

Carbapenem Resistant Organism (CRO) Testing Instructions

CURRENT DCLS LABORATORY TESTING

Test Type	Method
Identification Confirmation	MALDI-TOF
Antimicrobial Susceptibility Testing (AST)*	Broth Microdilution/Sensititre
Phenotypic testing - Carbapenemase Production	Modified Carbapenem Inactivation Method (mCIM)
Resistance Mechanism Identification	Real-Time PCR

* Submitting laboratories are **REQUIRED** to provide AST results when submitting suspected CRO isolates to DCLS for testing. These AST results are assessed upon receipt to determine suitability for testing and potential pan-resistance.

TESTING METHODS

- **mCIM** – Phenotypic testing for carbapenemase production will be performed for all carbapenem-resistant Enterobacterales (CRE) and carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) isolates.
- **AST** – The following drug Minimum Inhibitory Concentration (MIC) values will be determined for mCIM positive CRE and CRPA isolates as well as pan-non-susceptible CRE, CRPA, and carbapenem-resistant *Acinetobacter baumannii* (CRAB) isolates:

<u>CRE (non Proteae)</u>	<u>Proteae^ CRE</u>	<u>CRPA</u>	<u>CRAB</u>
<ul style="list-style-type: none"> • Amikacin • Ampicillin • Ampicillin/Sulbactam • Aztreonam* • Cefazolin • Cefepime* • Ceftazidime* • Ceftazidime/Avibactam • Ceftolozane/Tazobactam • Ceftriaxone* • Ciprofloxacin • Ertapenem* • Gentamicin • Imipenem* • Levofloxacin • Meropenem* • Piperacillin/Tazobactam • Tobramycin • Tetracycline • Trimethoprim/Sulfamethoxazole 	<ul style="list-style-type: none"> • Amikacin • Ampicillin • Ampicillin/ Sulbactam • Aztreonam* • Cefazolin • Cefepime* • Ceftazidime* • Ceftazidime/Avibactam • Ceftolozane/Tazobactam • Ceftriaxone* • Ciprofloxacin • Ertapenem* • Gentamicin • Imipenem* • Levofloxacin • Meropenem* • Piperacillin/Tazobactam • Tobramycin • Tetracycline • Trimethoprim/Sulfamethoxazole 	<ul style="list-style-type: none"> • Amikacin • Aztreonam** • Cefepime** • Ceftazidime** • Ceftazidime/Avibactam • Ceftolozane/Tazobactam • Ciprofloxacin • Imipenem** • Levofloxacin • Meropenem** • Piperacillin/Tazobactam** • Tobramycin 	<ul style="list-style-type: none"> • Amikacin • Ampicillin/sulbactam • Cefepime*** • Ceftazidime*** • Ceftriaxone • Ciprofloxacin • Gentamicin • Imipenem*** • Levofloxacin • Meropenem*** • Piperacillin/Tazobactam*** • Tetracycline • Tobramycin • Trimethoprim/Sulfamethoxazole

[^]Members of the Proteae Tribe include *Providencia* species, *Proteus* species, and *Morganella* species.

* Testing required by the CDC's Antibiotic Resistance Laboratory Network (ARLN) for CRO isolates.

** Testing required by the CDC's ARLN for *Pseudomonas aeruginosa* isolates.

*** Testing required by the CDC's ARLN for *Acinetobacter baumannii* isolates.

- **Real-time PCR** - Analyses will be performed on the following resistance marker genes for CRAB isolates and mCIM positive as well as pan-non-susceptible CRE and CRPA isolates:

<u>CRE/CRPA</u>	<u>CRAB</u>
<ul style="list-style-type: none"> • KPC • NDM • VIM • OXA-48-like • IMP 	<ul style="list-style-type: none"> • KPC • NDM • VIM • OXA-48-like • IMP • OXA-23 • OXA-24/40 • OXA-58

- **SPECIMEN TYPES**

- Pure suspect CRE isolates on slant or plate media.
 - 1) Member of the Enterobacteriales family
 - 2) Resistance to at least 1 carbapenem:
 - imipenem, meropenem or doripenem = **MIC of ≥ 4 μ g/mL**
 - ertapenem = **MIC of ≥ 2 μ g/mL**

Note: *Morganella spp.*, *Proteus spp.*, and *Providencia spp.* have intrinsic elevated MICs to imipenem. MIC results for meropenem, doripenem, and/or ertapenem should be used to determine if these organisms should be forwarded to DCLS for testing.

- Pure suspect CRPA isolates on slant or plate media.
 - 1) Isolate identified as *Pseudomonas aeruginosa*
 - 2) Resistance to at least 1 carbapenem:
 - imipenem, meropenem or doripenem = **MIC of ≥ 8 μ g/mL**
 - 3) Mucoid *Pseudomonas aeruginosa* isolates will **NOT** be tested
- Pure suspect CRAB isolates on slant or plate media.
 - 1) Isolate identified as *Acinetobacter baumannii* complex
 - 2) Resistant to at least 1 carbapenem:
 - imipenem, meropenem or doripenem = **MIC of ≥ 8 μ g/mL**

- **SPECIMEN TRANSPORT**

- Ship isolates at room temperature (2-30°C). Isolates received outside of this range will be rejected and require a new isolate submission.
- Submit a completed DCLS Test Request Form with isolate, to include the following:
 - 1) Complete patient information (including address)
 - 2) Complete submitter information
 - 3) Date of specimen collection
 - 4) Time of specimen collection
 - 5) Specimen source
 - 6) Organism suspected
 - 7) On page 2 of the DCLS test request form check the box for "Carbapenem Resistant Organism" under "Bacteriology ID/ Detection"

8) Outbreak ID number (if applicable)

- Include copy of laboratory's susceptibility results in specimen package
- **Shipping Address:**
Division of Consolidated Laboratory Services
Attn: CRO Team
600 North 5th Street
Richmond, Virginia 23219

• **RESULTS REPORTING**

- Alert value results (**results possibly requiring additional reference laboratory testing**) will be verbally reported within 1 working day of results. An alert notification will be sent to the CDC as well.
- Non-alert-value, positive results (**results NOT requiring additional reference laboratory testing**) will be verbally reported to the submitting laboratory within 2 working days of results.
- Negative results will not be verbally reported.
- A hard copy report of final test results will be provided to the submitter by mail.
 - CRAB isolates will include: identification and molecular results
 - Pan-non-susceptible CRAB isolates will include: identification, AST, and molecular results
 - Pan-non-susceptible and mCIM positive CRE/CRPA isolates will include: identification, AST, phenotypic, and molecular results
 - mCIM negative CRE/CRPA isolates will include: identification and phenotypic result only
- VDH will receive electronic reporting of results.
- Reference laboratory results for additional characterization testing will be provided to the submitting laboratory and VDH within 2 working days of receipt from the reference laboratory.

• **CONTACT INFORMATION**

- For questions regarding testing, specimen collection or shipment, please contact one of the following:
 - Katherine Wentz (804-648-4480, ext. 287)
 - Katelyn Gali (804-648-4480, ext. 339)
 - Dr. LaToya Griffin-Thomas (804-648-4480, ext. 281)
 - Microbial Reference Laboratory (804-648-4480, ext. 287 or 251)
 - Molecular Detection and Characterization Laboratory (804-648-4480, ext. 292)
 - DCLS 24/7 Emergency Mobile Number (804-335-4617)

• **RESOURCES**

Updated information on CRO testing can be found on the DCLS website, under the “Hot Topics” link:
<https://dgs.virginia.gov/division-of-consolidated-laboratory-services/updates/hot-topics/>

Link to DCLS Test Request Form:

<https://dgs.virginia.gov/division-of-consolidated-laboratory-services/resources/submit-forms/>

Link to CDC Antimicrobial Resistance Laboratory Network (ARLN) webpage

[Antimicrobial Resistance Laboratory Network | ARLN | CDC](https://www.cdc.gov/arln/)