

Gram-Negative Antibiotic Resistance Quick Reference Guide

The LIAISON PLEX® Gram-Negative Blood Culture (BCN) Assay offers the most comprehensive resistance coverage of any FDA-cleared molecular panel on market today. The following tables summarize resistance genes, their type, and key information.

Resistance Marker	Type	Related Information*	Isolated in:
Cefotaximase (CTX-M) ¹	Extended spectrum beta-lactamase (ESBL)	<ul style="list-style-type: none"> Likely resistant to expanded-spectrum cephalosporins and all beta-lactams except carbapenems. Replacing TEM-type and SHV-type ESBLs as the predominant ESBL type. Enzyme is acquired through the plasmid acquisition of beta-lactamase gene. 	Primarily <i>Enterobacteriaceae</i> <ul style="list-style-type: none"> <i>E. coli</i> <i>K. pneumoniae</i> <i>Enterobacter</i> spp.
<i>Klebsiella pneumoniae</i> carbapenemase (KPC) ²	Carbapenemase	<ul style="list-style-type: none"> Likely resistant to all carbapenems and beta-lactams. Most common carbapenemase. More than 150 variants have been identified. Enzyme is acquired through the plasmid acquisition of beta-lactamase gene. 	<ul style="list-style-type: none"> Primarily <i>Enterobacteriaceae</i> Occasionally <i>Acinetobacter</i> spp. and <i>P. aeruginosa</i>
New-Delhi metallo-beta-lactamase (NDM) ³	Carbapenemase	<ul style="list-style-type: none"> Likely resistant to all carbapenems and beta-lactams. Emerging carbapenemase in the US. Enzyme is acquired through the plasmid acquisition of beta-lactamase genes. NDM-1 is the predominant type. 	<ul style="list-style-type: none"> Primarily <i>Enterobacteriaceae</i> Prevalence in <i>Acinetobacter</i> spp. and <i>P. aeruginosa</i> is increasing
Verona integron-encoded metallo-beta-lactamase (VIM) ⁴	Carbapenemase	<ul style="list-style-type: none"> Likely resistant to all carbapenems and beta-lactams. More than 80 variants have been identified. Enzyme is acquired through integron and plasmid acquisition of beta-lactamase gene. 	<ul style="list-style-type: none"> Commonly found in <i>P. aeruginosa</i>, <i>K. pneumoniae</i>, and other <i>Enterobacteriaceae</i>
Imipenem-resistant metallo-beta-lactamase (IMP) ⁵	Carbapenemase	<ul style="list-style-type: none"> Likely resistant to all carbapenems and beta-lactams. At least 88 known variants. Enzyme is acquired through the plasmid acquisition of beta-lactamase gene. 	<ul style="list-style-type: none"> Identified and reported worldwide in <i>P. aeruginosa</i>, <i>Acinetobacter baumannii</i>, and <i>Enterobacteriaceae</i>
Oxacillinase-type beta-lactamase (OXA) ⁶	ESBL, Carbapenemase	<ul style="list-style-type: none"> Depending on OXA-type, likely resistant to either all carbapenems and/or expanded-spectrum cephalosporins and beta-lactams. Enzyme can be acquired through the plasmid acquisition of the beta-lactamase gene or be intrinsic. The acquired OXAs possess either a narrow spectrum (ESBL) or an expanded spectrum (carbapenemase) of hydrolysis depending of subtype. OXA-23-like, OXA-40-like, OXA- 48-like, and OXA-58-like enzymes are acquired carbapenemases. 	<ul style="list-style-type: none"> Certain OXA types intrinsic to <i>Acinetobacter</i> spp. and <i>P. aeruginosa</i> Acquired OXA enzymes of <i>Acinetobacter</i> are divided into five groups: OXA-23-like, OXA-24/40-like, OXA-58-like OXA-143-like, and OXA-235-like Enzymes of the OXA-51 group are chromosomally encoded
<i>Serratia marcescens</i> enzyme (SME) ⁷	Carbapenemase	<ul style="list-style-type: none"> A group of carbapenem-hydrolyzing beta-lactamases that confer resistance to a broad spectrum of beta-lactam antibiotics, included carbapenems. Four variants of SME carbapenemases have been identified that all confer resistance to carbapenems. Treatment could involve combination therapy to antimicrobials to which the bacteria remain susceptible, and newer beta-lactam/beta-lactamase inhibitor combinations. LIAISON PLEX BCN is the only panel in the market detecting SME. 	<ul style="list-style-type: none"> <i>Serratia marcescens</i>
Mobilized Colistin Resistance (MCR) ⁸	Colistin resistance	<ul style="list-style-type: none"> Enzymes that are plasmid-mediated and transposon-mediated and can be transferred horizontally to confer resistance to last-resort antimicrobial colistin. More than 10 MCR variants have been identified; The LIAISON PLEX BCN Assay is inclusive of <i>mcr-1</i>, <i>mcr-2</i>, and <i>mcr-3</i>. Combination therapy and the use of newer antibiotics or antibiotic adjuvants are strategies under investigation to manage these infections. 	<ul style="list-style-type: none"> The <i>Enterobacteriaceae</i> family—particularly <i>E. coli</i>, <i>K. pneumoniae</i>, and <i>Salmonella</i>—are the most common and concerning reservoirs of <i>mcr</i>-mediated colistin resistance.⁹

Resistance Marker Organism Associations

The LIAISON PLEX BCN Assay has the broadest organism-associated resistance genes, providing quicker identification for the most critical of patients.

Bacterial target	ESBL	Carbapenems						Colistin
	CTX-M	IMP	KPC	NDM	OXA	SME	VIM	MCR
<i>Acinetobacter baumannii</i>	✓	✓	✓	✓	✓	-	✓	-
<i>Acinetobacter</i> spp.	✓	✓	✓	✓	✓	-	✓	-
<i>Citrobacter</i> spp.	✓	✓	✓	✓	✓	-	✓	✓
<i>Enterobacteriaceae/</i> <i>Morganellaceae</i>	✓	✓	✓	✓	✓	-	✓	✓
<i>Enterobacter</i> spp.	✓	✓	✓	✓	✓	-	✓	✓
<i>Escherichia coli</i>	✓	✓	✓	✓	✓	-	✓	✓
<i>Haemophilus influenzae</i>	-	-	-	-	-	-	-	-
<i>Klebsiella oxytoca</i>	✓	✓	✓	✓	✓	-	✓	✓
<i>Klebsiella pneumoniae</i>	✓	✓	✓	✓	✓	-	✓	✓
<i>Klebsiella variicola</i>	✓	✓	✓	✓	✓	-	✓	✓
<i>Morganella morganii</i>	✓	✓	✓	✓	✓	-	✓	✓
<i>Proteus</i> spp.	✓	✓	✓	✓	✓	-	✓	✓
<i>Pseudomonas aeruginosa</i>	✓	✓	✓	✓	✓	-	✓	✓
<i>Pseudomonas</i> spp.	✓	✓	✓	✓	✓	-	✓	✓
<i>Salmonella</i> spp.	✓	✓	✓	✓	✓	-	✓	✓
<i>Serratia marcescens</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Stenotrophomonas maltophilia</i>	✓	✓	-	✓	-	-	✓	-
<i>Neisseria meningitidis</i>	-	-	-	-	-	-	-	-

In silico analysis predicts 100% inclusivity for all variants of CTX-M, IMP, KPC, MCR (1, 2, 3), NDM, OXA (OXA-23, OXA-24/40/143, OXA-48, and OXA-58 families), and VIM, and 99% inclusivity for SME, where sequences were available.

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19 Bacterial Targets
8 Resistance Genes



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