

# Gram Positive versus Gram Negative bacteria



In 1884 Christian Gram, a Danish bacteriologist, performed a test that introduced dye to the bacteria, to identify if bacteria had a peptidoglycan wall or a mesh-like layer of amino acids and sugars. This method is called "**Gram staining**" and it is used to distinguish between **Gram positive** and **Gram negative** bacteria. Gram positive bacteria contain a thick peptidoglycan layer (with teichoic acids), that stain **purple** while Gram negative bacteria lack the teichoic acids in their cell wall and therefore, stain **pink /red**.

## Commonly encountered Gram Negative Bacteria

Commonly Encountered Gram Negative Bacteria*	Common Sites of Infection*	Usual Drug of Choice	Comments *common but not all inclusive
<b>“SPICE” Organisms</b>			
<b>S</b> <i>Serratia</i> spp.	<ul style="list-style-type: none"> <li>respiratory system</li> <li>intra-abdominal</li> <li>urinary system</li> <li>blood</li> <li>wounds</li> <li>surgical sites</li> </ul>	<ul style="list-style-type: none"> <li>Carbapenems (e.g. meropenem)</li> <li>Fluoroquinolones (e.g. ciprofloxacin)</li> <li>Aminoglycosides (e.g. gentamicin)</li> </ul>	Can develop resistance to cephalosporins (e.g. ceftriaxone) while on treatment, therefore not used for serious infections. Nitrofurantoin-cystitis only
<b>P</b> <i>Providencia</i> spp.			
<b>I</b> ndole positive • <i>Proteus vulgaris</i>			
<b>C</b> <i>Citrobacter</i> spp.			
<b>E</b> <i>Enterobacter</i> spp.			
<b>Other Organisms</b>			
<i>Hafnia</i> spp.	respiratory symptom, gastro-intestinal, urinary system, blood	carbapenems, fluoroquinolones, aminoglycosides	
<i>Morganella morganii</i>	urinary system, intra-abdominal, skin, soft tissue, wounds	carbapenems, fluoroquinolones, aminoglycosides	
<i>Proteus mirabilis</i>	urinary system	cefazolin, ceftriaxone, ciprofloxacin, piperacillin/tazobactam,	
<i>Acinetobacter</i> spp.	respiratory system, heart, urinary system, blood, wound	ertapenem, meropenem, ciprofloxacin, moxifloxacin	
<i>Pseudomonas aeruginosa</i>	respiratory tract, blood, urinary tract, wounds, surgical sites	piperacillin-tazobactam, meropenem, ceftazidime, tobramycin, gentamicin, ciprofloxacin	<b>Respiratory:</b> causes VAP <b>Multidrug resistance (MDR):</b> colistin, ceftolozane/tazobactam <b>Tobramycin, gentamicin:</b> not used as first line due to toxicity and penetration reasons

**Note:** This is only an introduction to the gram negative bacteria. If you have any questions or suggestions please email: [Linda.Jorgoni@uhn.ca](mailto:Linda.Jorgoni@uhn.ca) , or [Linda.Dresser@uhn.ca](mailto:Linda.Dresser@uhn.ca).

### **References**

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