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Evaluation of Automated EM Plate Reader

Mark Gracie
LTS Manager
Pfizer

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Evaluation of Automated EM Plate Reader – Executive Summary

Our Opportunity

- QC Microbiology laboratory manually read approx. 88,000 EM plates/year.
- Is there technology to automate this manual process?

Our Solution

Identify a system that:

- Reliably reads and sorts plates
- Capability to download results directly to EM system eg MODA
- Improve/enhance compliance

Our learning journey

- Efficiency – system can read 240 plates/hour
- Simplification – “No Growth” plates removed from manual workflow.

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Our Opportunity and Process

Our opportunity

Identify methods to automate Environmental Plate reading in order to simplify the workflow and allow analysts to dedicate more time to other laboratory tasks.

1

Identify Automated System

Pfizer colleagues visited a hospital in Melbourne to observe the APAS Independence system in operation.

2

Deliver and Install of System to Pfizer Melbourne

Agreement signed with Clever Culture Systems (CCS) to deliver, install APAS Independence system for evaluation and pilot study.

3

Execution of Pilot Study Protocol

Pilot Study Protocol drafted in conjunction with Clever Culture Systems (CCS) to outline number of samples (contrived and non-contrived) to be assessed.

4

Pilot Study Summary Report

Summary report drafted detailing outcomes of the pilot study.

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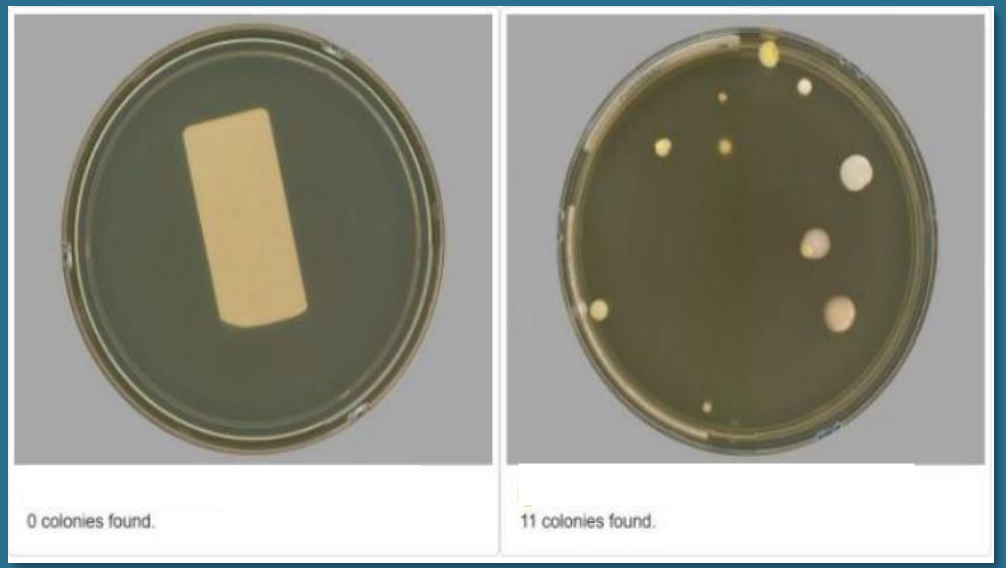
Pilot Study: Our Outcome and Solutions



Pilot Study: Our Outcome and Solutions

- **Pilot study scope and purpose:**
  The study aimed to assess the APAS Independence's ability to replace existing manual plate reading with an automated solution

- **Sample diversity and challenge representation:**

  A total of 6,538 plates were analyzed as part of the study, including 6,057 from routine environmental monitoring and 481 contrived plates designed to challenge detection capabilities, featuring various colony sizes, colors, shapes and locations

- **Evaluation methodology:**

  Performance was measured at plate and colony levels using metrics such as Positive Percent Agreement (PPA), False Negative Rate (FNR), and False Positive Rate (FPR), comparing readings from the original and a retrained algorithm modules

- **Plate-level results:**

  The original module showed a PPA of 99.82% and FNR of 0.18%, with a high false positive rate of 26.84%.

  The retrained module maintained similar PPA (99.63%) and FNR (0.37%) but reduced the FPR to 14%. False positives were largely due to plate defects and process-related artefacts.

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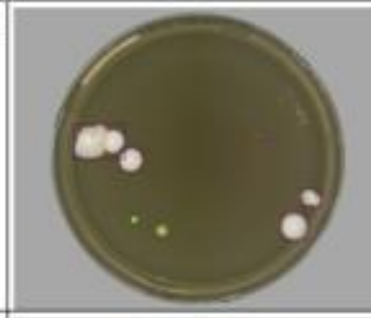
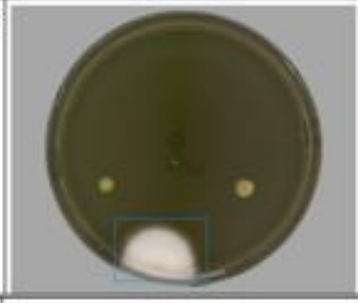
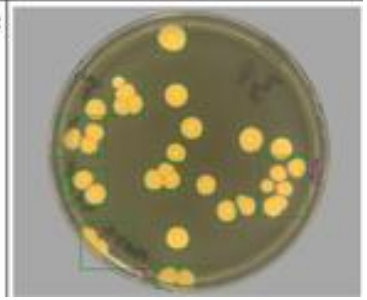
Pilot Study: Our Outcome and Solutions

- **Plate-level results: Examples**

Type of plates	Picture
With no growth	
Colony size: small	
Colony size: small Colony colour: translucent	

Type of plates	Picture
Colony size: overgrown	
Colony shape: fuzzy edges	
Colony shape: rounded	

Type of plates	Picture
Colony shape: tentacular	
Colony location: edges	
Defects in the agar	

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Pilot Study: Our Outcome and Solutions

- **Colony-level analysis:**
  For 100 randomly selected plates with growth, the original module did not identify colonies on 14 plates, mostly small, pale, or translucent colonies.
  The retrained module reduced this to 9 plates. Contrived plates posed greater detection challenges than typical samples.

- **Impact of plate defects on false positives:**
  False positives were often caused by labels, tape residue (~40%), damaged agar (~7%), and process interferences like non-microbial material (~36%). Positive plates flagged by APAS required further analyst review, highlighting the need for human oversight.

- **Instrument usability and performance:**
  No hardware issues were observed; the system provided high-quality top and bottom images with a low label reading error rate (1.19%). Compared to other automated readers, APAS Independence demonstrated superior accuracy and user-friendliness.

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Our Learning Journey and Reflections

What worked well?

- Samples used for Pilot study included routine EM samples which were readily analysed by APAS, directly after manual reads
- Instrument interface was easy to use
- Instrument automatically sorted plates with growth which would be confirmed and then provided for ID as applicable

Where did we get stuck?

- Preparation of contrived plates – difficult to replicate a contrived plate to reflect what would be seen routinely.
- False positives were often caused by labels, tape residue, damaged agar and process interferences like non-microbial material

What would we do differently and next steps?

- Data analysis/comparison to be performed at time of APAS reads
- The pilot study was for evaluation purposes only – not a validation study.
- Pilot study to be now extended to 55mm plates to assess APAS performance on plates with fewer defects

Thank You!

Mark Gracie
LTS Manager
Pfizer

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