

Mastery Series: *Staphylococcus aureus*

1. Compare the following between *Staphylococcus* and *Streptococcus*:
 - a) Gram reaction
 - b) Shape and arrangement
 - c) Catalase
 - d) Salt-tolerance
2. Compare the following between *Staphylococcus aureus* and *Streptococcus pyogenes*
 - a) Hyaluronidase vs. hyaluronic acid
 - Component of cell wall or exotoxin?
 - b) “A” protein vs. “M” Protein
 - Component of cell wall in both?
 - Role in adherence or avoiding phagocytosis
 - Binding of antibodies to “hide”
 - Role in type II hypersensitivity?
3. Group *Staphylococcus aureus*' mechanism of disease according to abilities that are part of the cell make-up, and which are exotoxins that are secreted out of the cell.
4. For each trait, list the virulence factor(s) that are involved:
 - a) Desquamation
 - b) Avoiding phagocytosis
 - c) Resisting penicillin
 - d) Spreading rapidly through connective tissue
 - e) Overstimulating T cells to cause cytokine storm
 - f) Destruction of WBCs
5. Describe the cause and physiological effects of Red Man Syndrome.
6. How is Scarlet Fever similar to Red Man Syndrome?
7. What antibiotic is typically prescribed for MRSA? What is the mode of action of this antibiotic?

Mastery Series ANSWERS: *Staphylococcus aureus*

- Compare the following between *Staphylococcus* and *Streptococcus*:
 - Gram reaction: both Gram positive**
 - Shape and arrangement: clusters versus chains of cocci**
 - Catalase: Staph makes catalase, Strep doesn't**
 - Salt-tolerance: Staph is salt-tolerant, Strep isn't**
- Compare the following between *Staphylococcus aureus* and *Streptococcus pyogenes*
 - Hyaluronidase vs. hyaluronic acid
 - Component of cell wall or exotoxin? --hyaluronidase is an exotoxin produced by Staph; hyaluronic acid is part of Strep's cell wall**
 - "A" protein vs. "M" Protein
 - Component of cell wall in both? A protein in Staph; M protein in Strep**
 - Role in adherence or avoiding phagocytosis: in both**
 - Binding of antibodies to "hide": A protein in Staph can bind to the tail (constant region) of IgG; it's like it's hiding behind our immune system!**
 - Role in type II hypersensitivity? It's *Strep* (NOT *Staph*) that's associated with type II hypersensitivity. Antibodies built to M protein have a nasty pattern of also binding to heart valves, kidneys, and joints.**
- Group *Staphylococcus aureus*' mechanism of disease according to abilities that are part of the cell make-up, and which are exotoxins that are secreted out of the cell.

Part of the Cell: **"A" protein; capsule**

Exotoxins: **hyaluronidase; coagulase; leukocidin; PVL; Beta-lactamase; enterotoxin (superantigen); exfoliatin**
- For each trait, list the virulence factor(s) that are involved:
 - Desquamation: **exfoliatin (exotoxin)**
 - Avoiding phagocytosis: **capsule; coagulase; Protein "A"**
 - Resisting penicillin: **Beta-lactamase**
 - Spreading rapidly through connective tissue: **Hyaluronidase**
 - Overstimulating T cells to cause cytokine storm: **enterotoxin that is a superantigen**
 - Destruction of WBCs: **PVL (leukocidin)**
- Describe the cause and physiological effects of Red Man Syndrome. **Infusing vancomycin too rapidly into the bloodstream can cause massive mast cell degranulation. The enormous quantity of histamine released causes vasodilation and bright red skin inflammation**
- How are Scarlet Fever and Red Man Syndrome similar and different? **Similar in that they are both skin inflammation resulting from the host's immune response to something. They are DIFFERENT, though, because Scarlet Fever is the host's response to the erythrogenic toxins of *Streptococcus*; and Red Man Syndrome is the host's response to an antibiotic used to treat MRSA.**
- What antibiotic is typically prescribed for MRSA? What is the mode of action of this antibiotic? **Vancomycin inhibits cell wall formation**