

# The Staph ID/R Blood Culture Panel: An FDA Cleared Rapid Detection Method for *Staphylococcus* and the *mecA* Gene Direct from Positive Blood Culture

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## Abstract

Staphylococci (Staph) bacteria are one of the most common causes of healthcare-associated bloodstream infections. The Staph ID/R Blood Culture Panel is a DNA multiplex assay that directly detects *S. aureus*, *S. lugdunensis*, other *Staph* species, and the *mecA* gene (for methicillin-resistance) within 2 hours from a positive blood culture. The Staph ID/R Blood Culture Panel demonstrates a limit of detection (LoD) well below typical blood culture bacteria load and a broad reactivity profile across multiple Staph species.

The assay is unique in its ability to distinguish Coagulase-negative *Staphylococcus* (CoNS), which may not require treatment with antibiotics, from pathogenic *Staphylococcus*. In addition the Staph ID/R Blood Culture Panel displays high specificity, is broadly reactive within the genus, and is compatible across multiple blood culture bottle types and manufacturers. Fast and accurate diagnosis of Staph bloodstream infections leads to decreased hospital length of stay, lower treatment costs by rapidly directing appropriate antimicrobial therapy and assists healthcare organizations with antimicrobial stewardship programs.

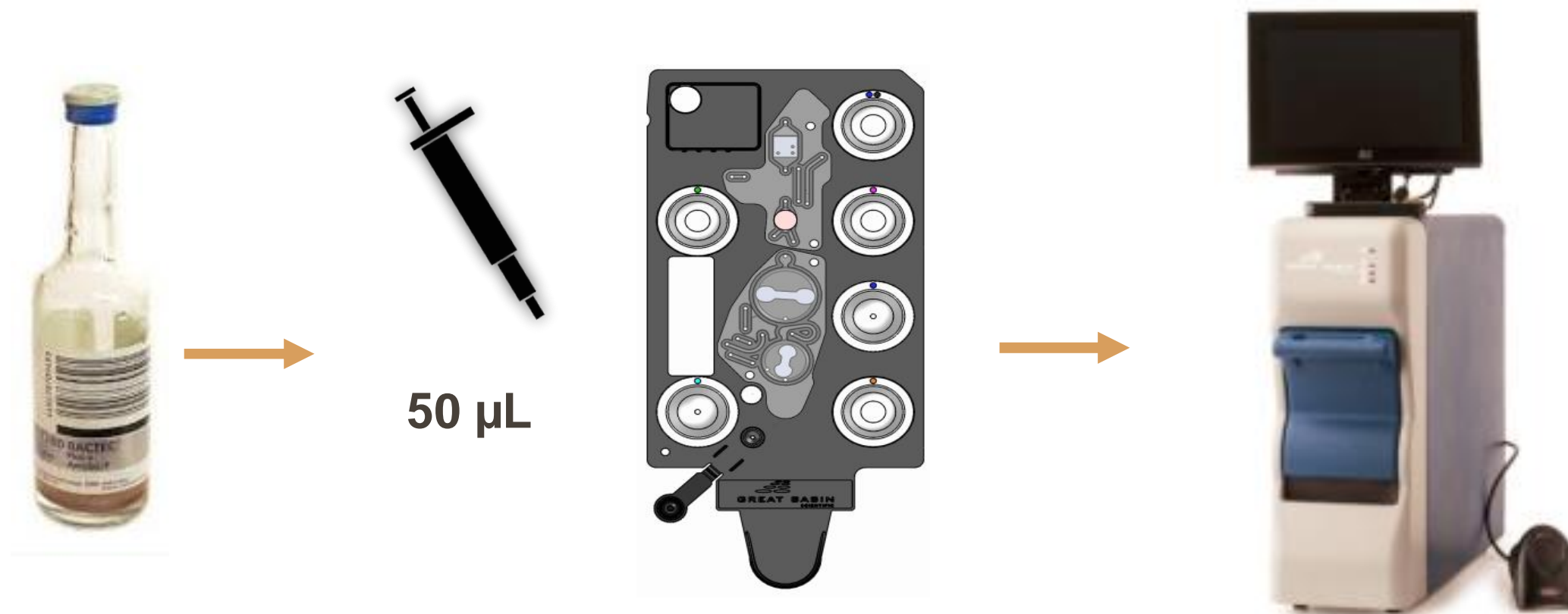
## Background and Methods

- For all *Staphylococcus* testing (i.e., LoD, reactivity, reproducibility, media compatibility):
  - BACTEC Blood culture bottles were inoculated with approximately 10-100 CFU, incubated to alarm positivity in a BACTEC 9050 Blood Culture System and Gram stained to confirm the presence of Gram Positive Cocci or Cocci Clusters (GPC or GPCC)
  - GPC were enumerated by plating serial dilutions on tryptic soy agar, diluted to target levels with negative blood culture media if necessary, and enumerated to confirm target levels were obtained
  - For media compatibility, non-BACTEC media bottles were incubated 16-20 hours, shaking at 37°C. Samples were Gram stained to confirm presence of GPC, and enumerated by plating serial dilutions on tryptic soy agar plates. 7 *Staphylococcus* species ± *mecA*, including *S. aureus*, *S. lugdunensis*, *S. epidermidis*, *S. capitis*, were tested in triplicate from three (3) independent blood culture bottles (9 tests per strain and bottle type)
- For all non-*Staphylococcus* testing (i.e. specificity):
  - Non-*Staphylococcus* GPC, Gram Negative, and Yeast were incubated 8 hours past alarm positivity to achieve high titer (≥10<sup>8</sup> CFU/mL) and enumerated to confirm target levels by plating serial dilutions as above.
  - Genomic DNA for *Mycoplasma* and *Mycobacterium* were inoculated into negative blood culture media at a concentration ≥10<sup>8</sup> genomic copies/mL.

### Compatible with Multiple Blood Bottle Types:

Manufacturer	System	Medium
Becton Dickinson	BACTEC™	Plus Aerobic/F
		Plus Anaerobic/F
		Peds Plus™/F
		Lytic/10 Anaerobic/F
		Standard/10 Aerobic/F
		Standard/10 Anaerobic/F
		FA FAN® Aerobic
		FN FAN® Anaerobic
bioMérieux	BacT/ALERT®	PF Pediatric FAN®SA
		Standard Aerobic
		SN Standard Anaerobic
		REDOX 1® (aerobic)
Thermo Scientific	VersaTREK®	REDOX 2® (anaerobic)

## Process



## Results

### Limit of Detection (LoD)

Staphylococcus Species Identified Specifically (ATCC Strains)		LoD (CFU/mL)
<i>S. aureus, mecA+</i>	BAA-1680, BAA-1682, BAA-1684	3.5 - 8.2 x 10 <sup>5</sup>
<i>S. aureus, mecA-</i>	25923, 6538, 11632	3.9 - 6.2 x 10 <sup>5</sup>
<i>S. epidermidis, mecA+</i>	35984, 51625, 700562, 700566	3.6 - 5.8 x 10 <sup>5</sup>
<i>S. epidermidis, mecA-</i>	700583, 12228	2.2 - 7.1 x 10 <sup>5</sup>
<i>S. lugdunensis, mecA-</i>	43809, 49576, NCTC-7990	2.8 - 4.7 x 10 <sup>5</sup>
Staphylococcus Species Identified by Genus Call (ATCC Strains)		LoD (CFU/mL)
<i>S. capitis, mecA-</i>	35661	1.5 x 10 <sup>5</sup>
<i>S. haemolyticus, mecA+</i>	BAA-1693	3.1 x 10 <sup>5</sup>
<i>S. hominis, mecA-</i>	27844	5.3 x 10 <sup>5</sup>
<i>S. pasteurii, mecA-</i>	51129	5.3 x 10 <sup>5</sup>
<i>S. sciuri, mecA-</i>	29060	4.3 x 10 <sup>5</sup>
<i>S. simulans, mecA-</i>	27848	2.0 x 10 <sup>5</sup>
<i>S. warneri, mecA-</i>	27830	4.0 x 10 <sup>5</sup>

### Staph ID/R Blood Culture Panel Highly Reproducible

Reproducibility conducted across 3 sites, 6 operators, 5 lots, 89 analyzers on 12 different days

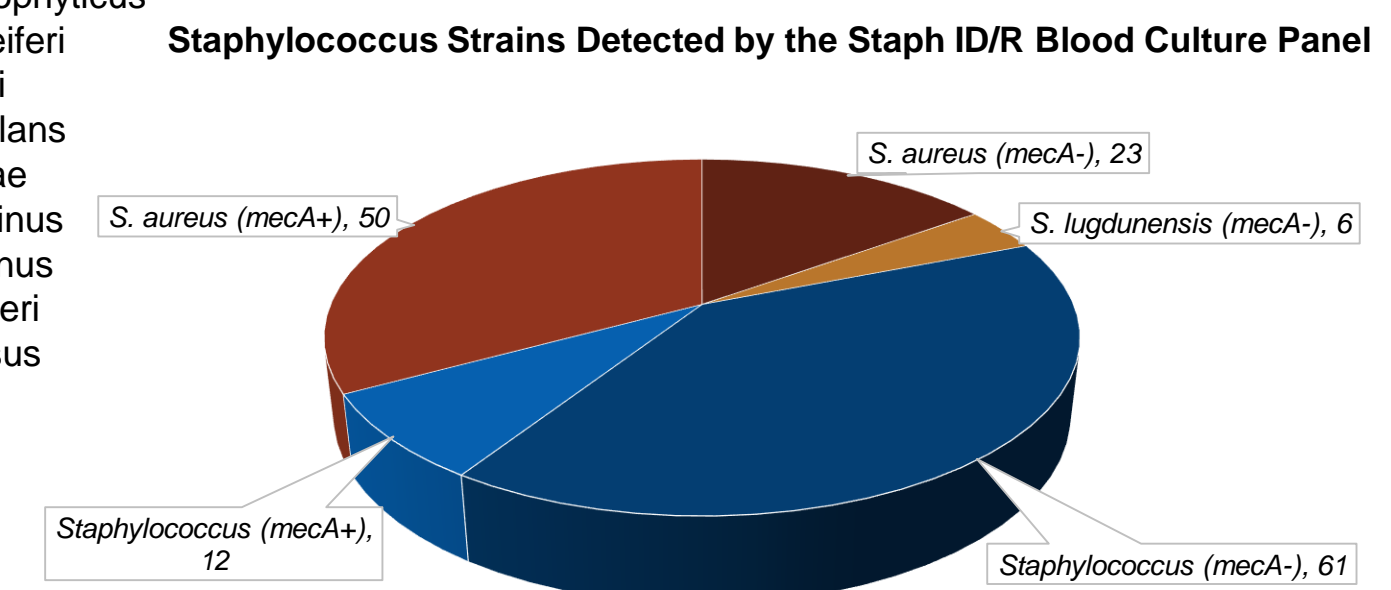
Staph ID/R Blood Culture Panel Result	Species, Bacteria Load (Low or High) Sample Input (CFU/mL)	Expected Result	% Agreement with Expected Result
<i>S. aureus, mecA</i> DETECTED	<i>S. aureus (mecA+)</i> , Low, 4.0x10 <sup>6</sup>	90/90	100%
	<i>S. aureus (mecA+)</i> High, 4.0x10 <sup>7</sup>	90/90	100%
	Negative	448/450 <sup>(1,2)</sup>	99.6%
<i>Staphylococcus</i> species OTHER than <i>S. aureus</i> or <i>S. lugdunensis, mecA</i> DETECTED	<i>S. epidermidis (mecA+)</i> , Low, 8.5x10 <sup>6</sup>	90/90	100%
	<i>S. epidermidis (mecA+)</i> , High, 7.0x10 <sup>7</sup>	90/90	100%
	Negative	446/450 <sup>(3,4)</sup>	99.1%
<i>S. lugdunensis, mecA</i> NOT DETECTED	<i>S. lugdunensis (mecA -)</i> , Low, 6.0x10 <sup>7</sup>	88/90 <sup>(5)</sup>	97.8%
	<i>S. lugdunensis (mecA -)</i> , High, 5.1x10 <sup>8</sup>	90/90	100%
	Negative	447/450 <sup>(5,6)</sup>	99.3%
<i>Staphylococcus</i> Negative	<i>E. faecalis (mecA -)</i> , High, 1.1x10 <sup>9</sup>	87/90 <sup>(4,6)</sup>	99.3%

(1) Sample detected as "*Staphylococcus aureus* in mixed Staph infection (NOT *S. lugdunensis*)"  
 (2) One *S. lugdunensis* specimen additionally detected *S. aureus*  
 (3) Two *S. lugdunensis* specimens detected as *Staph. OTHER* than *S. aureus* or *S. lugdunensis*  
 (4) Two *E. faecalis* specimens detected as *Staph. OTHER* than *S. aureus* or *S. lugdunensis*  
 (5) One specimen detected *S. aureus* correctly, but additionally detected *S. lugdunensis*  
 (6) One *E. faecalis* specimen detected as *S. lugdunensis*

### Inclusivity: 150+ *Staphylococcus* strains ± *mecA* Detected by the Staph ID/R Blood Culture Panel with approximately equal LOD

38 *Staphylococcus* species tested in duplicate, including:

- aureus*
- auricularis*
- capitis*
- caprae*
- carnosus*
- chromogenes*
- cohnii*
- condimenti*
- delphini*
- epidermidis*
- equorum*
- felis*
- fleuretti*
- gallinarum*
- haemolyticus*
- hominis*
- intermedius*
- kloosii*
- lentus*
- lutrae*
- massiliensis*
- muscae*
- nepalensis*
- pasteuri*
- pettenkoferi*
- piscifermentans*
- pulvereri*
- pseudintermedius*
- saccharolyticus*
- saprophyticus*
- schleiferi*
- sciuri*
- simulans*
- simiae*
- succinus*
- vitulinus*
- warneri*
- xylosus*

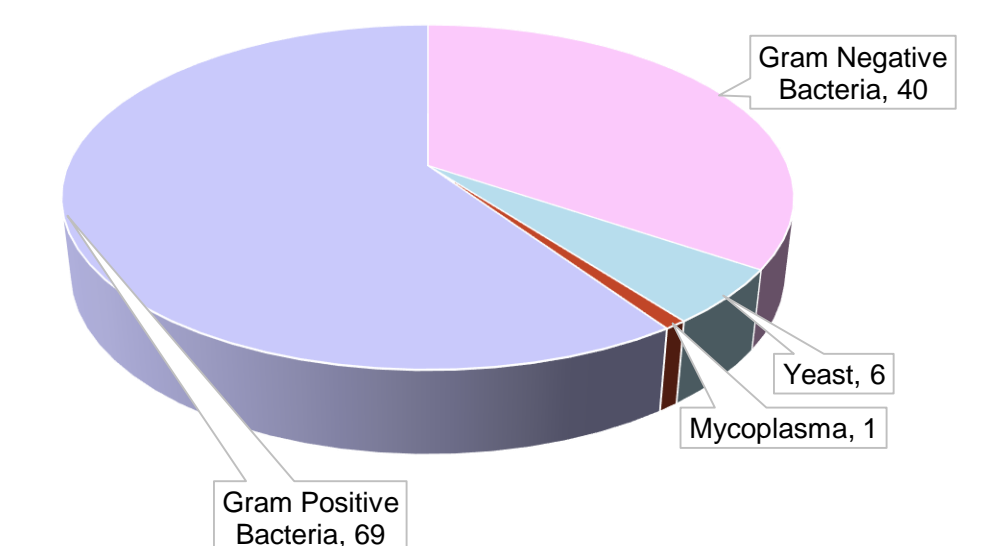


### Exclusivity: Staph ID/R Blood Culture Panel Highly Specific

52 Non-*Staphylococcus* Genus (116 Species) tested in duplicate, including:

- Actinomyces
- Acinetobacter (4)
- Abiotrophia
- Aerococcus
- Arcanobacterium
- Bacillus
- Bacteriodes
- Bordetella
- Burkholderia
- Candida (5)
- Citrobacter (3)
- Corynebacterium (2)
- Cryptococcus
- Enterobacter (2)
- Enterococcus (14)
- Escherichia (2)
- Fusobacterium
- Gemella
- Globicatella
- Haemophilus
- Hafnia
- Klebsiella (3)
- Kluyvera
- Kocuria (2)
- Kytococcus
- Lactobacillus
- Lactococcus
- Leuconostoc (3)
- Listeria (5)
- Macrocococcus
- Microcococcus (2)
- Moraxella
- Morganella
- Mycobacterium
- Mycoplasma
- Neisseria (3)
- Oligella
- Pediococcus (2)
- Peptostreptococcus
- Planococcus (2)
- Propionibacterium
- Proteus (2)
- Providencia (2)
- Pseudomonas (2)
- Rhodococcus
- Rothia (2)
- Salmonella (2)
- Serratia (2)
- Shigella
- Stenotrophomonas
- Streptococcus (19)
- Yersinia

Organisms NOT Detected by the Staph ID/R Blood Culture Panel



## Conclusions

The Staph ID/R Blood Culture Panel can determine the presence of *Staphylococcus* (either *S. aureus* or *S. lugdunensis* species, or *Staphylococcus* genus) as well as whether it harbors the *mecA* within two (2) hours of testing a GPCC positive blood culture. The Staph ID/R Blood Culture Panel demonstrates a limit of detection (LoD) well below typical blood culture bacteria load. The test is broadly reactive across the *Staphylococcus* genus with no loss in sensitivity for any individual species and is highly specific. Additionally, the Staph ID/R Blood Culture Panel is compatible across multiple blood culture bottle types and manufacturers and demonstrates excellent reproducibility.