AST Automated Systems Comparison and Review

WCLN Antibiotic Resistance Conference - 2022
April 26, 2022

Eric Beck, PhD; Technical Director – Microbiology; ACL Laboratories
Tim Block; Laboratory Manager; Froedtert West Bend Hospital
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Outline

- Brief Introductory Questions
- Beckman Coulter MicroScan System
- BD Phoenix System
- Biomeriuex Vitek 2 System
- Questions and Discussion

Does your laboratory perform antibiotic susceptibility testing?

a) Yes

b) No

For those who perform susceptibility testing within your laboratory, what is your primary testing method?

a) Beckman Coulter MicroScan
b) BD Phoenix System System
c) Biomerieux Vitek 2 System
d) MIC Strips (ETest or LioFilChem MTS)
e) Kirby-Bauer Disks

AST Automated Systems – Beckman Coulter MicroScan System

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Eric Beck, PhD, D(ABMM)
Technical Director – Microbiology
ACL Laboratories

Outline

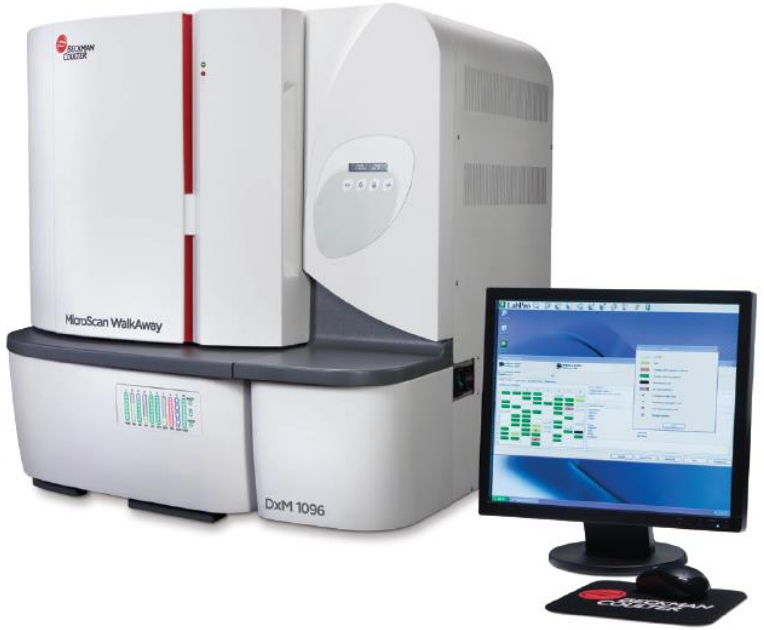
- Beckman Coulter Background
- MicroScan System Background
- Available Testing Panels
- Methodology and workflow
- Pros and Cons
- Support
- Experience

Beckman Coulter

- Make products associated with all departments of laboratory medicine
- Microbiology Lab focus is on:
  - ID/AST testing
  - Microbiology Automation

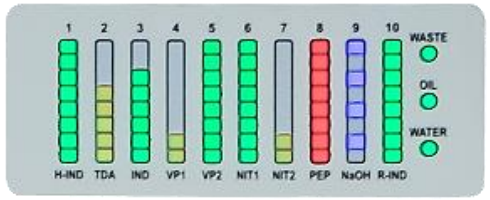
MicroScan ID/AST Systems

- MicroScan WalkAway ID/AST Systems
  - MicroScan WalkAway Plus
  - DxM MicroScan WalkAway
  - 40 plate capacity (< 500 panels/month)
  - 96 plate capacity (> 500 panels/month)
- MicroScan autoSCAN-4
  - Plate reader that connects with LabPro system
  - Useful if doing < 5 tests/day



MicroScan DxM

- Newest Version of the MicroScan WalkAway System
- Capable of performing
  - Rapid ID panels
  - Combination ID/AST panels
  - AST Only panels
- Top half of instrument = incubator
- Bottom half of instrument = reagent drawer



Types of Panels Available

- Panels include options for:
  - Identification + Sensitivity
  - Sensitivity only
- Combo panels
  - Wells dedicated to biochemical reactions
    - Utilize on board reagent inventory
  - Fewer wells available for MIC testing
    - Generally fewer antibiotics
    - Smaller dilution ranges

MICROSCAN GRAM-POSITIVE PANELS
OPTIONS FOR ROUTINE AND CRITICAL ISOLATE TESTING

										Specialty MIC		
PANEL NAME	Pos Combo 33	Pos Combo 34	Pos Combo 43	Pos Combo 44	Pos Combo 45	Pos Combo 46	Pos MIC 29	Pos MIC 34	Pos MIC 38	MICroSTREP *plus 1*	MICroSTREP *plus 2*	
MICROSCAN CATALOG NUMBER	B1017-211	B1017-214	B1017-217	B1017-218	B1017-219	B1017-220	B1017-212	B1017-216	B1017-222	B1027-201	B1017-202	
LANGUAGES	EN,ES,FR,PT	EN,ES,FR,PT	EN,ES,FR,PT	EN,ES,FR	EN,ES,FR,PT	EN,ES,FR,PT	EN,ES,FR,PT	EN,ES,FR,PT	EN,ES,FR,PT	EN,ES,FR,PT	EN,ES,FR,PT	
Antimicrobial Agent	µg/mL	µg/mL	µg/mL	µg/mL	µg/mL	µg/mL	µg/mL	µg/mL	µg/mL	µg/mL	µg/mL	Abbr.
Amoxicillin/K Clavulanate	4/2	4/2	–	4/2	4/2	4/2	4/2	–	4/2	0.5/0.25-4/2	0.5/0.25-4/2	Aug
Ampicillin	2-8	2-8	2-8	2-8	2, 8	2, 8	2-8	2-8	2, 8	0.06-4	0.06-4	Am
Ampicillin/Sulbactam	8/4-16/8	8/4-16/8	–	8/4-16/8	8/4-16/8	–	8/4-16/8	–	8/4-16/8	–	–	A/S
Azithromycin	–	–	–	2-4	2-4	–	–	–	2-4	0.25-2	0.5-2	Azi
Cefaclor	–	–	–	–	–	–	–	–	–	0.5-4	0.5-4	Cfr
Cefazolin	–	4-16	–	8-16	8-16	8-16	4-16	4-16	8-16	–	–	Cfz
Cefepime	–	–	–	–	–	8-16	–	–	4-16	0.25-2	0.25-2	Cpe
Cefotaxime	–	–	–	–	–	8-32	–	–	8-32	0.25-2	0.25-2	Cft
Cefoxitin Screen	4	4	4	4	4	4	4	4	4	–	–	CfxS
Ceftaroline	–	–	0.5-4	0.5-2	0.5-2	1-2	–	0.5-4	0.5-4	–	–	Cpt
Ceftriaxone	8, 32	–	–	–	8-32	–	4-32	4-32	4-32	0.25-2	0.25-2	Cax
Cefuroxime	–	–	–	–	–	8-16	–	–	–	0.25-2	0.25-2	Crm
Cephalothin	–	–	–	–	–	–	–	–	8-16	–	–	Cf
Chloramphenicol	–	–	–	8-16	–	–	8-16	8-16	–	1-16	1-16	C
Ciprofloxacin	1-2	1-2	1-2	1-2	1-2	–	1-2	1-2	1-2	–	–	Cp
Clarithromycin	–	–	–	–	–	–	–	–	–	–	0.25-1	Cla
Clindamycin	0.5-4	0.5-4	0.5-4	0.25-0.5, 2	0.5-4	0.5-2	0.25-4	0.25-4	0.25-4	0.06-0.5	0.06-0.5	Cd
Daptomycin	0.5-4	0.5-4	0.5-4	1, 4	1, 4	0.5-4	0.25-4	0.25-4	0.5-4	–	0.25-2	Dap
Erythromycin	0.5-4	0.5-4	0.5-4	0.5-4	0.25-4	0.25-4	0.25-4	0.25-4	0.25-4	0.06-0.5	0.06-0.5	E
Gatifloxacin	–	–	–	–	–	–	–	–	–	0.12-2	–	Gat
Gentamicin	4-8	4-8	4-8	4-8	4-8	4-8	1-8	1-8	4-8	–	–	Gm
Gentamicin Synergy Screen	500	500	500	500	500	500	500	500	500	–	–	GmS
Imipenem	–	–	–	–	–	–	4-8	–	4-8	–	–	Imp
Inducible Clindamycin Test	4/0.5	4/0.5	4/0.5	4/0.5	4/0.5	4/0.5	4/0.5	4/0.5	4/0.5	–	–	ICd
Levofloxacin	1-4	1-4	1-4	1-4	1-4	1-4	0.5-4	0.5-4	1-4	0.25-4	0.25-4	Lvx
Linezolid	1-4	1-4	1-4	2-4	2-4	2-4	0.5-4	0.5-4	1-4	–	0.5-4	Lzd
Meropenem	–	–	–	–	4-8	4-8	2-8	–	2-8	0.06-0.5	0.06-0.5	Mer
Moxifloxacin	0.5-4	0.5-4	0.5, 2-4	0.5-1, 4	–	–	0.5-4	0.25-4	–	–	0.25-4	Mxf
Nitrofurantoin	32-64	32-64	32-64	32-64	32-64	32-64	32-64	32-64	32-64	–	–	Fd
Oxacillin	0.25-2	0.25-2	0.25-2	0.25, 1-2	0.25-2	0.25, 1-2	0.25-2	0.25-2	0.25-2	–	–	Ox
Penicillin	0.03, 0.12-0.25, 2, 8	0.03, 0.12-0.25, 2, 8	0.03, 0.12-0.25, 2, 8	0.03, 0.12-0.25, 2, 8	0.03, 0.12, 2, 8	0.03, 0.12-0.25, 2, 8	0.03-8	0.03-8	0.03-2	0.03-4	0.03-4	P
Piperacillin/ Tazobactam	–	–	–	–	4/4-8/4	–	–	–	8/4	–	–	P/T
Rifampin	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2	–	–	Rif
Streptomycin Synergy Screen	1000	1000	1000	1000	1000	1000	1000	1000	1000		–	StS
Synercid	0.5-2	1-2	1-2	0.5-2	–	1-2	0.25-2	0.25-2	0.5-2	–	–	Syn
Tetracycline	4-8	4-8	4-8	4-8	4-8	4-8	1-8	2-8	4-8	0.5-4	0.5-4	Te
Tigecycline	–	–	0.25-1	–	–	0.25-0.5	–	0.12-1	0.25-1	–	–	Tgc
Trimethoprim/ Sulfamethoxazole	0.5/9.5-2/38	0.5/9.5-2/38	0.5/9.5-2/38	0.5/9.5-2/38	0.5/9.5-2/38	0.5/9.5-2/38	0.5/9.5-2/38	0.5/9.5-2/38	0.5/9.5-2/38	0.25/4.75-2/38	0.25/4.75-2/38	T/S
Vancomycin	0.25-16	0.25-16	0.25-16	0.5-16	0.5-16	0.5-16	0.25-16	0.25-16	0.25-16	0.12-1	0.12-4	Va
Total Antibiotic Tests/Panel	**24**	**24**	**23**	**27**	**27**	**27**	**28**	**26**	**32**	**18**	**21**	

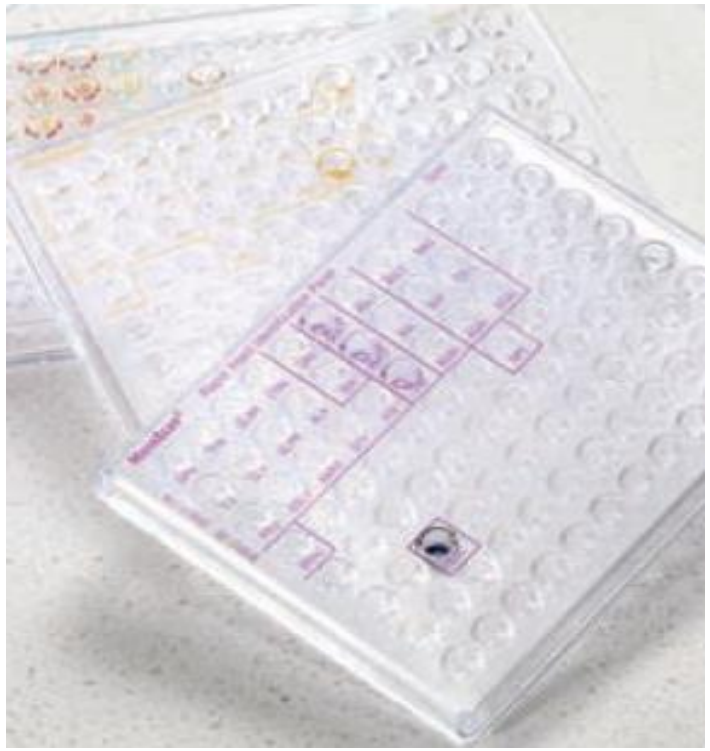
Languages: EN-English, ES-Spanish, FR-French, PT-Portuguese

For Beckman Coulter's worldwide office locations and phone numbers, please visit www.beckmancoulter.com/contact FL-297353 | 2020-8429

BECKMAN COULTER

Specialty ID Panels Available

- Specialty ID panels
  - Contain a series of biochemicals
  - Completed in about 4 hours
  - Options available for:
    - Yeast ID
    - *Haemophilus/Neisseria* ID
    - Anaerobe ID

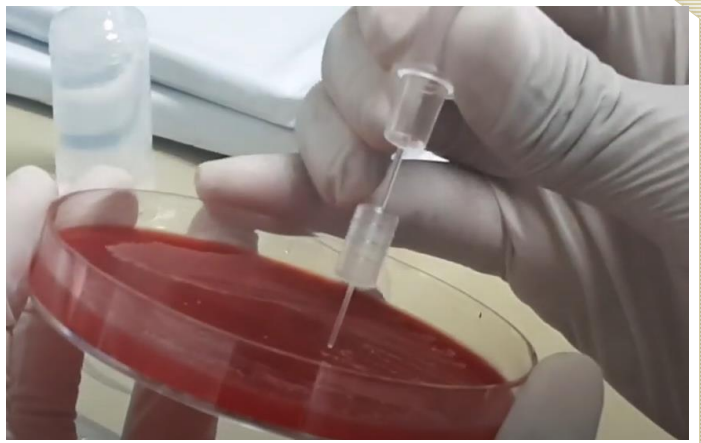


Specialty AST Panels Available

- Specialty MIC panels
  - *Streptococcus* MIC Panel
    - Designed for *Streptococcus* sp.
  - ESBL Panel
    - Designed to identify/confirm ESBLs
  - MDR Gram Neg Panel
    - Includes broad-spectrum, more powerful antibiotics such as:
      - Ceftazidime-avibactam
      - Ceftolozane-tazobactam
      - Colistin
      - Tigecycline

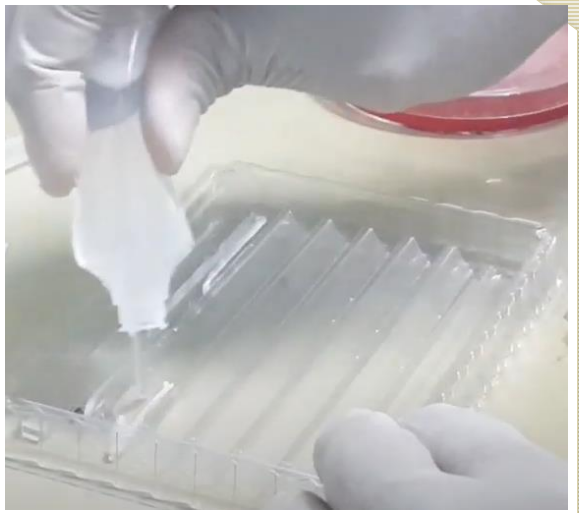
MicroScan Workflow

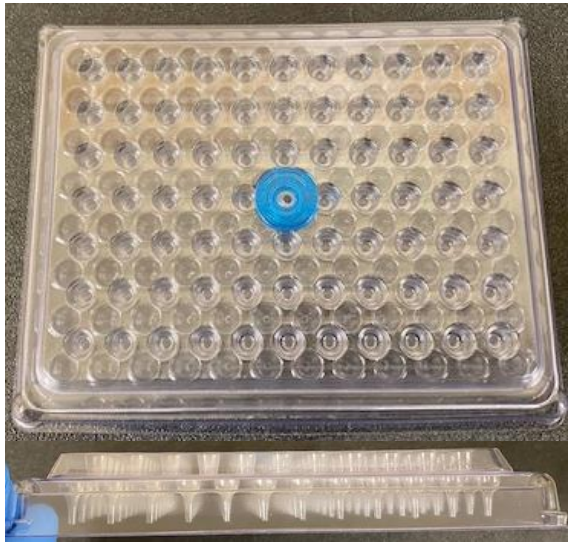
- Select isolated colonies using MicroScan Prompt inoculation wand
- Remove the collar on the inoculation wand and cap from water with pluronic surfactant
- Place wand into pluronic water bottle, close securely, shake to mix



MicroScan Workflow (cont'd)

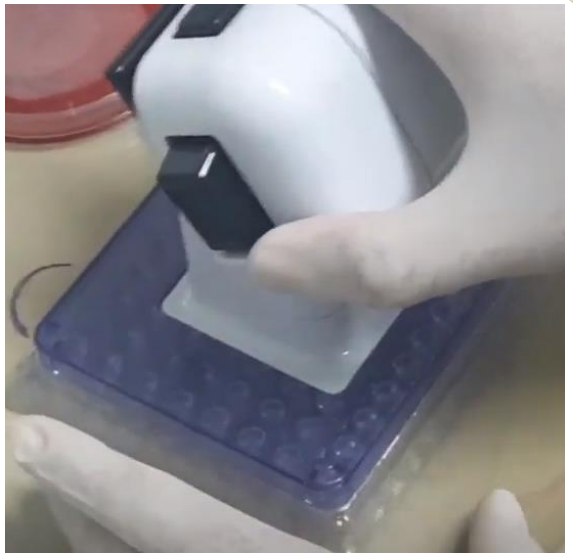
- Remove cap/wand and pour suspension into seed tray
- Place disposable inoculation cover on seed tray
  - Inoculation cover contains series of pipets

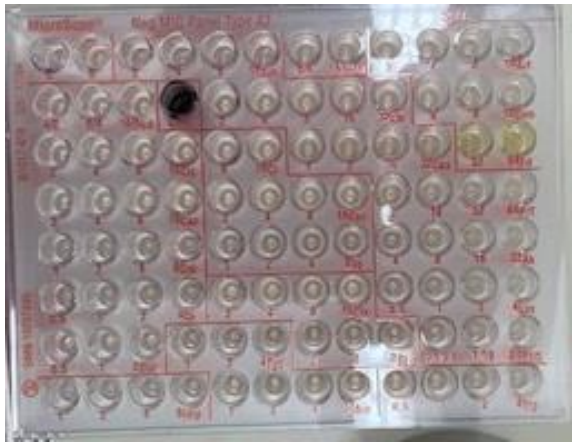




MicroScan Workflow (cont'd)

- Utilize MicroScan RENOK pipettor to aspirate bacterial suspension
- Using RENOK pipettor transfer bacterial suspension to MicroScan plate to rehydrate reagents
  - Same process for ID and sensitivity panels





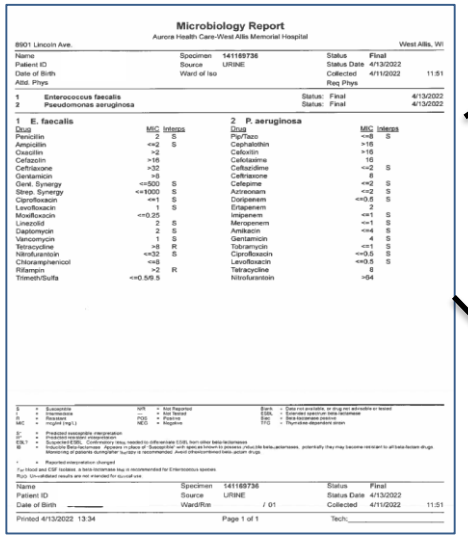
MicroScan Workflow (cont'd)

- Plates are labeled with a unique barcode
- Plates are placed in instrument
  - They are inoculated for appropriate time (18-24 hours)
  - Instrument reads the plates
    - Based on growth vs. no growth

https://www.youtube.com/watch?app=desktop&v=TZuc9IXRsRQ

MicroScan Workflow (cont'd)

- LabPro System evaluates and interprets results
  - Reads endpoints; determines MIC value
  - Assigns interpretation



Microbiology Report
Aurora Health Care-West Allis Memorial Hospital
8901 Lincoln Ave. West Allis, WI

Specimen 141169736 Status Final
Source URINE Status Date 4/13/2022
Ward of Iso Collected 4/11/2022 11:51
Req Phys

1 Enterococcus faecalis Status: Final 4/13/2022
2 Pseudomonas aeruginosa Status: Final 4/13/2022

1 E. faecalis

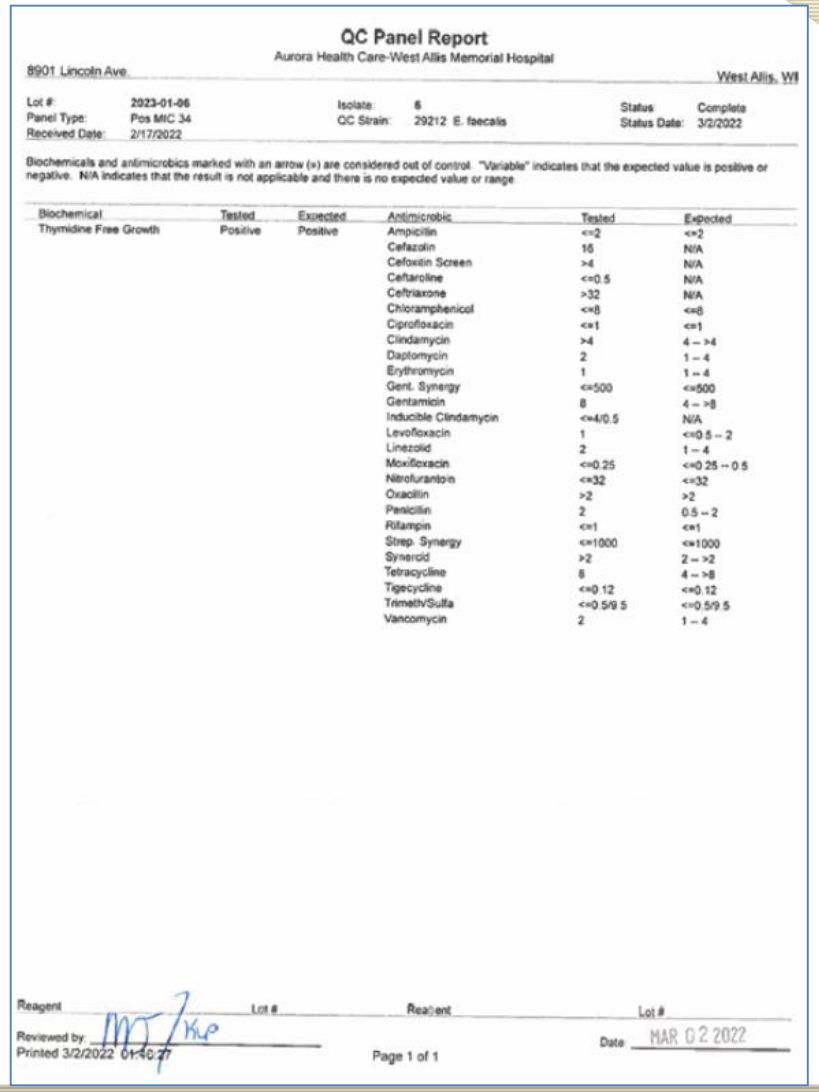
Drug	MIC	Interps
Penicillin	2	S
Ampicillin	<=2	S
Oxacillin	>2	
Cefazolin	>16	
Ceftriaxone	>32	
Gentamicin	>8	
Gent. Synergy	<=500	S
Strep. Synergy	<=1000	S
Ciprofloxacin	<=1	S
Levofloxacin	1	S
Moxifloxacin	<=0.25	
Linezolid	2	S
Daptomycin	2	S
Vancomycin	1	S
Tetracycline	>8	R
Nitrofurantoin	<=32	S
Chloramphenicol	<=8	
Rifampin	>2	R
Trimeth/Sulfa	<=0.5/9.5	

2 P. aeruginosa

Drug	MIC	Interps
Pip/Tazo	<=8	S
Cephalothin	>16	
Cefoxitin	>16	
Cefotaxime	16	
Ceftazidime	<=2	S
Ceftriaxone	8	
Cefepime	<=2	S
Aztreonam	<=2	S
Doripenem	<=0.5	S
Ertapenem	2	
Imipenem	<=1	S
Meropenem	<=1	S
Amikacin	<=4	S
Gentamicin	4	S
Tobramycin	<=1	S
Ciprofloxacin	<=0.5	S
Levofloxacin	<=0.5	S
Tetracycline	8	
Nitrofurantoin	>64	

MicroScan Workflow (cont'd)

- Includes separate options for tracking QC results
  - Reads endpoints
  - Determines MIC value
  - Determines if results are appropriate



QC Panel Report

Aurora Health Care-West Allis Memorial Hospital

8901 Lincoln Ave. West Allis, WI

Lot #: 2023-01-06 Isolate: 6 Status: Complete
Panel Type: Pos MIC 34 QC Strain: 29212 E. faecalis Status Date: 3/2/2022
Received Date: 2/17/2022

Biochemicals and antimicrobics marked with an arrow (») are considered out of control. "Variable" indicates that the expected value is positive or negative. N/A indicates that the result is not applicable and there is no expected value or range.

Biochemical	Tested	Expected
Thymidine Free Growth	Positive	Positive

Antimicrobic	Tested	Expected
Ampicillin	<=2	<=2
Cefazolin	16	N/A
Cefoxitin Screen	>4	N/A
Ceftaroline	<=0.5	N/A
Ceftriaxone	>32	N/A
Chloramphenicol	<=8	<=8
Ciprofloxacin	<=1	<=1
Clindamycin	>4	4 -- >4
Daptomycin	2	1 -- 4
Erythromycin	1	1 -- 4
Gent. Synergy	<=500	<=500
Gentamicin	8	4 -- >8
Inducible Clindamycin	<=4/0.5	N/A
Levofloxacin	1	<=0.5 -- 2
Linezolid	2	1 -- 4
Moxifloxacin	<=0.25	<=0.25 -- 0.5
Nitrofurantoin	<=32	<=32
Oxacillin	>2	>2
Penicillin	2	0.5 -- 2
Rifampin	<=1	<=1
Strep. Synergy	<=1000	<=1000
Synercid	>2	2 -- >2
Tetracycline	8	4 -- >8
Tigecycline	<=0.12	<=0.12
Trimeth/Sulfa	<=0.5/9.5	<=0.5/9.5
Vancomycin	2	1 -- 4

Reagent Lot # Reagent Lot #

Reviewed by: Date: MAR 02 2022

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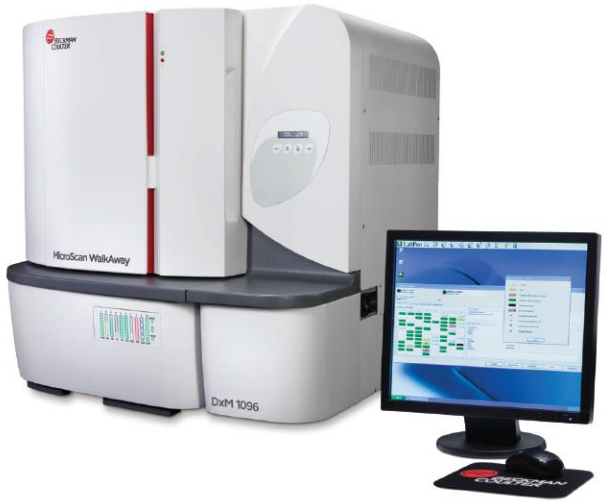
Page 1 of 1

MicroScan System PROS

- The system provides a true MIC value
- Reagents are stored at room temperature
- Panels can be read without an instrument
  - Low volume settings
  - Instrument errors can be overcome
- LabPro system
  - Pre-loaded with FDA breakpoints
  - Customizable to load alternative breakpoints
  - Allows you to add notes/reminders under certain conditions



MicroScan System CONS

- Turnaround time – 18-24 hours
- Slow to adjust formulations
- Several panels don't accommodate new breakpoints
  - Ciprofloxacin with *Enterobacterales*
    - Breakpoints recently revised to: ≤ 0.25 = S, 0.5 = I, ≥ 1 = R
    - Most microscan panels do not go below 0.5 mcg/mL
  - Similar issues with Levofloxacin
- A lot of disposable reagents required
- Manual barcoding of each plate

Support and Experience

- Support options include:
  - Weekday, business hours only
  - 24/7 service
- The instrument is highly reliable with very limited downtime
- Updates to system are painless
- Results are more accurate than other systems compared to reference methods

AST Automated Systems - BD Phoenix™ System

WCLN Antibiotic Resistance Conference - 2022
April 26, 2022

Tim Block, MT(ASCP)
Laboratory Manager
Froedtert West Bend Hospital

Phoenix ID/AST Systems

BD Phoenix™ M50 instrument

Phoenix ID/AST Systems

BD Phoenix™ M50 instrument

- 50 panel capacity (49)
- Ability to "stack" two analyzers for 100 panel capacity

BD Phoenix™ AP instrument

- Automated dilutions

Phoenix - Types of Panels Available

- Panels include options for:
  - Identification + Sensitivity (Combo)
    - 45 wells dedicated to ID
    - 84 wells for sensitivity
  - Sensitivity only
    - ID side is empty
    - Same AST dilution profile as combo panels
  - Emerge™ panel
    - Both sides utilized for AST
    - Allows for more antibiotics and extended dilutions

Types of Panels Available

BD Phoenix™ Gram negative panels

Rapid and accurate detection of antimicrobial resistance

BD Phoenix™ Gram negative panels			
Combination panels	Name	NMIC/ID-307	NMIC/ID-308
	Cat. no.	449289	449282
AST only panels	Name	NMIC-307	NMIC-308
	Cat. no.	449283	449065
Antibiotic	MIC test range (µg/ml)		
CPO Detection	Yes	Yes	
CPO Classification	-	-	
Confirmatory ESBL	Yes	Yes	
Amikacin	8 - 32	8 - 32	
Amoxicillin/Clavulanate (CLSI)	-	4/2 - 16/8	
Ampicillin	4 - 16	4 - 16	
Ampicillin/Sulbactam	1/0.5 - 16/8	-	
Aztreonam	2 - 16	2 - 16	
Cefazolin	1 - 16	1 - 16	
Cefepime	1 - 16	1 - 16	
Cefoxitin	-	-	
Ceftaroline	-	-	
Ceftazidime	2 - 16	2 - 16	
Ceftazidime/Avibactam	-	-	
Ceftolozane/Tazobactam	-	1/4 - 8/4	
Ceftriaxone[1]	1 - 32	1 - 32	
Cefuroxime	-	-	
Ciprofloxacin	0.25 - 2	0.25 - 2	
Ertapenem	0.25 - 1	0.25 - 1	
Gentamicin	2 - 8	2 - 8	
Imipenem	-	-	
Levofloxacin	0.5 - 4	0.5 - 4	
Meropenem	0.5 - 8	0.5 - 8	
Meropenem/Vaborbactam	-	-	
Minocycline	-	1 - 8	
Moxifloxacin	-	-	
Nitrofurantoin	16 - 64	-	
Piperacillin/Tazobactam	2/4 - 64/4	2/4 - 64/4	
Tetracycline	2 - 8	-	
Tigecycline	-	-	
Tobramycin	2 - 8	2 - 8	
Trimethoprim/ Sulfamethoxazole	0.5/9.5 - 2/38	0.5/9.5 - 2/38	

BD Phoenix™ Gram negative Emerge™ panels			
Name	NMIC-305	NMIC-306	NMIC-311
Cat. no.	449294	449292	449452
MIC test range (µg/ml)			
Yes	Yes	-	
Yes	Yes	-	
Yes	Yes	Yes	
8 - 32	8 - 32	8 - 32	
-	4/2 - 16/8	4/2 - 16/8	
2 - 16	4 - 16	4 - 16	
-	1/0.5 - 16/8	1/0.5 - 16/8	
1 - 16	2 - 16	2 - 16	
1 - 16	1 - 16	1 - 16	
0.5 - 16	1 - 16	0.5 - 16	
4 - 16	4 - 16	4 - 16	
0.25 - 1	0.25 - 1	0.25 - 1	
1 - 16	2 - 16	2 - 16	
0.25/4 - 8/4	0.25/4 - 8/4	0.25/4 - 8/4	
0.5/4 - 8/4	1/4 - 8/4	1/4 - 8/4	
1 - 32	1 - 32	1 - 32	
4 - 16	4 - 16	4 - 16	
0.25 - 2	0.25 - 2	0.25 - 2	
0.25 - 2	0.25 - 2	0.25 - 1	
2 - 8	2 - 8	2 - 8	
0.25 - 8	-	0.25 - 8	
0.25 - 4	0.5 - 4	0.25 - 4	
0.5 - 8	0.5 - 8	0.5 - 8	
2/8 - 16/8	2/8 - 16/8	2/8 - 16/8	
1- 8	1- 8	1 - 8	
-	1 - 4	1 - 4	
16 - 64	16 - 64	16 - 64	
2/4 - 64/4	2/4 - 64/4	2/4 - 64/4	
-	2 - 8	2 - 8	
0.5 - 8	1 - 8	1 - 8	
2 - 8	2 - 8	2 - 8	
0.5/9.5 - 2/38	0.5/9.5 - 2/38	0.5/9.5 - 2/38	

- Ideal for use in conjunction with BD Bruker MALDI Biotyper® System
- Additional drugs
- Additional dilutions

BD

Types of Panels Available

BD Phoenix™ Gram positive panels

Rapid and accurate detection of antimicrobial resistance

BD Phoenix™ Gram positive panels					
Combination panels	Name	PMIC/ID-106	PMIC/ID-107	PMIC/ID-108	PMIC/ID-109
	Cat. no.	448606	448607	448608	448609
AST only panels	Name	PMIC-106	PMIC-107	PMIC-108	PMIC-109
	Cat. no.	448416	448417	448418	448419
Antibiotic	MIC test range (µg/ml)				
Inducible macrolide resistance test (iMLSb)	Yes	Yes	Yes	Yes	
Ampicillin	0.0625 - 8	0.125 - 8	0.125 - 8	0.125 - 8	
Ampicillin/Sulbactam	-	2/1 - 16/8	-	2/1 - 16/8	
Cefazolin	2 - 16	2 - 16	2 - 16	-	
Cefoxitin	4 - 16	4 - 16	4 - 16	4 - 16	
Ceftaroline	-	-	-	-	
Chloramphenicol	-	-	-	-	
Clindamycin	0.5 - 2	0.5 - 2	0.5 - 2	0.5 - 2	
Daptomycin	1 - 4	1 - 4	1 - 4	1 - 4	
Doxycycline	0.5 - 8	-	-	-	
Erythromycin	0.5 - 4	0.5 - 4	0.5 - 4	0.5 - 4	
Gentamicin	2 - 8	2 - 8	1 - 16	1 - 8	
Gentamicin/Synergy	500	500	500	500	
Levofloxacin	0.5 - 4	1 - 4	1 - 4	1 - 4	
Linezolid	0.5 - 4	1 - 4	1 - 4	1 - 4	
Meropenem	-	-	-	2 - 16	
Minocycline	-	1 - 8	1 - 8	-	
Moxifloxacin	0.5 - 2	0.5 - 4	0.5 - 2	0.5 - 4	
Nitrofurantoin	16 - 64	16 - 64	16 - 64	16 - 64	
Norfloxacin	-	-	-	-	
Oxacillin	0.25 - 2	0.25 - 2	0.25 - 2	0.25 - 2	
Penicillin	0.0625 - 1	0.125 - 8	0.125 - 8	0.125 - 8	
Quinupristin/Dalfopristin	0.5 - 2	-	0.5 - 2	0.5 - 2	
Rifampin	0.5 - 2	0.5 - 2	0.5 - 2	0.5 - 2	
Streptomycin/Synergy	1000	1000	1000	1000	
Tetracycline	0.5 - 8	0.5 - 8	0.5 - 8	0.5 - 8	
Tigecycline	-	-	-	-	
Trimethoprim/ Sulfamethoxazole	1/19 - 4/76	0.5/9.5 - 2/38	0.5/9.5 - 2/38	0.5/9.5 - 2/38	
Vancomycin	0.5 - 16	0.5 - 16	0.5 - 16	0.5 - 16	

BD Phoenix™ Gram positive Emerge™ panel	
Name	PMIC-110
Cat. no.	449036
MIC test range (µg/ml)	
	0.125 - 8
	2/1 - 16/8
	2 - 16
	4 - 16
	0.125 - 4
	1 - 32
	0.5 - 4
	0.5 - 4
	0.5 - 16
	0.25 - 4
	1 - 8
	500
	1 - 4
	1 - 4
	2 - 16
	1 - 8
	0.5 - 4
	16 - 64
	1 - 16
	0.25 - 4
	0.0625 - 16
	0.5 - 2
	0.25 - 2
	1000
	0.5 - 8
	0.125 - 2
	0.5/9.5 - 2/38
	0.5 - 32

- Ideal for use in conjunction with BD Bruker MALDI Biotyper® System
- Additional drugs
- Additional dilutions

BD Phoenix™ Strep panels		
Combination panel	Name	SMIC/ID-101
	Cat. no.	448802
AST only panel	Name	SMIC-101
	Cat. no.	448803
Antibiotic	MIC test range (µg/ml)	
Amoxicillin	0.25 - 4	
Cefepime	0.0625 - 2	
Cefotaxime	0.0625 - 2	
Ceftriaxone	0.0625 - 2	
Clindamycin	0.03125 - 2	
Erythromycin	0.03125 - 4	
Levofloxacin	0.5 - 4	
Linezolid	0.5 - 4	
Meropenem	0.0625 - 2	
Moxifloxacin	0.25 - 2	
Penicillin	0.03125 - 8	
Tetracycline	0.25 - 8	
Trimethoprim/ Sulfamethoxazole	0.25/4.75 - 2/38	
Vancomycin	0.25 -16	

BD Phoenix™ ID panels			
	Gram Negative	Gram Positive	Yeast
Name	NID	PID	Yeast ID
Cat. no.	448007	448008	448316

Panel Technology

- Identification
  - Conventional biochemical
  - Chromogenic biochemical reactions
  - Fluorogenic biochemical reactions
  - Available for Gram positive, Gram negative, Streptococcus sp, and yeast
- AST
  - Broth based micro dilution
  - Utilizes a redox indicator and turbidity to detect growth
  - Available for Gram negative, Gram positive, and Streptococcus

Specialty AST Testing

CPO Detect

- Carbapenemase detection and classification
- Growth-based algorithms for detection
- Enterobacterales, *P. aeruginosa, A. baumannii*

ESBL Test

- Based on CLSI procedure
- *E. coli, K. pneumoniae*, and *K. oxytoca*

Inducible Macrolide Resistance

- Based on CLSI procedure (D-test)
- *Staphylococcus* species

Phoenix Workflow

- Create 0.5 McFarland suspension of organism.
  - Select isolated colonies and suspend in BD Phoenix ID broth
  - Vortex, read on nephelometer
- Add drop of AST indicator to AST broth
- Transfer 25µL of suspension from ID tube to AST tube
- Pour both ID and AST broth into respective side of panel

Phoenix Workflow (Alternate)

- Phoenix™ AP
- Create suspension
- AP adjusts suspension to correct McFarland equivalent
- AP adds AST indicator and pipettes suspension to AST broth
- Manually pour both ID and AST broth into respective side of panel

Phoenix Workflow, (cont'd)

- Cap panels
- Load panel onto instrument
- Instrument takes initial read on panel, then every 20 minutes for up to 16 hours.

Phoenix Workflow, (cont'd)

- EpiCenter
  - Evaluates and interprets results
  - Reads endpoints; determines MIC value
  - Assigns interpretation
    - FDA guidelines
    - Custom

Isolate Number: 1 **Final**

Organism Name: Escherichia coli
Isolate Classification: Significant / Unknown

Isolate AST Results

Antimicrobial	MIC or Concentration	Interp	Expert SIR	Final SIR	Rule Number	Drug Test Group
Amikacin	<=8	S		S		B
Ampicillin	>16	R		R		A
Ampicillin-Sulbactam	>16/8	R		R		B
Aztreonam	<=2	S		S		B
Cefazolin	4	S		S		A
Cefepime	<=1	S		S		B
Ceftazidime	<=2	S		S		B
Ceftriaxone	<=1	S		S		B
Ciprofloxacin	<=0.25	S		S		B
Ertapenem	<=0.25	S		S		B
Gentamicin	<=2	S		S		A
Levofloxacin	<=0.5	S		S		B
Meropenem	<=0.5	S		S		B
Nitrofurantoin	32	S		S		U
Piperacillin-Tazobactam	<=2/4	S		S		B
Tetracycline	<=2	S		S		B
Tobramycin	<=2	S		S		A
Trimethoprim-Sulfamethoxazole	<=0.5/9.5	S		S		B

Phoenix Workflow (cont'd)

- EpiCenter
  - Applies standard and custom rules

Isolate Number: 1 — **Final**

Organism Name: Staphylococcus simulans
Isolate Classification: Significant / Unknown

Isolate AST Results

Antimicrobial	MIC or Concentration	Interp	Expert SIR	Final SIR	Rule Number	Drug Test Group
Ampicillin			R	R	132	N
Cefazolin	<=2		R	R	132	N
Cefoxitin	<=4		R	R	132	N
Clindamycin	<=0.5	S	R	R	1470	O
Daptomycin	<=1	S		S		B
Doxycycline	<=0.5	S		S		B
Erythromycin	>4	R	X	X	140	N
Gentamicin	<=2	S		S		B
Gentamicin-Syn					1597	N
Levofloxacin	>4	R		R		B
Linezolid	1	S		S		B
Moxifloxacin	>2	X		X		N
Nitrofurantoin	<=16	S		S		U
Oxacillin	>1	R		R		A
Penicillin G	>1	R		R		A
Quinupristin-dalfopristin	1					N
Rifampin	<=0.5	S		S		B
Streptomycin-Syn					1597	N
Tetracycline	<=0.5	S		S		B
Vancomycin	<=0.5	S		S		B

Resistance Markers

Rule 1506	BLACT	☑ Beta-lactamase producing Staphylococcus
Rule 1530	MRS	☑ Methicillin Resistant Staphylococcus
Rule 1547	STAIML	☑ Staphylococcus Inducible MLSb Phenotype

Quality Control

- QC panels loaded in QC mode
  - Determines MIC value
  - Tracks biochemical results
  - Determines if results are appropriate

Phoenix System PROS

- No biochemical reagents
- Mechanically reliable
  - Minimal moving parts
- Epicenter
  - Pre-loaded with FDA breakpoints
  - Ability to customize alternative breakpoints
  - Ability to build custom rules
    - Sensitivity changes
    - Allows you to add notes/reminders under certain conditions

Phoenix System PROS (cont'd)

- No off-line tests
- Low inoculum option (0.25 McFarland)
- Compatible with Bruker MALDI-TOF

Phoenix System CONS

- Turnaround time – 16 hours
- Slow to adjust formulations and breakpoints
- Manual labeling/inoculation of each panel
- Cannot be read manually
- Manual set up is time consuming
- Automated set up is space consuming

Phoenix System CONS (cont'd)

Panel Limitations

- Gram positive
  - Overcall of SXT resistance on *S. aureus* isolates
    - Erythromycin: *Enterococcus* species other than *E. faecalis* and *E. faecium*
    - Nitrofurantoin: *Enterococcus faecium*
    - Levofloxacin: *Enterococcus* species other than *E. faecalis* and *E. faecium*
    - Rifampin: All *Enterococcus* species
    - Trimethoprim/Sulfamethoxazole: *Staphylococcus* species other than *S. aureus*
    - Vancomycin: *Enterococcus casseliflavus*, *Enterococcus gallinarum*, and *Enterococcus casseliflavus/gallinarum*
- Gram negative
  - CPO Detect reliability is questionable

• Ampicillin-sulbactam	*Proteus vulgaris* and *Proteus penneri*
• Ciprofloxacin	*Stenotrophomonas maltophilia*
• Gentamicin	*Providencia stuartii*
• Meropenem	*Proteus mirabilis*
• Piperacillin-tazobactam	*Acinetobacter* species and *Stenotrophomonas maltophilia*
• Tobramycin	*Providencia stuartii*
• Trimethoprim-sulfamethoxazole	*Serratia marcescens*

- Strep
  - Cefepime: *Streptococcus parasanguinis*
  - Erythromycin: *Streptococcus* viridans group except *Streptococcus* bovis group

Support and Experience

- Support options include:
  - Tech Support hotline
  - Service agreements
- Highly reliable

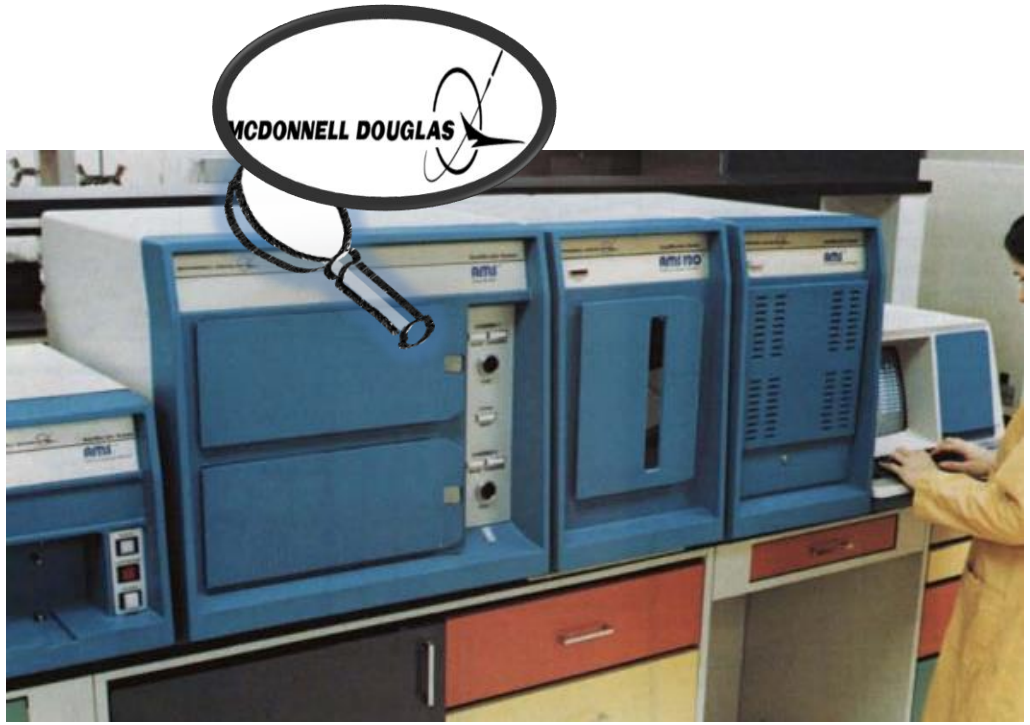
AST Automated Systems – bioMerieux Vitek System

WCLN Antibiotic Resistance Conference - 2022
April 26, 2022

Thomas Novicki, PhD, D(ABMM)
Clinical Laboratory Scientist – Microbiology
Marshfield Labs

Then and Now

The OG (Original Gadget)



The Vitek 2

A Short History Lesson

- Vitek AMS ID & AST instrument
  - Designed for space by McDonnell-Douglas and NASA.
  - Introduced commercially in 1979.
  - Acquired by bMx in 1988.
- Vitek 2
  - Introduced in the USA in 2003.
  - Built on the Vitek AMS:
    - More automation.
    - A rapid, dynamic AST system.
    - Novel five step Advanced Expert System (AES).
    - Two platform designs with capacities of 15-120 cards.

Vitek 2

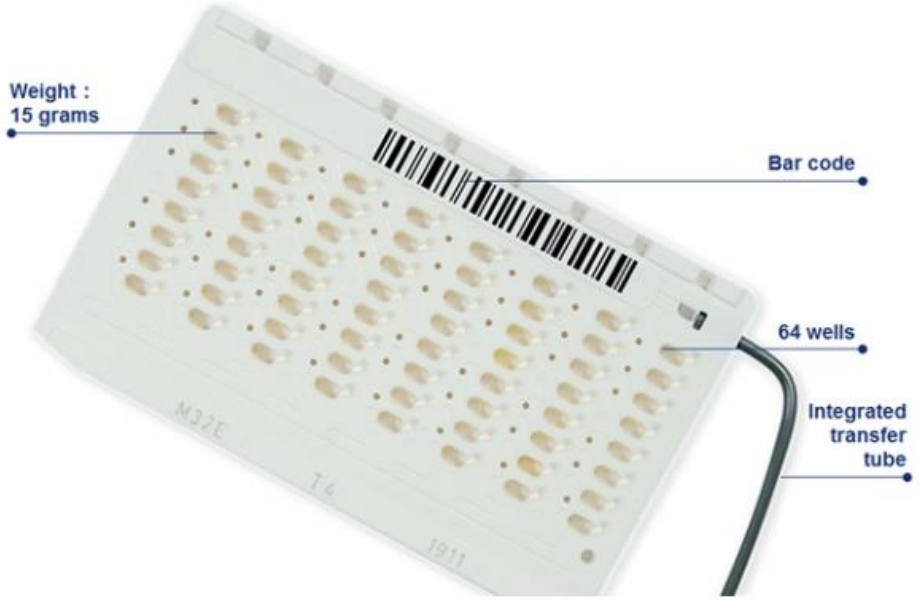
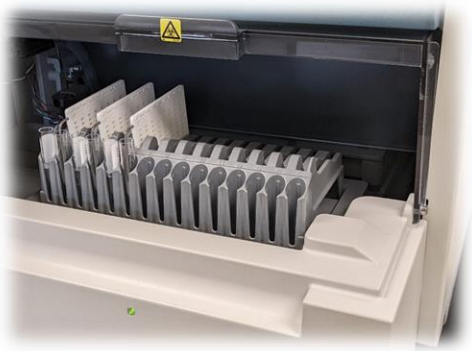


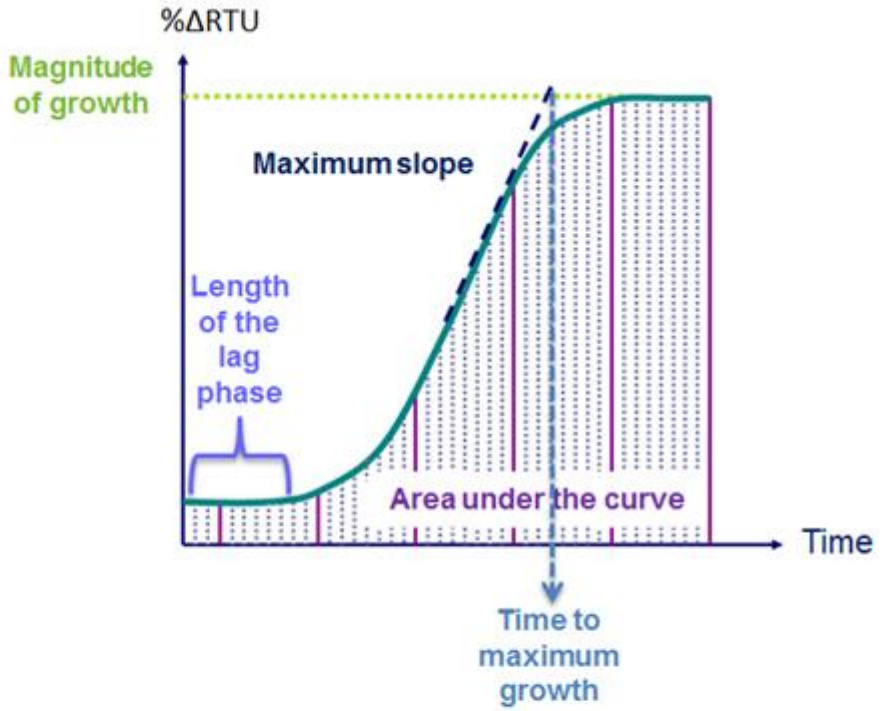
Figure 1: VITEK® 2 AST Card

https://www.biomerieux-microbio.com/



Rapid AST – That Old Black Magic

- Standard AST: end-point method.
- Vitek 2: dynamic, calculation-based.
  - Growth rate & AUC for each drug.
  - Data compared to >3,000 reference strains to calculate MICs.



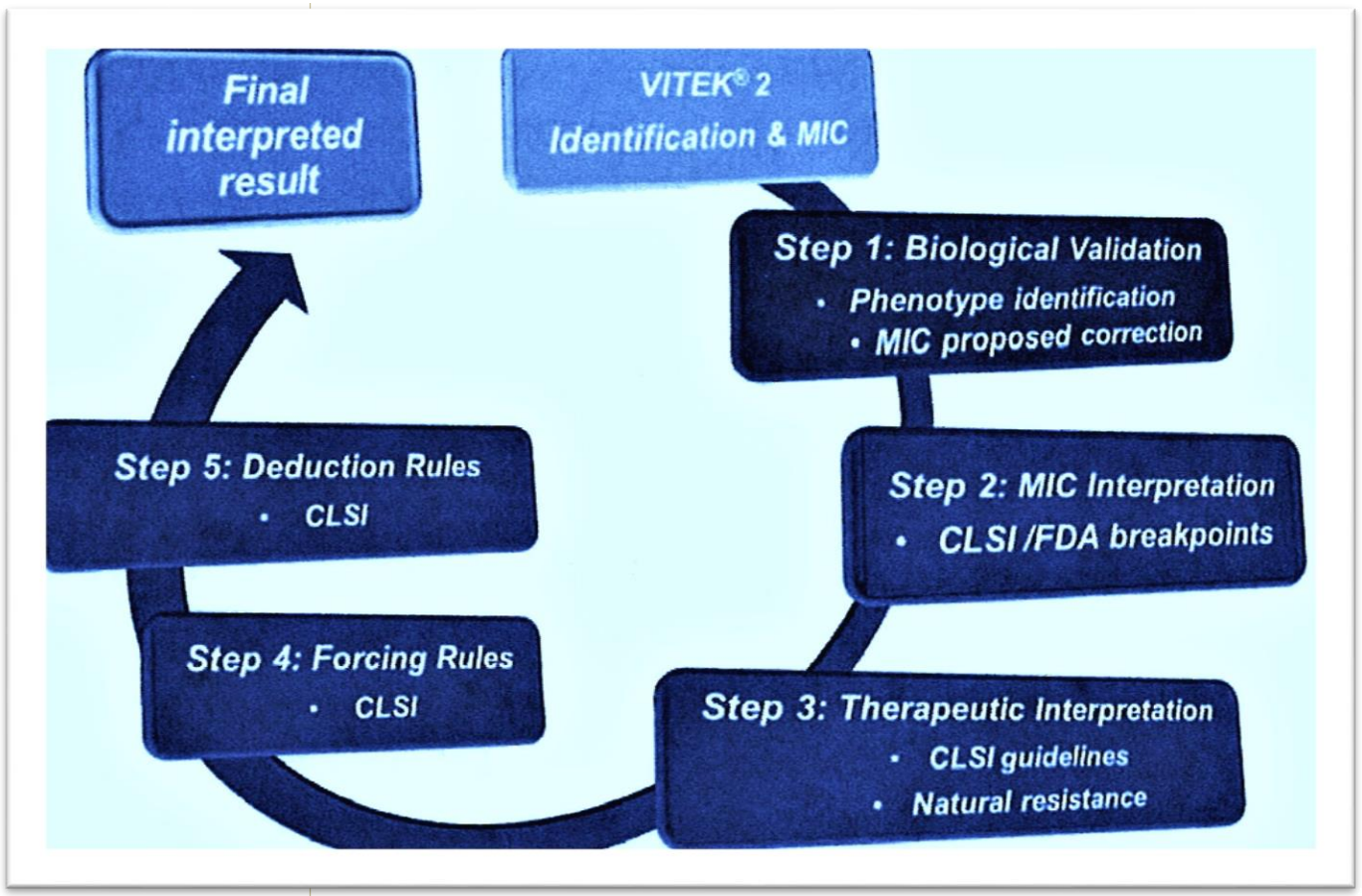
Magnitude of growth = Maximum percent change of the transmittance signal (RTU)
Maximum slope = maximum rate of growth during exponential growth phase

https://www.biomerieux-microbio.com

Advanced Expert System

Not Your Grandma's Rules-based Expert System

- AES: a five-step expertization process.
- Fundamentally different from, and more complex than, standard bug/drug expert rules systems.

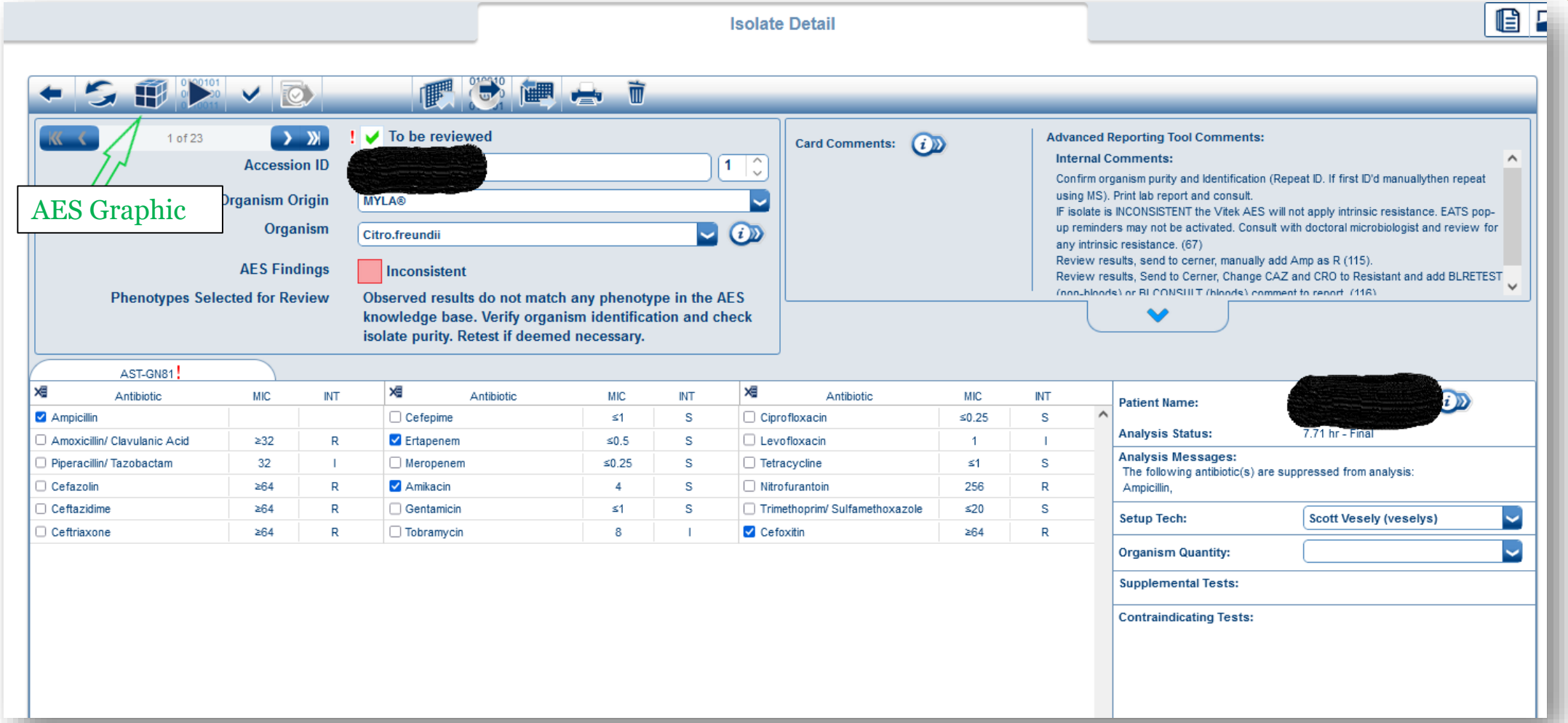


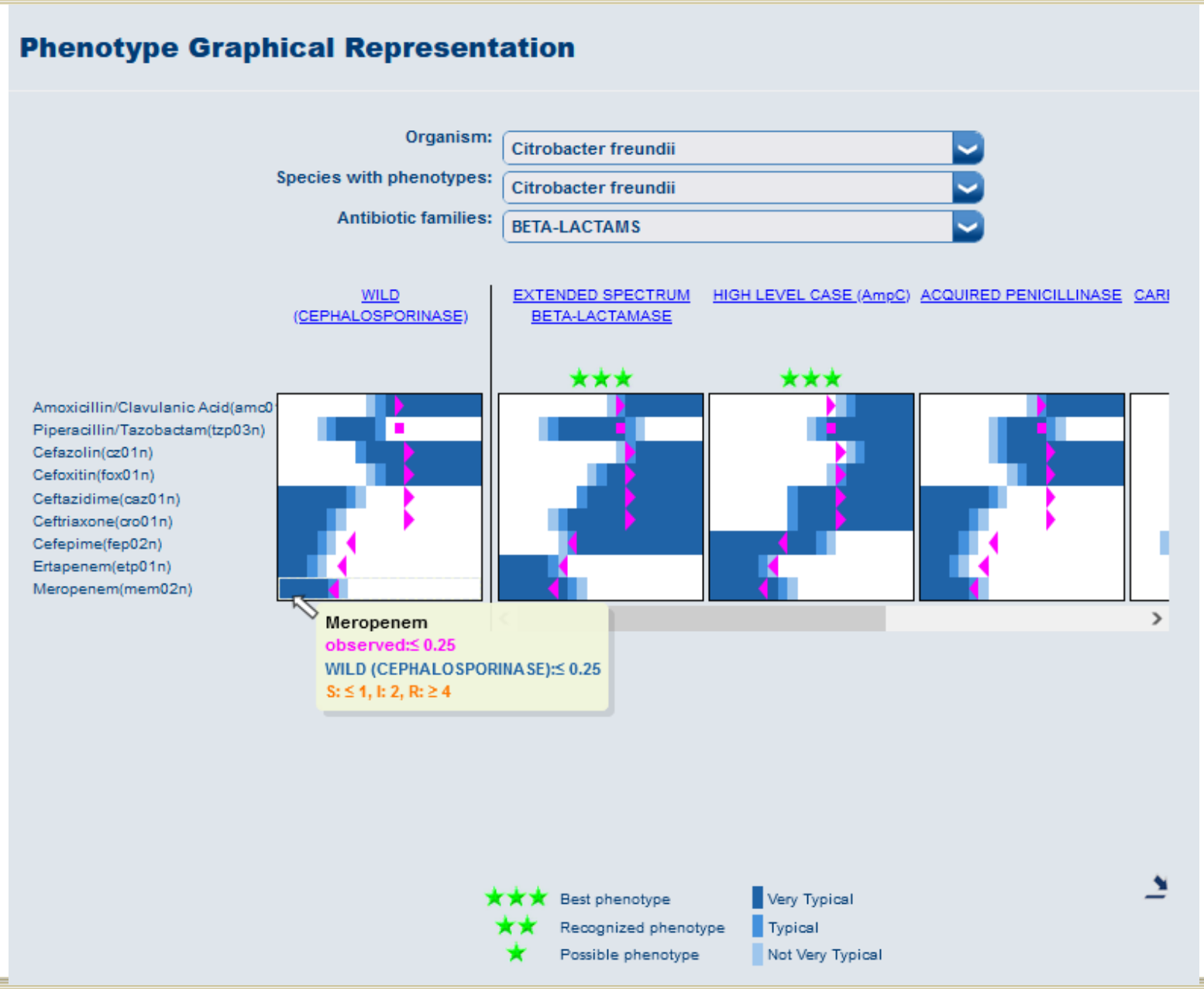
Source: bioMerieux University Advanced AES training manual

AES Step 1. Biological Validation

Approach:

- Looks at the entire drug class phenotype, not bug/drug.
- Phenotypes based on known drug resistance mechanisms (e.g. ESBL, KPC).
- Phenotypic data from >100,000 references and in-house testing.
- AES DB continually updated.

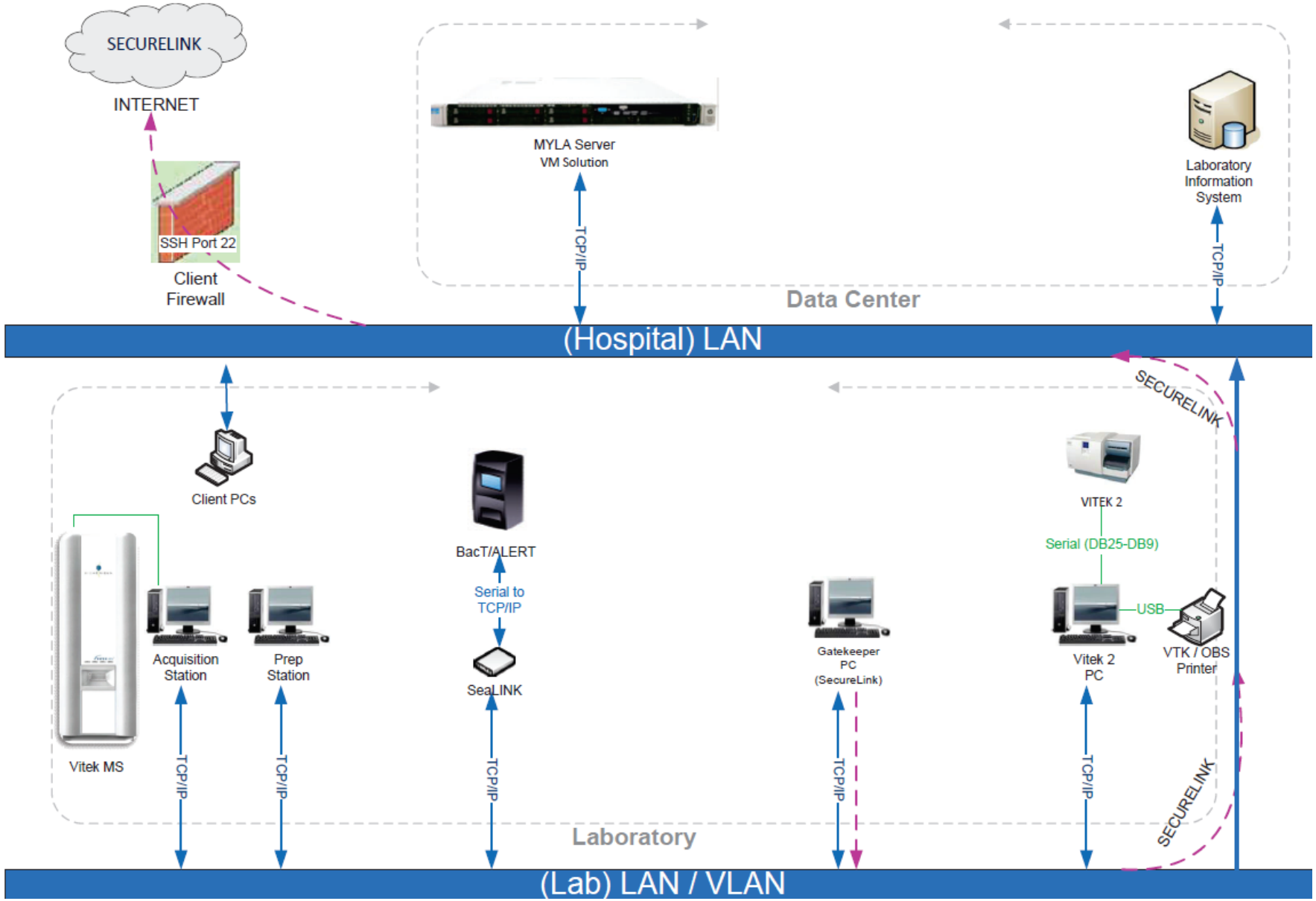

Isolate Detail
AES Graphic
1 of 23
To be reviewed
Accession ID
[redacted]
1
Organism Origin
MYLA®
Organism
Citro.freundii
AES Findings
Inconsistent
Phenotypes Selected for Review
Observed results do not match any phenotype in the AES knowledge base. Verify organism identification and check isolate purity. Retest if deemed necessary.
Card Comments:
Advanced Reporting Tool Comments:
Internal Comments:
Confirm organism purity and Identification (Repeat ID. If first ID'd manuallythen repeat using MS). Print lab report and consult.
IF isolate is INCONSISTENT the Vitek AES will not apply intrinsic resistance. EATS pop-up reminders may not be activated. Consult with doctoral microbiologist and review for any intrinsic resistance. (67)
Review results, send to cerner, manually add Amp as R (115).
Review results, Send to Cerner, Change CAZ and CRO to Resistant and add BLRETEST
AST-GN81
Antibiotic MIC INT
Ampicillin
Amoxicillin/ Clavulanic Acid ≥32 R
Piperacillin/ Tazobactam 32 I
Cefazolin ≥64 R
Ceftazidime ≥64 R
Ceftriaxone ≥64 R
Cefepime ≤1 S
Ertapenem ≤0.5 S
Meropenem ≤0.25 S
Amikacin 4 S
Gentamicin ≤1 S
Tobramycin 8 I
Ciprofloxacin ≤0.25 S
Levofloxacin 1 I
Tetracycline ≤1 S
Nitrofurantoin 256 R
Trimethoprim/ Sulfamethoxazole ≤20 S
Cefoxitin ≥64 R
Patient Name:
[redacted]
Analysis Status:
7.71 hr - Final
Analysis Messages:
The following antibiotic(s) are suppressed from analysis:
Ampicillin,
Setup Tech:
Scott Vesely (veselys)
Organism Quantity:
Supplemental Tests:
Contraindicating Tests:



AES Analysis Results

- Green*: Consistent
- Yellow*: Consistent with correction
- Red**: Inconsistent
- Purple**: No phenotypes available

* All other AES steps done
** S/I/Rs only


SECURELINK
INTERNET
SSH Port 22
Client Firewall
MYLA Server VM Solution
TCP/IP
Laboratory Information System
TCP/IP
Data Center
(Hospital) LAN
SECURELINK
Client PCs
BacT/ALERT
Serial to TCP/IP
SeaLINK
VITEK 2
Serial (DB25-DB9)
Vitek MS
Acquisition Station
Prep Station
Gatekeeper PC (SecureLink)
Vitek 2 PC
USB
VTK / OBS Printer
TCP/IP
TCP/IP
TCP/IP
TCP/IP
TCP/IP
SECURELINK
Laboratory
(Lab) LAN / VLAN

Conclusions

Pros

- Reliable operation, efficient workflow, & great tech support.
- Wide range of AST & ID cards.
- Rapid AST results vs endpoint methods.
- Seamless pairing with Vitek MS.
- Integrates with LIS, other bMx instruments, tech workstations over network.
  - Extends to off-site labs.
- Competitive cost-per-test pricing.

Cons

- AES isn't practical, and whose worth isn't clear to me.
- Positioning of Myla on a network server brings in an extra IT layer.
  - Biggest impact was at start-up for us.

QUESTIONS??