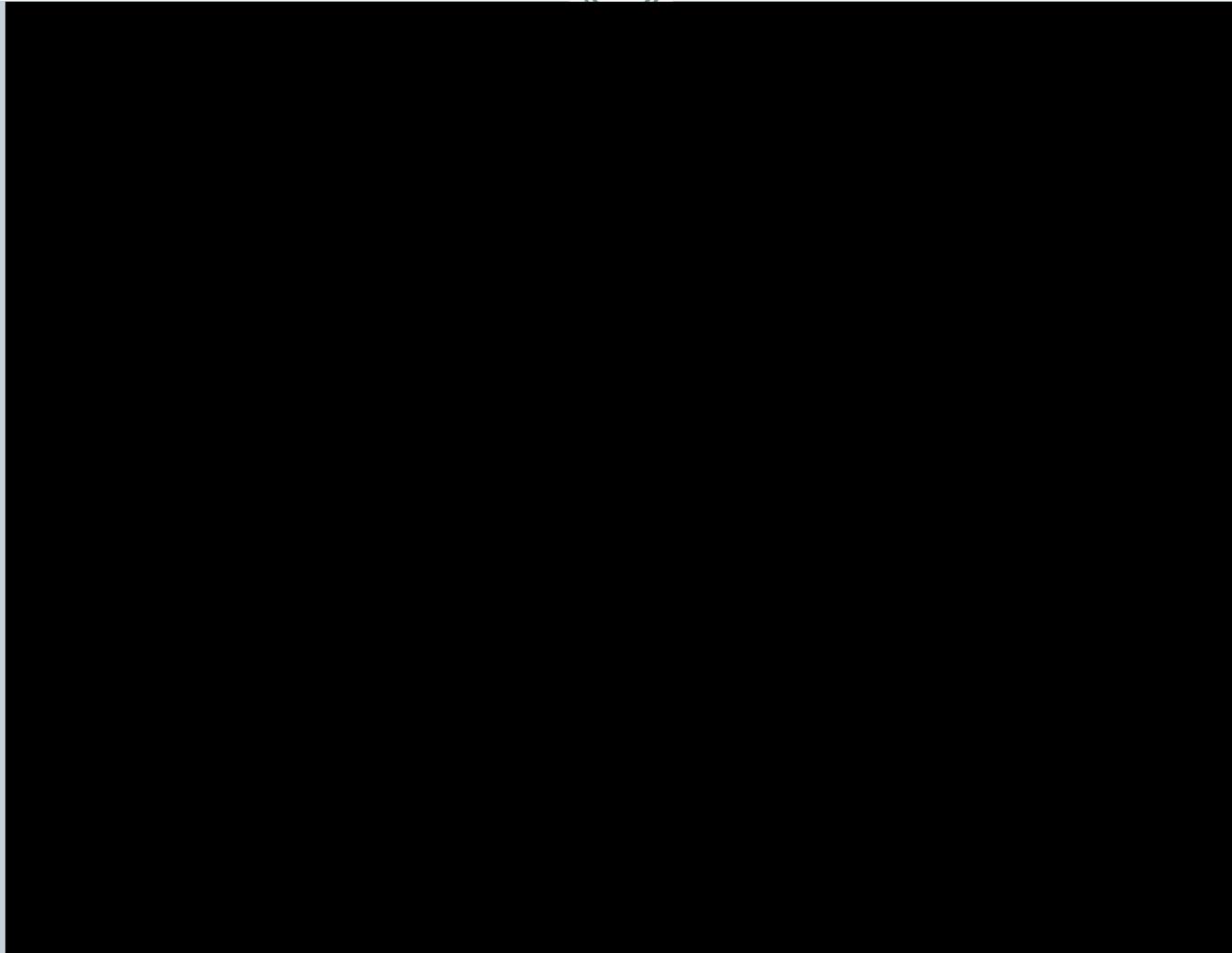
MALDI – TOF







MISSION IMPOSSIBLE! Is it really?



Issues with MALDI-TOF



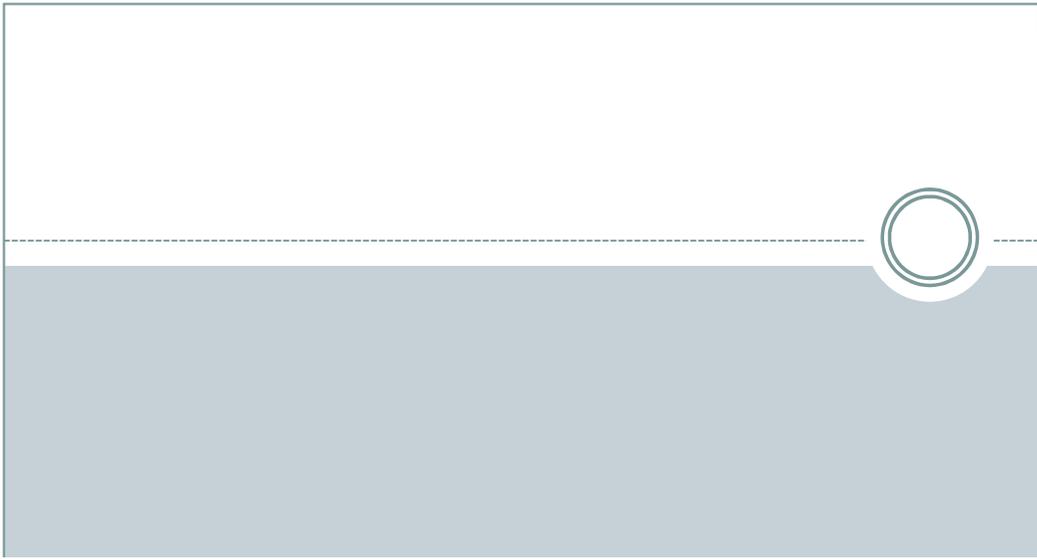
- Pure culture
- In mixed cultures, will pick up the dominant organism
- Antimicrobial susceptibility not possible
- Viruses not identified
- Identifies only organisms in database

Plate Streakers

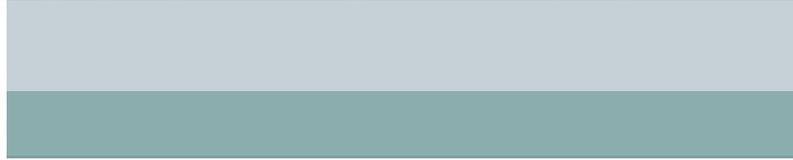


- Select appropriate media
- Loads the samples
- Spreading the inoculum to obtain isolated single colonies following incubation
- Suppliers: WASP (Copan) Previ-Isola (BioMerieux) Innova (BD) and Inoqula (KIESTRA)
- Not all systems include Gram stain preparation





The WASP manages all specimen types & styles



Way ahead.....



- Total lab automation???????

Obstacles to automation in Microbiology



- Microbiology is too complex to automate: blood, sterile body fluids, urine, catheter tips, tissues, prosthetic devices, lower respiratory tract specimens
- Variations in the processing of specimens: tissue digestion, urine colony count, impression smears preparation.....**BUT THE SIMPLER METHODS CAN BE AUTOMATED**
- Machines are programmable but humans are flexible
- Costs of automation
- Microbiology labs are small for automation.....Not all!!!

CONCLUSION-TWO QUOTES



“The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency.”

-Bill Gates



CONCLUSION-TWO QUOTES



Education makes machines which act like men and produces men who act like machines.

(Erich Fromm)



THANK YOU

